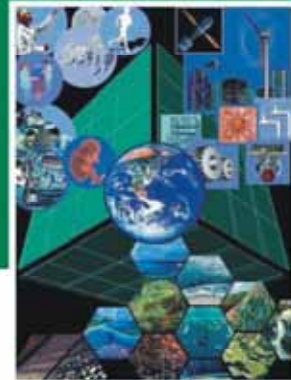
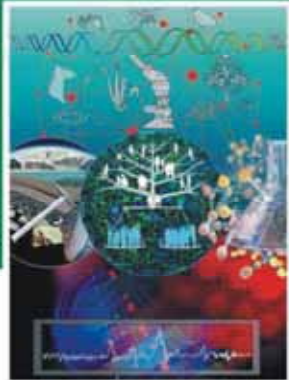




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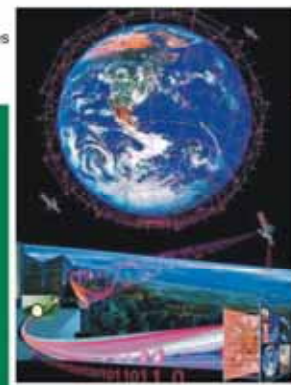
Encyclopedia of Life Support Systems (EOLSS)



An Integrated Compendium of twenty Encyclopedias



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- Biological, Physiological and Health Sciences
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- Land Use, Land Cover and Soil Sciences
- Social Sciences and Humanities
- Physical Sciences, Engineering and Technology resources
- Control Systems, Robotics and Automation
- Chemical Sciences Engineering and Technology Resources
- Water Sciences, Engineering and Technology Resources
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- Environmental and Ecological Sciences, Engineering and Technology Resources
- Food and Agricultural Sciences, Engineering and Technology Resources
- Human Resources Policy and Management
- Natural Resources Policy and Management
- Development and Economic Sciences
- Institutional and Infrastructural Resources
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15N Cycling in Watersheds
34S and the Sulfur Cycle
Chlorine and Bromine Isotopes
Light Lithophile Elements: $d6Li$ and $d11B$

ENVIRONMENTAL GEOCHEMISTRY

Time and Space Scales
Chemical Principles
Geochemical Partitioning
Environmental Contaminants
Environmental Change and Human Impact

COSMOCHEMISTRY

Origin of the Elements
Classification of Chemical Elements
Composition of the Solar System
Processes Recorded in Meteorites
Solar System and Planetary Formation
Origin of Life—a Cosmochemical View

PLANETOLOGY - COMPARATIVE PLANETOLOGY OF EARTH-LIKE PLANETS AND ASTROBIOLOGY

Comparative planetology
Astrobiology
Future exploration of Earth-like Planets and Moons

THE SOLAR SYSTEM

Accretion
Dust Condensation
Planetesimals
Planetary Accretion
The Edgeworth–Kuiper Belt
Satellite Formation
Origin of Atmospheres
Origin of Life
Extrasolar Planetary Systems

COMPARATIVE PLANETOLOGY

Planet and Satellite Orbits and Rotation States
Composition and Interior Structure of Planets
Surfaces and Atmospheres
Energy Balance and Evolution
Magnetic Fields and Field Generation

PLANETARY SATELLITES, ASTEROIDS, COMETS AND METEORS

Planetary satellites
Asteroids
Comets
Meteoroids and meteors

SOLAR WIND AND INTERPLANETARY MAGNETIC FIELD

Basic Concepts
Sun and Heliosphere at Times of Solar Activity Minimum
The "Active" Solar Wind and Transient Phenomena
Slow Variations

OCEANOGRAPHY

The oceans
Physical oceanography
Chemistry of the oceans
Biology of the oceans
Geology of the oceans
Coral reef studies
Human uses of oceans
Ocean engineering
Ocean modeling

THE OCEANS

History of Oceanic Research
The Open Oceans
Continental Margins and Marginal Seas
Role of the Oceans in the Global Cycles of Carbon and Nutrients
Role of the Oceans in the Global Climate System
Related Legal Issues

THE OPEN OCEANS

Physical Parameters

Geological Parameters
Biological Parameters

CONTINENTAL MARGINS AND MARGINAL SEAS

Physical Parameters
Biological Parameters
Land-Ocean Interactions

ROLE OF THE OCEANS IN GLOBAL CYCLES OF CARBON AND NUTRIENTS

The Great Conveyor Belt
Carbon and Nutrient Cycles
The Excess CO₂ Budget in the Global Oceans
Teleconnections between the Marginal Seas

ROLE OF THE OCEANS IN THE GLOBAL CLIMATE SYSTEM

Spatial Variations
Temporal Variations
Feedback

PHYSICAL OCEANOGRAPHY

Other aspects of Physical Oceanography
Inter-relations

SEAWATER PROPERTIES, WATER MASSES, AND GLOBAL SCALE CURRENTS

Chemical physics of sea water.
Global scale surface currents and thermohaline circulation.
Smaller scale processes and observable current fields.

AIR-SEA INTERACTIONS

Wind waves
Air-Sea Interactions

WAVES IN THE OCEANS

Basic Equations
Gravity Waves at the Sea Surface
Internal Waves
Inertial Waves
Kelvin Waves
Rossby Waves
Equatorial Waves

SEA - ICE INTERACTIONS

Sea Ice Formation
Distribution of Sea Ice
Growth of Sea Ice
Salt-driven Convection Beneath Growing Sea Ice
Ice Drift Modelling
Ocean Wave - Sea Ice Interaction
Wind-induced Upwelling at an Ice Edge
Processes at the Antarctic Ice Shelves

SYNOPTIC/MESOSCALE PROCESSES

Dynamics
Statistics (spectra, dependence on latitude)
Regional characteristics
Effects

FRONTS AND MIXING PROCESSES

- Frontal Zones and Fronts
- Persistence and Instability of Fronts
- Cross-frontal Water Exchange
- Biological Productivity and Frontal Phenomena

COASTAL OCEANOGRAPHY

- Some Dynamical Factors
- Phenomena
- Processes
- The Way Ahead

CHEMISTRY OF THE OCEANS

- General Chemistry of Seawater
- Nutrients Cycling in the Oceans
- Carbonate Chemistry of the Oceans
- Natural and Anthropogenic Radionuclides
- Human Perturbations
- Non-Radioactive Ocean Pollution

GENERAL CHEMISTRY OF SEAWATER

- Physical Parameters
- Chemical Composition
- Dissolved Gases
- Organic Material
- Hydrothermal Vents

NUTRIENT CYCLING IN THE OCEANS

- Nitrogen
- Phosphorus
- Silicon
- Iron
- Continental Shelves

CARBONATE CHEMISTRY OF THE OCEANS

- Carbon Dioxide and Carbonate System
- Carbon Cycle
- Carbonate Sedimentation

NATURAL AND ANTHROPOGENIC RADIONUCLIDES

- Natural Radionuclides
- Anthropogenic Radionuclides

HUMAN PERTURBATIONS

- Nutrients
- Carbon Dioxide
- Continental Margin Studies

NON-RADIOACTIVE OCEAN POLLUTION

- Trace Metals
- Pesticides and Organic Compounds
- Sewage
- Temporal Trend

BIOLOGICAL OCEANOGRAPHY

- Organic Matter in the Sea

Functional Groups of Marine Pelagic Organisms
Effects of Ocean Physics and Light
Effects of Inorganic and Organic Substances on Marine Organisms
Effects of Marine Organisms on Inorganic and Organic Substances
Interactions Among Groups of Marine Organisms
Pelagic Food Webs
Perspectives

OCEANS AS MAJOR RESERVOIRS OF PROTEIN

Oceanic Primary Production
Capture Fisheries
Marine Aquaculture
Oceans as a Source of High-Quality Protein

MARINE BIOGEOCHEMICAL CYCLES: EFFECTS ON CLIMATE AND RESPONSE TO CLIMATE CHANGE

Carbon and Carbonate Cycles
Interaction with the Nutrient Cycles
Interactions with Climate and Environmental Changes

MARINE BIODIVERSITY

Four Kinds of Biodiversity on Our Planet
How do we Know About Biodiversity?
Species Biodiversity in the Oceans
High-level Marine Biodiversity
Ecological Marine Biodiversity
Genetic Marine Biodiversity
Marine Biodiversity in Danger

MODELS AND FUNCTIONING OF MARINE ECOSYSTEMS

Bacteria, their viral parasites, and their protozoan predators
Adding a phytoplankton competitor to the bacteria
Opening the model to export and import
The concept of characteristic time scales and hierarchical dynamic systems
Adding a diatom-copepod food chain
Higher trophic levels
A full ecosystem model?

LITTORAL ZONE

The Extent of the Littoral Zone
Types of Primary Producers in the Littoral Zone
Littoral Ecosystems
The Functions of the Littoral Zone
The Value of the Littoral Zone to Society
Threats to the Littoral Zone

DEEP SEA BENTHOS, CONTRASTING ECOSYSTEMS

Introduction: The Exploration of the Depths
In the Reign of Zoology
New Technologies
Functional Ecology, Trophic Levels and Biology
Communities Based on Chemolithotrophy
Deep-sea Biodiversity
Abys and the Origin of Life

GEOLOGICAL OCEANOGRAPHY: INTRODUCTION AND HISTORICAL PERSPECTIVE

History and Development of Marine Geological Exploration
Ocean Drilling Investigation on the Sea-Floor
Dynamic Geo-marine Environment

MORPHOLOGY OF OCEAN FLOOR AND PLATE TECTONICS

Principle Provinces of Sea Floor
Continental Drift, Sea-Floor Spreading and Plate Tectonics
Major Morphological Features

SEISMIC IMAGING IN THE OCEANS

Seismic Wave Propagation
Seismic Data Acquisition
Processing of Reflected Data
Processing of Refracted Data
Visualization of 3D Geological Structures

MINING AND OIL EXPLORATION IN THE OCEANS AND SEAS

Occurrence of Hydrocarbons in Oceans and Seas
Exploiting Hydrocarbon Resources in the Oceans and Seas
Occurrence of Minerals in the Oceans and Seas
Mineral Extraction
Future Directions in Hydrocarbon and Mineral Extraction in the Seas

CORAL REEFS AS A LIFE SUPPORTING SYSTEM

The natural history of coral reefs
Nutrients in coral reefs
Mass bleaching of corals
Social and humanity
Policy making of coral reef management
The future of coral reefs

CORAL REEF ECOSYSTEMS: AN OVERVIEW OF THEIR STRUCTURE AND FUNCTION

Reef structure, composition and function
Threats to the chain

BIOLOGICAL DYNAMICS OF CORAL REEFS

Population Dynamics of Branching Corals
Population Dynamics of Foliaceous Corals
Predation on Corals
Phase Shift of Coral Communities in Jamaica

CORAL REEF BIODIVERSITY

Invertebrates
Fishes
Other reef organisms

THE PRODUCTIVITY OF CORALS

Zooxanthellae: The Primary Producers in Corals
Factors influencing the rates of photosynthesis by zooxanthellae
The fate of zooxanthella primary production

EFFECTS OF CLIMATE CHANGE ON CORAL REEFS

Climate change in tropical regions
Coral reefs as vulnerable ecosystem
Sea temperature and coral bleaching

Calcification rates and the Aragonite Saturation State
Sea level rise
Downstream effects of climate change on coral reef ecosystems
Interactions with other human related stresses (see also, Human Uses of the Oceans)
How will coral reefs respond?

HUMAN USES OF THE OCEANS

Human Use and Ocean Circulation
Ocean Regeneration
Coral Reef Regeneration
Management Options for Ocean Conservation
International Cooperation

HUMAN USE AND OCEAN CIRCULATION

Marine Living Resources
Marine Non-living Resources
Transportation and Communications
Tourism and Recreation
Reclamation for Economic Development
Waste Disposal
Key Issues of Ocean Use Management

OCEAN REGENERATION

Developing Ocean Regeneration Plans
Restoring Degraded Habitats
Stocking Fingerlings
Establishing Artificial Habitats
Promoting Sustainable Fishing
Enhancing Marine Environment Quality
Facilitating the Co-management of the Marine Environment in the 21st Century

CORAL REEF REGENERATION

The Nature of Coral Reefs
Destruction of Coral Reefs
Coral Reef Regeneration
Miscellaneous Ideas for Restoration of Coral Reefs
Coral Farming

MANAGEMENT OPTIONS FOR OCEAN CONSERVATION

International Treaties and Initiatives
National Oceans Policies
Legislation and Enforcement
Environmental Impact Statement
Integrated Management Plan
Training and Education
Public-Private Partnership

MANAGEMENT OPTIONS FOR CORAL REEF CONSERVATION

Importance of Coral Reefs
Coral Reef Degradation
Options for Coral Reef Conservation

OCEAN ENGINEERING

Field Measurement and Remote Sensing
Marine Structures and Materials

Naval Architecture
Ocean Energy
Mariculture Engineering
Underwater Acoustic
Harbor and Navigation

FIELD MEASUREMENTS

In situ and Remote Sensing Measurements
Wave Measurements
Current Measurements
Wind Measurements
Remote Sensing Techniques
Field Data and Quality Control
Challenges and Considerations of Field Measurements

MARINE STRUCTURES AND MATERIALS

Definition and Catalog of Marine Structures
Design Criteria and Methods of Marine Structures
The Material for Marine Structures
Trends of Research on Marine Structures

NAVAL ARCHITECTURE

Ship Hull
Propeller

OCEAN ENERGY

Ocean Thermal Energy Conversion
Tidal Energy
Wave Energy
Current Energy

MARICULTURE ENGINEERING (SEA FARMING SYSTEMS)

Sea Farming Technology Research and Development
Choosing A Location Requires Experience And Technological Knowledge
Sea Farming Technology
A New Design for Favorable Tension Leg Net Pen Developed

UNDERWATER ACOUSTICS

An Acoustical View of Oceanography
The History of Research on Ocean Acoustics
Measurement of Speed of Sound
Other Applications

HARBORS AND NAVIGATION

Maritime Transport and Shipping Vessels
Loading and Unloading in Seaports
Harbor Structures
Wave Protection

MODELING THE OCEAN SYSTEM FROM A SUSTAINABLE DEVELOPMENT PERSPECTIVE

Subject and Objectives of a Model
The Overall Model's Dimensions
A Diversity of Models
Hierarchy and Scales
Defining Models by their Operant Variables
Resolution, Realism and Predictability

NESTED INTERDISCIPLINARY THREE-DIMENSIONAL MODELS OF THE MARINE SYSTEM

- Operant State Variables and Evolution Equations of a 3D Interdisciplinary Ocean Model
- The Hydrodynamic Component
- Formulation of Flow and Fluxes
- Formulation of the Production/Destruction Rates
- Mathematical Forecasting and Mathematical Visualization

MATHEMATICAL AND NUMERICAL GEOHYDRODYNAMIC MODELS

- Conservation equations
- Preparation for numerical resolutions
- Spatial discretizations
- Temporal discretizations
- Staggering
- Critical parts for ocean models
- Other model ingredients
- Discussion

MODELING BIOGEOCHEMICAL PROCESSES IN MARINE ECOSYSTEMS

- General Classification of Biogeochemical Models
- Models Complexity in terms of Food Web Structure
- Physical Factors on Biogeochemical Models
- Inverse Approaches in Biogeochemical Modeling
- Regional Applications of Coupled Physical-biogeochemical Models

GEOGRAPHY

- Scope of Geography
- Main Topics and Fields of Geography
- Historical Perspectives
- Future Trends

FOUNDATIONS OF GEOGRAPHY

- Development of Modern Geographic Thought
- The basic geographic approach
- Regions
- Diversification of subject matters
- Plurality of approaches in human geography
- The present dilemma between physical and human geography
- Future prospects

MAIN STAGES OF DEVELOPMENT OF GEOGRAPHY

- The Predecessors
- Middle Ages
- Early Modern Times
- Founders of Modern Geography
- New Directions
- The Present
- The Future

THEORY AND METHODS IN GEOGRAPHY

- Theories
- Methods

GEOGRAPHICAL EDUCATION

- What is Geographical Education?
- How is Geographical Education Relevant to Society and Environment?

- Past Trends in Geographical Education
- Current Trends in Geographical Education
- Current Practices in Geographical Education
- Challenges for Geographical Education
- Future Directions

PHYSICAL GEOGRAPHY

- Historical Background
- The Main Fields of Study
- Past Environmental Change
- Global Environmental Change
- Applied Physical Geography

GEOMORPHOLOGY

- Development of Geomorphology
- Main Concepts, Research Lines, and Methods
- Structural Geomorphology
- Weathering and Soils
- Morphoclimatic Zones and Special Landform Associations
- Process Domains
- Environmental and Global Change

CLIMATE AS LIFE-SUPPORT SYSTEMS: A CLIMATOLOGICAL OVERVIEW

- Physical Representation
- Impacts of Climate on Systems
- Interactions between Climate and Human Activities

HYDROLOGY

- Scope of hydrology
- The Hydrological cycle
- Historical background
- Main components of the hydrological cycle
- Water quality
- Paleohydrology
- Extreme hydrological events: floods and drought
- Impact of Human Activities And Climate Change on the Hydrological Cycle

BIOGEOGRAPHY

- Introduction: defining the indefinable
- History of biogeography
- The major approaches to biogeography
- Towards an applied biogeography

SOIL GEOGRAPHY

- Concepts and definitions
- Historical background
- The soil profile
- Soil properties
- Factors and processes of soil formation
- Climate-soil and vegetation-soil relationships
- Soil Classification
- Geographical distribution
- Environmental issues

COASTAL SYSTEMS

Coasts
Coastal Systems
Case Study: The Coast of Suriname

THE OCEAN SYSTEM

Managing the Ocean Ecosystem
The Ocean Facing Climate Change
Ocean Resource Uses
Ocean Governance
The Sustainable Ocean
Recapitulation

MOUNTAIN GEOECOLOGY. THE EVOLUTION OF INTELLECTUALLY-BASED SCHOLARSHIP INTO A POLITICAL FORCE FOR SUSTAINABLE MOUNTAIN DEVELOPMENT

Introduction and Definition
Scientific Foundation
Development before 1990
Scientific Progress
Political Engagement
Current Status
Research Priorities
Specific Research Requirements
Indicators, Knowledge Management, and Sustainable Development

NATURAL HAZARDS

Introduction - What is A Natural Hazard?
Vulnerability - The Fundamental Counterpart of Hazard
Risk - The Product of Hazard and Vulnerability
Perception - A Vital Factor in Hazard and Risk Analysis
Natural Hazards and the Classification Problem
Natural Hazard Mitigation
Managing Natural Hazards
Natural Hazards and the Question of Poverty

LAND DEGRADATION AND DESERTIFICATION: HISTORY, NATURE, CAUSES, CONSEQUENCES, AND SOLUTIONS

A Brief Historical Review of Land Degradation
The Forms of Land Degradation
Research into the Causes of Land Degradation
Consequences of Land Degradation
Integrated Solutions and the Delimitation of Planning Regions

HUMAN GEOGRAPHY

Historical Background
The Main Fields Of Study
Alternative Approaches To Thematic Studies
The Present Human Geographical Problems

POPULATION GEOGRAPHY

Introduction to Population Geography
The current state of the Population Geography
The world population
The agricultural models
The demographic transition

Evolution of the European pattern of growth
The American pattern of growth
The models of quick transition
Perspectives on Population Geography

CULTURAL AND SOCIAL GEOGRAPHY

The Cultural Approach and the New Epistemological Bases of Geography

AGRICULTURAL AND RURAL GEOGRAPHY

Agricultural Change
Changing Geographical Perspectives
Agricultural Geography
Rural Geography
Introduction
Conclusion

GEOGRAPHY OF INDUSTRY AND TRANSPORT

Introduction: A Relational Science
General Concepts and Processes
The Theoretical and Methodological Tradition
A World in Transition
The Local Synthesis
Transport and Territorial Organization

GEOGRAPHY OF ECONOMIC ACTIVITIES

Global and Regional Economic Integration
Industrial Districts and Clustering
Geography of Innovation
Knowledge-Based Economy and Services
Sustainable Industrialization
Future Trends and Perspectives

URBAN GEOGRAPHY

Introduction. The Scope of Urban Geography
Changing Approaches in Urban Geography
The City and the Changing Economic Context
The Global Context of Urbanization
Residential Differentiation and Segregation
City Growth and Urban Governance
The Urban Future

MEDICAL GEOGRAPHY

Medical Geography
Health Geography
New Ways of Looking at Old and New Problems

POLITICAL GEOGRAPHY

First and Second Stages of Development
Third Stage
Fourth Stage
The World Systems Theory
Concepts of the State in Political Geography
Postmodernism and the Construction of Space
Territoriality, Ethnic, and Political Identity
The Problem of Scale, the Concept of Place, and the Contextual Approach

GEOGRAPHY OF TOURISM

- Defining Tourism
- The Development of the Geography of Tourism
- Demand for Tourism
- Tourism Supply
- Impacts of Tourism
- Tourism Planning
- Trends for the Twenty-first Century

REGIONAL GEOGRAPHY

- Introduction: Regional Geography, the Oldest Type of Geography
- How to Define a Region?
- From Administrative Regions to Cultural Regions
- The Applied Side of Regional Geography
- The Renewal of Regional Identities
- Regional Science: A New Way of Analyzing Regions and Regional Development

TECHNICAL GEOGRAPHY.CORE CONCEPTS IN THE MAPPING SCIENCES

- Introduction, Formalistic and Communication Approaches in Cartography
- Mapping as a Value-Adding Process/Cognitive Reactions
- Digital Conceptual Influences
- The Complexity of Cartographic Messages
- Human Input into Map Reading
- Mapping as a Selection Process
- Aspects of Meta-Communication (Communication about Communication)
- Reference Frames and Mapping
- Merging of Data Sources
- New Trends
- Global Data Initiatives and Global Data Access
- International Mapping Framework

GEODESY AND TOPOGRAPHY

- The Figure of Earth
- Coordinate Systems
- Map Projections
- Geodetic Survey
- Topographic Survey
- Topographic Maps
- Topographic Information Systems

MAPPING AND ATLAS PRODUCTION

- Maps and Map Types
- Map Functions and Map Themes
- Base Maps
- Mapping
- Map Use
- Data Quality
- Atlas Production
- Atlas Information Systems
- Outlook

REMOTE SENSING SYSTEMS

- Remote Sensing – a Definition

Passive versus Active Remote Sensing Systems
Satellite Remote Sensing Systems
Meteorological Satellites: NOAA, GOES and METEOSAT
Remote Sensing Applications: Monitoring our Environment
An Outlook to the Future

GEOGRAPHICAL INFORMATION SYSTEMS

Geographical Information Systems a Definition
History of GIS
Relevance of Metadata,
GIS Analysis
GIS Applications
Outlook on Technological Developments

MODELING GEOGRAPHICAL SYSTEMS AND PREDICTION

Modeling and the Quantitative Revolution
The State of Modeling
The Art of Modeling
Modeling and Prediction
Modeling in the Twenty-First Century

ENVIRONMENTAL STRUCTURE AND FUNCTION: CLIMATE SYSTEM

Processes in the Global Climate System
Climate Now
Weather Systems and Weather Forecasting
Observed climate change in the twentieth Century
Global Climate Models
Climate Projections and Future Climate
International Activity Concerning Climate

WEATHER SYSTEM AND WEATHER FORECASTING

AIRMASSES AND FRONTS

Airmasses
Atmospheric fronts

EXTRATROPICAL CYCLONES AND ANTICYCLONES

Typical cyclone evolution
Mesoscale structure of extratropical cyclone
Typical anticyclone evolution
Special cases of cyclone and anticyclone development
General properties of cyclonic activity
Mechanisms of cyclogenesis and cyclonic activity

PRINCIPAL WEATHER SYSTEMS IN SUBTROPICAL AND TROPICAL ZONES

The general circulation: tropics and subtropics
Main perturbation systems in tropical and subtropical zones

PRINCIPAL WEATHER SYSTEMS IN TEMPERATE AND CONTINENTAL ZONES

Weather Systems Typical of Temperate Latitudes
Weather Systems Typical of Continental Zones

PRINCIPAL WEATHER SYSTEMS IN POLAR ZONES

Weather Systems Typical of the Arctic
Weather Systems Typical of the Antarctic

SHORT-TERM WEATHER FORECASTING

Hydrodynamic Modeling of Meteorological Fields and Large-scale Weather-producing Mechanisms
Prediction of local weather patterns

LONG-RANGE WEATHER FORECASTING

Synoptic long -range Weather Forecasting
Statistical Long-range Weather Forecasting
Hydrodynamic Long-range Weather Forecasting
Verification Systems for Long-range Forecasts

SCIENTIFIC WEATHER MODIFICATION

History of the Problem
Physical Basis for Artificial Modification of Clouds and Precipitation
The Enhancement and Redistribution of Precipitation
Hail Suppression
Fog Dispersal
Dispersal of Super cooled Low-level Clouds and Precipitation
Other Weather Modification Experiments

CLASSIFICATION OF THE CLIMATE OF THE EARTH

Methods of climatic classification
Descriptive classifications
Genetic classifications

METHODS OF CLIMATE CLASSIFICATION

General structure of methods of climate classification
Approaches to geographical classifications of climates

OBJECTIVE EMPIRIC CLASSIFICATIONS OF EARTH'S CLIMATE

Koepfen's classification
Thornthwaite's classification

GENETIC CLASSIFICATIONS OF EARTH'S CLIMATE

Classifications derived from air mass analysis
Classifications based on characteristics of surface energy budget

APPLIED CLASSIFICATIONS OF EARTH'S CLIMATE

Agroclimatic classification
Bioclimatic classification
Climatic classifications for technical purposes
Energy-climatic classifications

CLIMATE ZONES AND TYPES

General circulation features of major climate belts
Heat-balance components in the main climate zones
Brief description of the main climatic types

LOW-LATITUDE CLIMATE ZONES AND CLIMATE TYPES

Equatorial belt
Subequatorial belt
Tropical belt

MIDDLE-LATITUDE CLIMATE ZONES AND CLIMATE TYPES

Subtropical belt
Temperate belt

HIGH-LATITUDE CLIMATE ZONES AND CLIMATE TYPES

Climate types of subarctic and subantarctic belts
Climate types in Arctic and Antarctic Regions

HIGH-ALTITUDE CLIMATE ZONES AND CLIMATE TYPES

- Basic controlling factors of highland climates
- Highland climates in different climatic zones

LOCAL CLIMATES

- Spatial scales of local climate
- Heat balance of active surface
- Turbulent mixing
- Local circulation
- Influence of Relief on the Local Climate Formation

FACTORS CONTROLLING LOCAL CLIMATE

- Radiation balance
- Turbulent heat flow
- Heat flow into the ground
- Evaporation

URBAN CLIMATE: THE MOST IMPORTANT MODIFIED

- Cities of high and middle latitudes
- Low latitudes cities

FOREST CLIMATES

- Solar radiation.
- Temperature and humidity.
- Wind
- Precipitation.

ISLAND CLIMATES

- Ocean and sea islands
- Lake and river islands

HISTORY OF THE EARTH'S CLIMATIC CHANGES

- Methods of palaeoclimatic reconstructions
- Ancient climates of the Earth (Late Precambrian and Palaeozoic)
- Cenozoic climatic change
- Pleistocene and Holocene climates
- Climates of the historical time

HISTORY OF PLANETARY AND GEOLOGICAL FACTORS

- Main planetary factors of climatic variations
- Main geological factors of climate variations

HISTORY OF ATMOSPHERIC COMPOSITION

- Evolution of the Ancient Atmosphere
- Atmospheric Composition during the Phanerozoic Time
- History of the Cenozoic Atmosphere
- Anthropogenic Changes in the Atmospheric Composition

GLOBAL CLIMATIC CATASTROPHES (VOLCANISM AND IMPACT EVENTS)

- Climatic catastrophes in the Earth's history
- Volcanic explosions and climate
- The fall of celestial bodies and climate
- Local climatic catastrophes

CHANGES IN BIOGEOCHEMICAL CYCLES

- The Global Carbon Cycle
- The Nitrogen Cycle

GREENHOUSE GASES, AEROSOLS AND OZONE LAYER

Parameters connected with atmospheric substances and their effects on climate

Greenhouse gases

Aerosols

CARBON DIOXIDE

Carbon dioxide sources and sinks

Carbon dioxide content distributions in the atmosphere

Climatic impact of carbon dioxide

METHANE

Methane sources

Methane sinks

Distribution of methane content in the atmosphere

Methane concentration trends

The influence of methane on climate

HALOCARBONS

Halocarbon sources

Halocarbons sinks

The influence of halocarbons on climate

Distribution of halocarbons content in the atmosphere

NITROUS OXIDE

Nitrous oxide sources

Nitrous oxide sinks

Distribution of nitrous oxide content in the atmosphere

The influence of nitrous oxide on climate

TROPOSPHERIC OZONE AND RELATED TRACE GASES

Ozone photochemical sources and sinks

Tropospheric ozone content measurements

Ozone and the environment

Tropospheric ozone forming species

PHYSICS OF AEROSOLS AND THEIR EFFECT ON CLIMATE

Atmospheric aerosol sources and sinks

Physico-chemical properties of aerosols

Aerosol effects on climate

REDUCTION OF THE OZONE LAYER

Photochemistry of stratospheric ozone

Stratospheric ozone: spatial distribution and seasonal variations

Antarctic ozone hole

Ozone in the Northern hemisphere and nonpolar regions

GEOINFORMATICS

Fundamentals

Measurement and Spatial Sampling

Remote Sensing

Geographical Information Systems

Spatial Statistics

International Cooperation

SAMPLE DATA AND SURVEY

Survey

Spatial Sampling
Geostatistical Theory
Nested Variation
Optimizing Sampling
Case Studies

GEOGRAPHIC INFORMATION SYSTEMS IN BIOGEOGRAPHY AND LANDSCAPE ECOLOGY

Biogeographic and Landscape Ecological Research Themes
Remote Sensing and Geographic Information Systems in Biogeography and Landscape Ecology
Future Trends and Directions for Biogeography and Landscape Ecology

LANDFORM AND EARTH SURFACE

Sampling Landform
Ground-based Survey
Remote Sensing of Landform
Existing Sources of DEMs
Quality of DEMs
Application of DEMs
Case Studies
Mapping Landform: Present Trends
Future Developments

LAND HYDROLOGY

Traditional Hydrologic Field Measurement
Spatial Analyses
Geoinformatics and Hydrological Modelling

FIELD GEOLOGY

Geological Surveying
Mapping what you Can't See: Geophysical Surveying
Mapping Geological Composition: Geochemical and Mineralogical Surveying
Surveying the Flow Characteristics of Rocks in the Field: Geofluids Surveying

REMOTE SENSING AND ENVIRONMENTAL MONITORING

Digital Data Processing

PHYSICAL BASIS OF REMOTE SENSING

Overview of Remote Sensing and Common Remote Sensing Systems
Electromagnetic Radiation
The Electromagnetic Spectrum
Sources of Electromagnetic Radiation
Interaction of Electromagnetic Radiation with the Atmosphere
Electromagnetic Radiation from Earth's Surface
Sensors

FIELD SPECTROSCOPY

Principles of Spectroscopy
The Natural Radiation Environment
Visualisation of the Bidirectional Reflectance Distribution Function
Historical Development of Field Spectroscopy
Field Measurement of Reflectance Factors
Applications of Field Spectroscopy
Emerging Technologies for Field Spectroscopy

SATELLITE REMOTE SENSING

The Components of a Satellite Remote Sensing Systems

- Ground Facilities
- Satellite Programs
- Applications of Satellite Remote Sensing
- Land-Based Applications
- Oceanographic Applications
- Meteorological Applications
- Atmospheric Sounding
- Modern and Future Systems

IMAGING SPECTROMETRY

- Introduction and Historical Perspective
- Physics of Spectroscopy
- Airborne Imaging Spectrometer Systems
- Airborne Simulators
- Spaceborne Imaging Spectrometer Systems
- Data Acquisition and Pre-processing of Imaging Spectrometer Data
- Thematic Analysis Techniques for Absorption Feature Extraction
- Applications of Imaging Spectrometry

RADAR REMOTE SENSING

- Basic Properties of Radar Systems
- Characteristics of Radar Systems
- What a Radar Measures
- Radar Sensors and Their Applications
- Synthetic Aperture Radar Applications
- Future Prospects

NASA EARTH SCIENCE ENTERPRISE: A NEW WINDOW ON OUR WORLD

- A Scientific Vision—The Earth as a System
- A View From Above—Characterizing the Earth System
- Taking It All In—Understanding the Earth System
- Getting There From Here—Predicting Earth System Change

STATISTICAL ANALYSIS IN THE GEOSCIENCES

- Examining Multivariate Geochemical Data
- Exploratory Multivariate Techniques
- Modeled Approaches for Assessing Multi-element Geochemical Data
- Sequence of Data Analysis
- Future Trends

SPATIAL DATA HANDLING AND GIS

- Geographical Data
- Data Models
- Measurement and Sampling
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MATHEMATICAL MODELS IN ENVIRONMENTAL SCIENCES

MATHEMATICAL MODELS AND SIMULATION IN ENVIRONMENT

Mathematical model for regional transport and transformations of gaseous pollutants and aerosols

Application of the combined model of atmospheric thermo-hydrodynamics and pollution transport to solving specific environmental problems

Numerical model of global transport and transformations of multicomponent gaseous pollutants and aerosols

MATHEMATICAL MODELS FOR PREDICTION OF CLIMATE

Mathematics for climate modeling

Climatic models

Predictability of climate changes

MATHEMATICAL MODELING IN METEOROLOGY AND WEATHER FORECASTING

Equation system used in the hydrodynamic atmospheric models

Hydrodynamical Modeling of large-scale weather-producing mechanisms

Atmospheric models based on the primitive hydrodynamic equations

Application of hydrodynamical models to forecasting of local weather patterns

Tropical cyclone modeling

ENVIRONMENTAL POLLUTION AND DEGRADATION MODELS

Mathematical model for global transport of persistent organic pollutants in the Northern Hemisphere

Numerical results

MATHEMATICAL MODELS IN FOOD AND AGRICULTURAL SCIENCES

FOOD PRODUCTION AND AGRICULTURAL MODELS: BASIC PRINCIPLES OF DEVELOPMENT

- Classification of Agricultural Models
- Typical Theoretical Models in Agriculture
- Agroecosystem Productivity Models and Simulation Systems
- The Use of Models
- Experimental Support of Models and Experiment Planning

MATHEMATICAL MODELS OF SOIL IRRIGATION AND SALTING

- Balance models of calculation of the irrigation regime and crops productivity.
- Simulation of water and salts transport in unsaturated-saturated soils.
- The complex simulation models

DETERMINISTIC MODELS OF PLANT ENVIRONMENT

- Static models: empirical-statistical approach
- Dynamical models: An approach oriented to process account
- Deterministic models of energy and mass exchange for plant environment

MATHEMATICAL MODELS OF AGRICULTURAL SUPPLY

- Models and decision making in agriculture
- Mathematical models of optimization and allocation of sown areas
- Mathematical models of fertilization optimization
- Complex optimization of resource allocation in crop growing
- Economic-mathematical models of optimization of structure of herds and flocks
- Economic-mathematical models of optimization of rations of cattle feeding
- Economic-mathematical models of optimization of combination of several branches in a farm
- Economic efficiency of precision agriculture farm application

MATHEMATICAL MODELS IN BIOLOGICAL AND MEDICAL SCIENCES

MATHEMATICAL MODELS IN BIOPHYSICS

- Specificity of mathematical modeling of living systems
- Basic models in mathematical biophysics
- Oscillations and rhythms in biological systems
- Space-time self-organization of biological systems
- Physical and mathematical models of biomacromolecules
- Modeling of complex biological systems

POPULATION MODELS

- Construction of Mathematical Population Models and the Main Tasks of Their Study
- Deterministic Models of Population Genetics
- Stochastic Models of Population Genetics
- Mathematical Models of Biological Populations and Communities

PATTERN FORMATION AND NEURAL MODELS

- Mathematical models of autowave systems of the type "reaction-diffusion" or the models with local connections
- Autowaves in homogeneous neuron-like systems

MATHEMATICAL MODELS IN IMMUNOLOGY

- Mathematical models of humoral immune response
- Mathematical models of network interactions in the immune system
- Mathematical models of lymphocyte circulation

Mathematical models of infectious diseases
Other models
Immune system and optimality

MATHEMATICAL MODELING IN MEDICINE

Physiological systems and processes
System of blood circulation
The respiratory system
Regulation of water and salts exchange
Thermoregulation
Regulation of blood sugar

MATHEMATICAL MODELS IN GLOBAL PROCESSES AND DEVELOPMENT

MATHEMATICAL MODELS AND CONTROL OF CATASTROPHIC PROCESSES

Basic Notions and Examples
Singularity Theory
Singularities in Optimization problems

MODELS AND METHODS OF ACTUARIAL MATHEMATICS

Empirical principles of determination of insurance premiums.
Classification of risk models
Collective risk model
Individual risk model

MATHEMATICAL MODELING AND GLOBAL PROCESSES

Mathematical Modeling and the Control Theory in Examining Complex Processes
Numerical Modeling of the General Circulation of the Atmosphere and Oceans; Climate
Mathematical Modeling of Biospheric Processes
Control Theory and Controllable Dynamics
Scientific Problems for the Twenty-first Century

OPTIMIZATION AND OPERATIONS RESEARCH

Optimization and operations research: history and organizations
Optimization and operations research: impact and excellence
Operations research: scientific decision-making and the role of modeling
Optimization: the mathematical theory of models and algorithms
Optimization and computers: complexity and efficiency
Operations research and information systems: the implementation issue
Operations research and decision support systems: a case study
Selected WWW sites related to optimization and operations research

FUNDAMENTALS OF OPERATIONS RESEARCH

Linear Programming
Discrete Optimization and Integer Programming
Nonlinear Programming
Implementation Aspects: Efficiency and Productivity

THE ROLE OF MODELING

Modeling as a Mental Activity
Mathematical Modeling

LINEAR PROGRAMMING

Linear Programming Problems

Primal and Dual Programs and Polyhedra
The Simplex Method
Polynomial Solution Methods for LPs

NONLINEAR PROGRAMMING

Optimality Conditions
Optimization Algorithms
Large Scale Optimization

DYNAMIC PROGRAMMING

Preliminary Examples
Sequential Decision Processes
Decomposition of Objective Functions
Functional Equations
Policies
Algorithms
The Principle of Optimality
The Curse of Dimensionality
Generalizations
The Art of Dynamic Programming
Epilogue

DISCRETE OPTIMIZATION

Modeling
Solution Methods

THE ROLE OF SOFTWARE IN OPTIMIZATION AND OPERATIONS RESEARCH

Historical Perspectives
Obtaining a Solution
Modeling
Computer-Assisted Analysis
Intelligent Mathematical Programming Systems
Beyond the Horizon

ADVANCED DETERMINISTIC OPTIMIZATION

Foundations
Seminal Development-Discrete Optimization

COMBINATORIAL OPTIMIZATION AND INTEGER PROGRAMMING

Modeling
Mathematical Foundations
Algorithmic Approaches
Software

GRAPH AND NETWORK OPTIMIZATION

Preliminaries
Shortest Path Problem
The Maximum Flow Problem
The Minimum Cost Flow Problem
The Minimum Spanning Tree Problem

SCHEDULING

General Scheduling Models

Applications
Classification, Complexity and Solution Methods

ROUTING PROBLEMS

The Chinese Postman Problem
The Traveling Salesman Problem
Vehicle Routing Problems
Capacitated Arc Routing Problems

LARGE SCALE OPTIMIZATION

LP Relaxations
Lagrangian Relaxations
Decomposition Methods
Reformulations
Final Remarks

DUALITY THEORY

Convex Programming
Linear Programming
Integer Programming
General Mathematical Programming

NONSMOOTH OPTIMIZATION

The general problem and its motivation
Algorithms for convex optimization
Some illustrations

GLOBAL OPTIMIZATION AND META-HEURISTICS

Meta-Heuristic Features
Brief Description of Some Meta-Heuristics
Metaphors of Nature

APPROXIMATION ALGORITHMS

Combinatorial Optimization Problems
Design Techniques for Approximation Algorithms
Non-approximability results
Advanced Topics

OPTIMIZATION IN INFINITE DIMENSIONS

Infinite-Dimensional Optimization Problems
Convex Problems and Duality
Necessary Optimality Conditions
Optimal Control Problems
Calculus of Variations
Nonsmooth Problems
Optimal Shape Design

THE PRINCIPLES OF THE CALCULUS OF VARIATIONS

Classical Theory
Direct Methods
Unstable Critical Points

THE MAXIMUM PRINCIPLE OF PONTRYAGIN

The Maximum Principle

Structure of Optimal Controls
Relation to Dynamic Programming
Numerical Solution Based on the Maximum Principle

DYNAMIC PROGRAMMING AND BELLMAN'S PRINCIPLE

Optimal Control
Value Function and Bellman's Principle
The Hamilton-Jacobi-Bellman Equation
Optimal Feedback Synthesis

OPTIMIZATION AND CONTROL OF DISTRIBUTED PROCESSES

Optimization Problems Governed by Distributed Processes
Existence and Characterization of Solutions
Discretization of the Problem
Optimization Algorithms

NONCONVEX VARIATIONAL PROBLEMS

The Direct Method of the Calculus of Variations
Relaxation theory
Vector Valued Problems
Problems with No Minimizer, Minimizing Sequences

GAME THEORY

Foundations of Non-cooperative Game Theory
NTU-Games
TU-Games
The Equivalence Principle
Mechanism Theory
Repeated Games
Evolution and Learning in Games
Experimental Games

FOUNDATIONS OF NON-COOPERATIVE GAMES

Chess-Like Games
Representations of Non-Cooperative Games
Two-Person Zero-Sum Games
Non-Zero-Sum Games
Games with Incomplete Information

NTU-GAMES

Basic Model and Definitions
The Core of an NTU-Game
The Bargaining Set
Values for NTU-Games

TU-GAMES

Characteristic Function Form Games
Solutions
Market Games
Voting Games
Other Applications

THE EQUIVALENCE PRINCIPLE

Notation and the Basic Model
Walrasian Equilibrium
Equivalencies in Atomless Economies
Approximations to Equivalence: Large Finite Economies
Strategic Behavior and Walrasian Equilibria

MECHANISM THEORY

A General Mechanism Design Setting
Dominant Strategy Mechanism Design
Bayesian Mechanism Design
Implementation

STOCHASTIC AND REPEATED GAMES

Supergames
Repeated Games with Incomplete Information
Stochastic Games

EVOLUTION AND LEARNING IN GAMES

Biological Contexts: A Static Approach
Biological Contexts: A Dynamic Approach
Social Contexts
Equilibrium Selection: Coordination Games
Equilibrium Selection: Oligopoly Games

EXPERIMENTAL GAME THEORY

One-Person Decision Making
Experimental Results in Strategic Games
Alternating Offer Bargaining
Characteristic Function Experiments
Quo Vadis Experimental Game Theory?

STOCHASTIC OPERATIONS RESEARCH

Markov Models
Markov Decision Processes
Stochastic Games
Queueing Systems
Inventory Models
Investment Models
Adaptive Dynamic Programming

MARKOV MODELS

Discrete-time Markov Chains
Continuous-Time Markov Chains
Further Models

MARKOV DECISION PROCESSES

Problem Definition and Examples
Finite Horizon Decision Problems
Infinite Horizon Markov Decision Problems
Continuous-time Markov Decision Processes
Further Topics

STOCHASTIC GAMES

Basic Definitions and Notations
Zero-Sum Stochastic Games
General-Sum Stochastic Games
Further Topics

QUEUEING SYSTEMS

Design of Queueing Systems
Performance Measures and Special Queues
Little's Formula
Queueing Networks and Examples

INVENTORY MODELS

The Basic EOQ Model
The Dynamic Economic Lotsize Model
Periodic Review Stochastic Demand Models
Continuous Review Stochastic Demand Models

INVESTMENT MODELS

Mean-Variance Portfolio Selection
Portfolio Selection in Discrete Time
Portfolio Selection in Continuous Time
Further Models

ADAPTIVE DYNAMIC PROGRAMMING

Basic Models and Valuations
Adaptive Algorithms
Estimation Procedures
Remarks on Applications
Remarks on Related Concepts

DECISION ANALYSIS

Examples
General Concepts
Decision Making Under Uncertainty
The Expected Utility Paradigm
The Risk-Value Approach
Graphical Representation of Decision Problems

EXPECTED UTILITY THEORY AND ALTERNATIVE APPROACHES

The General Framework
Expected Utility Theory
Non-Expected Utility Theory

RISK-DEFUSING BEHAVIOR

Decision Behavior: Are Lottery Tasks and Quasi-Realistic Tasks Comparable?
An Outline of the Decision Process in Quasi-Realistic Risky Decision Tasks
Risk-Defusing Behavior
The Role of Probability
Consequences for Decision Analysis

DECISION PROBLEMS AND DECISION MODELS

A Classification of Decision Problems
Theories and Models

Decision Trees and Influence Diagrams

MULTIPLE-CRITERIA DECISION MAKING

Value Function Approach

Vector Optimization

Final Remarks

DECISION TREES AND INFLUENCE DIAGRAMS

A Medical Diagnosis Problem

Decision Trees

Influence Diagrams

FRAMING EFFECTS IN THEORY AND IN PRACTICE

Framing Effects in Theory

Framing Effects in Practice

Moderators of Framing Effects

FUZZY DECISION THEORY

Classical Decision Model

Basic Definitions of the Fuzzy Set Theory

Modeling Fuzzy Values

Fuzzy Expected Values

Fuzzy Preference Orderings

The Use of Additional Information

Fuzzy Probabilities

MEASUREMENT OF RISK

Standardized Risk Measures

Luce's Measures of Risk

Sarin's Measures of Risk

Fishburn's Measures of Pure Risk

Fishburn's Measures of Speculative Risk

Risk Measurement Under Partial Probability Information

Final Remarks

FOUNDATIONS OF TARGET-BASED DECISION THEORY

Bentham and Utility-Based Decision Analysis

Hobbes and Decision Analysis

Target-Based Decision Analysis

Bounded Rationality and Target-Based Decision Analysis

Pedagogical Advantages

Improved Modeling of Individual Choice

Better Linkages with Finance

State-Dependent Utility Functions

Better Linkages with Practice

More Consistent with Psychological Evidence

THE DEVELOPMENT OF MATHEMATICS IN A HISTORICAL PERSPECTIVE

Introduction

Measure Theories and Probability

Invariant Measures

Ergodicity and Dynamical Systems

MATHEMATICS IN JAPAN

Introduction
The beginnings (seventh to sixteenth century)
Textbooks of Commercial arithmetic
The construction of a learned tradition
Wasan status : between art and science
Conclusion

THE MATHEMATIZATION OF THE PHYSICAL SCIENCES - DIFFERENTIAL EQUATIONS OF NATURE

Everything is number
Ancient Astronomy
Optics and statics
The middle ages and the renaissance
Mechanics of motion
Newtonian mechanics
Early differential equations
The Brachistochrone
Early methods of solution. Linear differential equations
Newton's second law as a differential equation. The method of perturbations
The vibrating string. Partial differential equations
The vibrating string. Trigonometric series
Potential theory. Laplace's equation
The parsimonious universe. Calculus of variations
The Hamilton formalism
Electrostatics. Poisson's equation
Fourier on heat conduction and Fourier series
Orthogonal functions and curvilinear coordinates
Sturm-Liouville theory. The qualitative theory
Continuum mechanics. Elasticity
Hydrodynamics. The Navier-Stokes equation
Electromagnetism. Maxwell's equations
Relativity
Quantum mechanics. The Schrödinger equation
Distributions. Generalized solutions of differential equations
Concluding remarks

A SHORT HISTORY OF DYNAMICAL SYSTEMS THEORY: 1885-2007

Introduction
The qualitative theory of dynamical systems
Central themes
Some recent extensions and applications of dynamical systems
Epilogue and further reading

MEASURE THEORIES AND ERGODICITY PROBLEMS

Introduction
Measure theories and probability
Invariant measures
Ergodicity and dynamical systems

THE NUMBER CONCEPT AND NUMBER SYSTEMS

- Introduction
- Arithmetic
- Length and Area
- Algebra and Geometry
- Real Numbers
- Imaginary numbers
- Geometry of Complex Numbers
- Algebra of complex numbers
- Quaternions
- Geometry of Quaternions
- Octonions
- Incidence Geometry

OPERATIONS RESEARCH AND MATHEMATICAL PROGRAMMING: FROM WAR TO ACADEMIA – A JOINT VENTURE

- Introduction
- Precursor of OR: Taylorism
- The beginning of OR in Britain: The use of radar in anti-aircraft warfare
- OR's move to the US military: The mobilisation of civilian scientists
- ASWORG: Philip Morse's OR group
- The Applied Mathematics Panel: OR training courses during World War II
- Game theory: The significance of John von Neumann
- The origin of linear programming: Logistic planning in the Army Air Force
- Mathematical programming in academia: ONR project and game theory
- Operations research in academia: Societies, journals, and conferences
- Classical OR problems
- Operations research and linear programming outside academia: some examples
- The role of mathematical programming and game theory in OR: Disputes
- Conclusion

THE HISTORY AND CONCEPT OF MATHEMATICAL PROOF

- Introduction
- The Concept of Proof
- What Does a Proof Consist Of?
- The Purpose of Proof
- The History of Mathematical Proof
- The Middle Ages
- The Golden Age of the Nineteenth Century
- Hilbert and the Twentieth Century
- Computer-Generated Proofs
- Closing Thoughts

COMPUTATIONAL METHODS AND ALGORITHMS

- Mathematical modelling
- Discretization process
- Combination of the discretization and solution process
- Parallelism and decomposition
- Solution process
- Implementation aspects

BASIC METHODS FOR SOLVING EQUATIONS OF MATHEMATICAL PHYSICS

Analytical methods for problems of mathematical physics

Approximate methods

METHODS OF POTENTIAL THEORY

Fundamentals of the Potential Theory

Application of the Potential Theory to the Classical Problems of Mathematical Physics

Other Applications of the Potential Method

EIGENVALUE PROBLEMS: METHODS OF EIGENFUNCTIONS

Eigenvalue problems

Special functions

The method of eigenfunctions

The method of eigenfunctions for some problems of the theory of electromagnetism

The method of eigenfunctions for the heat conductivity problem

The method of eigenfunctions for problems of the oscillation theory

METHODS OF INTEGRAL TRANSFORMS

Basic integral transforms

The application of integral transforms to problems of the oscillation theory

The application of integral transforms to heat conductivity problems

The application of integral transforms in the theory of neutron slow-down and diffusion

The application of integral transforms to problems of hydrodynamics

The application of integral transforms in the elasticity theory

The application of integral transforms in the coagulation kinetics

Brief instructions for the application of integral transforms

DISCRETIZATION METHODS FOR PROBLEMS OF MATHEMATICAL PHYSICS

Finite difference methods

Variational methods

Projection methods

VARIATIONAL FORMULATION OF PROBLEMS AND VARIATIONAL METHODS

The variational method

Applications of the Lax-Milgram theorem

Extensions of the variational theory

METHODS OF TRANSFORMATION GROUPS

Continuous Transformation Groups

Invariant Differential Equations

Tangential Transformations

Conservation Laws

Bäcklund Transformations

Sine-Gordon Equation

Korteweg de Vries Equation and Lax Pairs

Hirota Transformation and Penleve Property

Method of Inverse Scattering Problem

Schrodinger Equation

NUMERICAL ANALYSIS AND METHODS FOR ORDINARY DIFFERENTIAL EQUATIONS

The solution of systems of linear equations

The solution of nonlinear equations and systems

Numerical integration

Interpolation and approximation of functions

Numerical differentiation
Two-sided methods and interval analysis
Numerical methods for ordinary differential equations

SOLUTION OF SYSTEMS OF LINEAR ALGEBRAIC EQUATIONS

An Unusable Formula
Direct methods
Iterative methods
The conjugate gradient method
Conjugate gradient method: general case
Domain decomposition methods

NUMERICAL INTEGRATION

Statements of Problems
Quadrature Formulae
Cubature Formulae

NUMERICAL METHODS FOR ORDINARY DIFFERENTIAL EQUATIONS AND DYNAMIC SYSTEMS

Dynamic Systems
Analytic Methods
One-step Methods
Stiff Systems
Linear Multistep Methods
Error Estimation
Delay Differential Equations

NUMERICAL METHODS AND ALGORITHMS IN MATHEMATICAL PHYSICS

FINITE ELEMENT METHOD

Other one-dimensional boundary problems
Higher order elements in one dimension
Two or Three-dimensional Elliptic Problems
Two-dimensional P_k Lagrange Elements
Three-dimensional P_k Elements
Isoparametric elements
Numerical quadrature formulas
Error analysis with numerical integration
Error analysis with exact integration

AN INTRODUCTION TO FINITE VOLUME METHODS

Advection equation and method of characteristics.
Finite volumes for linear hyperbolic systems.
Gas dynamics with the Roe method.
Second order and two space dimensions.

NUMERICAL METHODS FOR INTEGRAL EQUATIONS

Quadrature methods
Degenerate Kernels. Projection and Collocation Methods
Iterative methods for linear and nonlinear integral equations
Singular integral equations

NUMERICAL ALGORITHMS FOR INVERSE AND ILL-POSED PROBLEMS

Inverse Problems
Ill-Posed Problems
Numerical Algorithms for Solving Inverse and Ill-Posed Problems

COMPUTATIONAL METHODS AND ALGORITHMS IN CONTINUOUS MEDIUM PROBLEMS

SOLUTION OF ELECTROMAGNETISM THEORY PROBLEMS

Two-dimensional electrostatics problems
Three-dimensional electrostatics problems
Two-dimensional magnetostatics problems
Three-dimensional magnetostatics problems
Electroconductivity problems
Solutions harmonic with respect to time
Nonstationary solutions

COMPUTATIONAL METHODS IN ELASTICITY

Basic aspects of continuum mechanics
The three-dimensional linearized elasticity
The three-dimensional elastodynamics problem
A particular case of structures: plates

COMPUTATIONAL METHODS FOR COMPRESSIBLE FLOW PROBLEMS

A Brief Description of the Solutions
Numerical Schemes for 1-D Problems
Schemes for Multidimensional Problems
Numerical Examples

METHODS OF NONLINEAR KINETICS

The Boltzmann equation
Phenomenology and Quasi-chemical representation of the Boltzmann equation
Kinetic models
Methods of reduced description
Discrete velocity models
Direct simulation
Lattice Gas and Lattice Boltzmann models
Other kinetic equations

METHODS FOR MAGNETOSPHERE AND NEAR-SPACE PROBLEMS

MHD model of solar wind flow around the magnetosphere
Mathematical statement of the flow problem: Basic equations
Thermal anisotropy of the magnetosheath plasma
Reconnection problem

NUMERICAL MODELS AND SIMULATION OF GLOBAL PROBLEMS

NUMERICAL SIMULATION OF CLIMATE PROBLEMS

Climate, Climatic Variability and Climate Changes
Atmosphere & Ocean Circulation Models
Numerical Modeling of Climatic Variability and Climate Changes

NUMERICAL SIMULATION OF BIOSPHERE DYNAMICS

Models of Global Dynamics by Club of Rome
The Problem of the Earth's Biosphere Stability
Canadian Climate Change Model

Global Models of Biosphere Dynamics
Problems of Biosphere Dynamics Prediction
Numerical Simulation and Experimental Models of the Biosphere
Is Uncertainty of Global Models Principal?
Resume

NUMERICAL METHODS FOR WEATHER FORECASTING PROBLEMS

Data assimilation system.
Numerical data analysis and initialization.
Mathematical Models for Numerical Weather Prediction
Numerical Methods in Weather Forecast
Parameterization schemes.
Use of numerical weather forecasting products.
Resume.

MODERN BIOMETRY

History
Biometric Data Collection and Analysis
Biometry in Action
Mathematics in Biometry
Future

DATA COLLECTION AND ANALYSIS IN BIOMETRICS

Experimental Design
Sample Surveys
Clinical Trials and Case Control Studies
Longitudinal Studies and Time Series
Species Abundance
Data Collection

THE DESIGN OF EXPERIMENTS

Standard Factorial Designs
Split-Plot Designs
Repeated Measures Designs
Importance of Correct Design and Analysis

SAMPLE SURVEYS

What is a Survey?
Probability sampling
Common probability sampling designs
Survey estimates and standard errors
Nonsampling errors
Sampling rare populations
Issues in Survey Design

RESPONSE ADAPTIVE RANDOMIZATION IN CLINICAL TRIALS

The Design
Likelihood Based Inference
Nonparametric Inference
Regression Models

TIME SERIES MODELS

Standard Linear ARMA Models

Bilinear Models
Standard Space Time ARMA Models
Space Time Bilinear Models
Exponential Models

ESTIMATING SPECIES ABUNDANCE

Quadrat Sampling
Adaptive Cluster Sampling
Line and Point Transect Sampling
Nearest-Neighbour Distance Methods
Capture-Recapture Methods

STATISTICAL METHODOLOGY IN BIOMETRY

Linear Regression, Generalized Linear Models, Exponential Family and Logistic Regression
Hierarchical Data
Survival Analysis

LINEAR REGRESSION MODELS

Simple Linear Regression model
Diagnostics and Remedial Measures
Multiple Linear Regression Model
Model Adequacy and Diagnostics
Comments on Interpreting Regression Analysis

GENERALIZED LINEAR MODELING

A Corner Stone: the Exponential Family of Distributions
Generalized Linear Modelling
Estimation for Generalized Linear Models
Quasi-likelihood and Generalized Estimating Equations (GEE)

CATEGORICAL DATA ANALYSIS

Inference for a Single Proportion
Analysis of 2×2 Contingency Tables
Analysis of $R \times C$ Contingency Tables
Analysis of Sets of 2×2 Contingency Tables
Log-linear Models
Logistic Regression
Multinomial Regression Models
Poisson Regression
Clustered Categorical Data

SURVIVAL ANALYSIS

Basic concepts of survival analysis
The Kaplan-Meier Method and the Log-rank Test
The Cox proportional hazards model
Evaluating the proportional hazards assumption
The stratified Cox model
Extension of the Cox Proportional Hazards Model for Time-dependent Variables

MULTIVARIATE AND MULTIDIMENSIONAL ANALYSIS

Continuous Outcomes
Non-continuous Outcomes
Graphical Analysis

A Magician at Work?

REPEATED MEASURES AND MULTILEVEL MODELING

General Model

Some Models for Continuous Data

Models for Discrete Data

Generalized Estimating Equations

Discussion

META-ANALYSIS

Types of meta-analyses

Statistical principles of meta-analysis

Statistical models for meta-analysis

Example of a meta-analysis

Further topics in meta-analysis

COMPUTATION AND BIOMETRY

Computer Language and Systems Past, Present and Future

Changing Views of Statistical Computing

Statistical Computing in the Larger Context of Scientific Computing

Limitations of Coverage

Directions for Future Development

Chapters Included Under This Theme

STATISTICAL GRAPHICS

Graphs for models involving two or more variables

Graphs for models involving several covariates

Graphs for modelling data developing in time or space

Graphs for modelling survival data

Graphs for multivariate data

COMPUTER-INTENSIVE STATISTICAL METHODS

Resampling and Monte Carlo methods

Numerical optimization and integration

Density estimation and smoothing

Relaxing least-squares and linearity

STATISTICAL COMPUTING

Advances in Routines Used for Statistical Computation

Languages and Systems for Statistical Computing

Key Ideas for Statistical Systems

Desiderata for Statistical Systems

Large Data Bases - Data Mining

Connectivity

The Future of Statistical Computing

SPATIAL STATISTICAL MODELING IN BIOLOGY

Gaussian Random Process Models

Non-Gaussian Random Process Models

Multivariate Spatial Models

Spatiotemporal Models

Computation

Future Directions

BIostatistical Methods and Research Designs

- Biostatistical Research Strategies
- Study Designs
- Statistical Models and Methods
- Statistical Inference

Epidemiology Methods

- Types of Investigation
- Measures of Association
- Common Designs
- Discussion

Communicable Diseases and Data Analysis

- Transmission probability
- Basic reproductive number
- The dependent happening relation
- Population-level effects of intervention
- Challenges for the future

Nutritional Epidemiology

- Research Designs and Methods
- Example of Dietary Fat and Post-Menopausal Breast Cancer
- Future Directions, Research Needs and Opportunities

Statistical Methods in Laboratory and Basic Science Research

- Theory: Universal Distributions
- The Role of Statistics
- Statistical Strategies
- Case Studies
- Closing Remarks

Statistical Methods for Toxicology

- Applications of Biostatistics to Toxicology
- General Methods in Dose-Response Modeling
- Quantitative Risk Assessment

Selected Topics in Biometry

- Inference
- Design and analysis of experiments
- Spatial analysis
- Multivariate methods
- Variation over time
- Simulation
- Statistical genetics
- Bioinformatics

Statistical Methodology in Agriculture and Horticulture

- Current methodology
- Future developments

Statistical Methodology in Forestry

- Forest Inventory
- Modeling Individual Tree Characteristics

Quantitative Characteristics of Forest Stands
Statistically Designed Experiments in Forestry

STATISTICAL ECOLOGY AND ENVIRONMENTAL STATISTICS

Simple Stories but Challenging Concerns
Ecological Sampling and Statistical Inference
Biodiversity Measurement and Comparison
Environmental Data and Cost-Effective Acquisition
Landscape Ecology and Multi-Scale Assessment
Echelon Analysis for Multispectral Environmental Change Detection
Statistics as an Instrument to Deal with Environmental and Ecological Crisis
Future Areas of Concern and Challenge
Looking Ahead

POPULATION GENETICS

Basic Principles
Explanations for Genetic Variation

STATISTICAL GENETICS

Basic Principles
Relatedness
Plant and Animal Breeding
Locus Mapping
Quantitative Trait Locus Mapping

BIOINFORMATICS: PAST, PRESENT AND FUTURE

Biological sequence analysis
Applications of hidden Markov models in bioinformatics
Evolutionary models and phylogenetic reconstruction
Gene expression analysis
Statistical methods in proteomics
Systems biology
Federated Data Integration and BioGrids
Discussion

ENVIRONMETRICS

STATISTICAL ANALYSIS OF ECOLOGICAL DIVERSITY

Defining and Measuring Ecological diversity
Abundance Estimation
Statistical Inference on Diversity
Ecological Diversity Ordering
Field Studies

DESCRIPTIVE MEASURES OF ECOLOGICAL DIVERSITY

Diversity, richness, evenness
General properties of diversity indices
Special indices and families of indices

SAMPLING DESIGNS FOR MONITORING ECOLOGICAL DIVERSITY

Unit sampling
Area sampling
Further developments: two-stage sampling

INFERENCE ON ECOLOGICAL DIVERSITY

- Diversity index estimation
- Species-abundance curve models

THE INVENTORY AND ESTIMATION OF PLANT SPECIES RICHNESS

- Species Inventorying
- Estimating and Comparing Species Richness through Samples

SPATIAL STATISTICS

- Models
- Exploring Spatial Structure
- Estimation
- Prediction
- Future Directions

GEOSTATISTICS: PAST, PRESENT AND FUTURE

- Distribution-Free Methodology
- Likelihood-Based Modeling
- Model Based Prediction
- Discussion and Future Directions

SPATIAL DESIGN

- A statistical framework
- Single purpose spatial designs
- Multipurpose spatial designs
- Relationships among design criteria

STATISTICAL ANALYSIS OF SPATIAL COUNT DATA

- Random Spatial Indices
- Non-Random Spatial Indices
- Spatial Epidemiology and Disease Mapping

SPATIAL DISEASE MAPPING

- Reasons for spatial pattern in disease data
- Types of spatial disease data
- Analytic methods by data type
- Future Trends

MULTIVARIATE DATA ANALYSIS

- Multivariate Distributions
- Parameter Estimation for a Multivariate Normal Population
- Tests of Hypotheses for Mean Vectors and Covariance Matrices
- The General Linear Hypothesis Model
- Discriminant Analysis
- Principal Components
- Factor Analysis

THE ANALYSIS OF PUTATIVE SOURCES OF HEALTH HAZARD

- Study Design
- Problems of Inference
- Modeling the Hazard Exposure Risk
- Models for Case Event Data
- Models for Count Data

SPATIO-TEMPORAL METHODS IN CLIMATOLOGY

Descriptive Statistical Methods
Future Directions

ENVIRONMENTAL MONITORING

AREA PRECIPITATION MEASUREMENT

The Area Precipitation Measurement Problem
The Kalman Filter Approach
The Cokriging Approach

WATER-QUALITY MONITORING OF RIVERS

Design Considerations in Water-Quality Monitoring Networks
Case Studies from the United States
The Future of Water-Quality Monitoring Networks

STOCHASTIC MODELING IN LIFE SUPPORT SYSTEMS

The Concept of Stochastic Modelling
SM Metaphors and Reality Levels
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How Is Mathematical Modeling Done?
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Emerging Technologies for Flow Modeling
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MATHEMATICAL MODELS OF CLIMATE

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A fundamental chemical kinetics system

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Modeling of chemical ordinary differential equations

One example of the modeling of the air pollution problem: the CHIMERE software.

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The Green and Ampt (1911) Model

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MATHEMATICAL EQUATIONS OF THE SPREAD OF POLLUTION IN SOILS

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- Steady State Solutions of the Rose - Hairsine Model
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- Introduction: Purposes of Mathematical Modeling in the study of Marine Ecosystems.
- Processes and Fluxes in Marine Ecosystems
- Various Approaches to Marine Ecosystems Modeling
- More about Population-level Models
- Parameter Estimation and Verification of Models
- Some Open Problems

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- Dynamic Models of Diversity
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MATHEMATICAL MODELS IN EPIDEMIOLOGY

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- Models for Vector-Born Infections
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- Posing the Question and Design of the Answer
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The Snake of Rational Curiosity in the Medieval Garden
The Slow Dawn of Technology in Medieval Europe
Descartes, the not very Systemic Systemist
The Expansion of the Universe of Knowledge
The Twilight of Scientific Simplicity: A can of Worms in 20th Century Science
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The Social Dimension of Systems Thinking
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SOCIAL PROBLEM DIAGNOSIS: A SOCIOPATHOLOGY IDENTIFICATION MODEL

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CRITICAL SYSTEMS THINKING

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- Current General Systems Approaches
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- The Scientific Imperative and the Quantification Problem
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- Quantification. Formal Definition
- Adequacy in the form of Quantification
- Quantification of Attributes in Soft System Domains
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- The 20th century: the difficult co-existence of Mechanicist Thought and Systemic Thought: emergence of chaos
- Structure
- A multi-stage modeling process to research on the detection and control of chaos dynamics in the evolution of biological and social systems.
- An outstanding example of the chaotic dynamic system: the logistic map
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- Origins of Cybernetics
- Basic Concepts
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- Background—the Logical Basis for Second Order Cybernetics
- Second Order Cybernetics—Historical Overview
- Theory of Second Order Cybernetics
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- The First Order Study of Natural Systems
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- Cybernetics and the Arts, Humanities and Vocational Disciplines
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- Communication between Man and Machine
- Cybernetics and Communication on a Biological Level (cybernetics b)
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- The Evolution of Models in Regional Economic Research
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EUKARYOTE CELL BIOLOGY

- Origin of Eukaryotes
- Cellular differentiation in multicellular organisms
- Eukaryotic cell structure
- Organization of eukaryotic cells
- The cell cycle
- Regulation of cell growth
- Experimental models
- Future Investigations

CELL THEORY, PROPERTIES OF CELLS AND THEIR DIVERSITY

- The Composition of Life
- Cell as the unit of life
- The diversity of life
- Cellular diversity
- Tissue maintenance and renewal
- Discussion

CELL MORPHOLOGY AND ORGANIZATION

- Cell organization

CELL NUCLEUS AND CHROMATIN STRUCTURE

- The nucleus
- The genome
- Chromosomes
- DNA replication
- Nucleolus
- Transcription
- mRNA processing and turnover
- tRNA processing and turnover

ORGANELLES AND OTHER STRUCTURES IN CELL BIOLOGY

- The distribution and function of the mitochondrion
- Distribution and structure of the chloroplast
- An endosymbiotic origin for the mitochondrion and chloroplast

MITOSIS, CYTOKINESIS, MEIOSIS AND APOPTOSIS

- The eukaryote cell cycle
- Mitosis
- Meiosis
- Fertilization and development
- Regulators of Cell cycle
- Programmed cell death

CELL GROWTH REGULATION, TRANSFORMATION AND METASTASES

- Signal molecules
- Switches of intracellular molecules
- Cell surface receptors
- Cancer

MICROBIOLOGY

- Taxonomy
- Prokaryote and Eucaryote Microbial Cell Structure

Cultivation of Microorganisms
Control of Microorganisms
Major Groups of Prokaryotes
Major Groups of Eucaryotic Microorganisms
Viruses
Pathogenesis and Microorganisms
Antibiotics and Microorganisms
Microbial Biotechnology

PROKARYOTIC CELL STRUCTURE AND FUNCTION

Nucleoid
Cytoplasmic Matrix
The Cell Envelope
Components Exterior to the Cell Wall
Differentiation and multicellularity

PROKARYOTIC DIVERSITY

The Archae, Cyanobacteria, Green phototrophs, and Deeply Branching Genera
The low G+C gram-positives
The high G+C gram-positives
The Planctomycetes, Spirochetes, Fibrobacter, Bacteroides and Fusobacteria

PROKARYOTE GENETICS

Mechanism of DNA Mutation, Transfer and Recombination in Bacteria
Mutation
Transformation
Transduction
Conjugation
Recombination in viruses
Prokaryote Genetics and Evolution

PROKARYOTIC GROWTH, NUTRITION AND PHYSIOLOGY

Bacterial Cell Growth and Division
The bacterial cell cycle and its regulation
Bacterial Population Growth
Bacterial Nutrition
Energy generation
Bacterial Nutrient Stress Responses

MICROBIAL PATHOGENESIS AND ANTIBIOTICS

Microbial Disease and Pathogenesis in History
Foodborne and Water Borne Diseases
Air Borne Diseases
Sexually Transmitted Diseases
Infections Acquired in Hospital
Prion Diseases

GENETICS AND MOLECULAR BIOLOGY

Signal Transduction via Plasma Membrane to Gene Expression
Signal Transduction of Light in Animals (Vertebrates), Neurospora Crassa, and Plants
Epigenetic Regulation of Gene Expression in Eukaryotes

HISTORY AND SCOPE OF GENETICS; EPIGENETIC REGULATION OF GENE EXPRESSION

- RNA interference
- Repeat induced point mutation (RIP)
- Genetic regulation by Polycomb group (PcG) proteins
- Epigenetics in *Arabidopsis thaliana*
- Paramutation

MENDELIAN GENETICS AND ITS DEVELOPMENT

- The Classical Theory of Direct Inheritance
- Mendelian Genetics
- Molecular Genetics
- Population Genetics

CLASSICAL TO MODERN GENETICS

- Bacillus subtilis*
- Agrobacterium tumefaciens*
- Neurospora crassa*
- Aspergillus nidulans*
- Lotus corniculatus* L. var. *japonicus* Regel

BACTERIAL AND YEAST GENETICS - A HISTORICAL ACCOUNT

- Bacterial genetics
- Yeast genetics

DIPLOID AND HAPLOID GENETICS AND RECOMBINATION MECHANISMS

- General Recombination
- Recombination and Pairing of Homologous Chromosomes
- Induction of Recombination
- Establishment of Recombination
- Structure and Function of the Synaptonema Complex (SC):
- Transcription and Recombination
- Somatic recombination/ Diploid Genetics
- Genes and Proteins in Meiotic Cells / Haploid Cell Genetics
- Meiosis and Environment

NON-MENDELIAN INHERITANCE

- Chloroplast Inheritance
- Mitochondrial Inheritance

GENOME ANALYSIS OF CYANOBACTERIA

- Sequence Features of the *Synechocystis* sp. PCC6803 Genome
- Assignment of RNA and Protein-Coding Genes in the *Synechocystis* Genome
- Characteristic Features of *Synechocystis* Genes
- Functional Genomics in *Synechocystis*
- Databases Supporting *Synechocystis* Research
- Genome Analysis of Other Cyanobacteria

GENOME SCIENCE OF CYANOBACTERIA, GREEN ALGAE AND PLANTS (GENOME SCIENCE OF GREEN ALGAE)

- Chlamydomonas* as a model organism for plants
- Nuclear genome
- Chloroplast genome

Mitochondrial genome

GENOMIC ANALYSIS OF ARABIDOPSIS THALIANA

Introduction: Why is Arabidopsis a Model Plant Species?
Small Size and Simple Organization of the Arabidopsis Genome
Chromosomes and Maps
Analysis of the Complete Genome Sequence
Chromosomal Elements: Centromeres, Telomeres, and rDNA Repeats
Arabidopsis Plastid and Mitochondrial Genomes
Functional Genomics of Arabidopsis
Perspectives

GENOME SCIENCE OF INVERTEBRATES: THE NEMATODE C.ELEGANS

What is a nematode?
What is C.elegans ?
Genetic resources of C.elegans: CGC
Genomic resources
Resources for gene expression and function

GENOME SCIENCE OF THE RAT

Genome Resources
Genetic Engineering
Positional Cloning of Monogenic Traits
QTL Analysis

GENOME SCIENCE OF VERTEBRATE

The Importance of the Mouse Genome and Transcriptome Study
The History of Mouse Genetics
The Determination of Mouse Genome Sequences
A Full-Length Mouse cDNA Project
Positional Cloning
cDNA Encyclopedia and the Positional Candidate Approach
Functional Genomics

MOLECULAR BIOLOGY

DNA REPAIR

DNA Damage
DNA Repair by Reversal of Damage Without Excision
Base Excision Repair in Non-Mammalian Cells
Base Excision Repair in Mammalian Cells
Nucleotide Excision Repair in Non-Mammalian Cells
Nucleotide Excision Repair in Mammalian Cells
Mismatch Repair
Repair Enzymes in Mitochondria
SOS Responses
Recombination Repair
Human Hereditary Diseases with Defective Processing of DNA Damage

RECOMBINATION - TRANSFORMATION, TRANSDUCTION AND CONJUGATION

Recombination
Involvement of RNA in DNA Recombination
Recombination of RNA

Inverted Repeats
Conjugation
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Transformation

REVERSE TRANSCRIPTASE AND CDNA SYNTHESIS

Discovery of Reverse Transcriptase
Characteristic Features of Retroviral Reverse Transcriptases
Reverse Transcriptase Activity in Other Organisms
Conserved Amino Acid Residues in Putative Reverse Transcriptase
Structure of Retroviral Reverse Transcriptases
cDNA Synthesis by Reverse Transcription

HORIZONTAL AND VERTICAL GENE TRANSFER

Gene Transfer
Horizontal Gene Transfer
Vertical Gene Transfer

PATTERNS OF HEREDITY AND GENETIC ALTERATION; EPIGENETICS OF MAMMALS

DNA Methyltransferase in Mammals
DNA Methyltransferase Defective Mice
Genomic Imprinting and DNA Methylation
X-Chromosome Inactivation and DNA Methylation
Methyl-CpG-Binding Proteins
Chromatin Formation
Remodeling of Nucleosomes
Histone Acetylation and Nucleosome Remodeling
Histone Deacetylation
SIN3 Complex
Mi2-NuRD Complex
Transition Regulation Under the Control of Chromatin Remodeling Factors

GENE ACTION IN INHERITANCE

Germline Development
Polar Granules, the Distinctive Organelles of Germ Plasm
Maternal Genes Required for Germ Plasm Assembly
Maternal Factors Required for Pole Cell Formation
Maternal Factors Required for Pole Cell Differentiation
Germ Plasm Components in Other Animals

GENOTYPIC AND PHENOTYPIC VARIATIONS

Brief Introduction to Historical Background
Brief Introduction to the Genetics of the Nematode *Caenorhabditis*
Uncoordinated Mutants of *C. elegans*
Other Mutants
Future Scope

MOLECULAR GENETICS OF INHERITED DISORDERS

Mutations
Effects of mutations on gene function
Molecular pathology of the human β -globin gene.
Patterns of inheritance

HEREDITY AND ENVIRONMENT; LIGHT SIGNAL TRANSDUCTION IN PLANTS AND FUNGI

Historical aspects of analysis of respond to light
Plants; *Arabidopsis thaliana*
Fungi; *Neurospora crassa*

THE HUMAN GENOME

Human Genome
DNA Variation
Physical Maps of Human Chromosomes
Body Expression Map of the Human Genome
Applications of Gene Expression Analysis in Biomedical Research
Mitochondrial DNA
The Origin of Modern Humans

HUMAN GENETICS

Human Genetics and Medical Genetics
Historical Aspects of Human Genetics
Genetic Diseases
Genetic Services
Gene Therapy

GENETICS AND SOCIETY

GENE EXPRESSION AND EMBRYOGENESIS IN AMPHIBIANS

Historical background
The search for inducing factors
The Responding Tissue
Autoneuralization and the Neural Default Hypothesis
Organizer and Antiorganizers
The importance of gradients for the anterior-posterior organization of the embryo
Germ layer determination – the three-signal (cascade)-model
Planar versus vertical signal during neural induction
Amphibians – a model system for organ engineering

ETHNOPHARMACOLOGY: AN OVERVIEW

Methods
Contexts of Medicinal Plant Use
Multicontextual Plant Use

HISTORICAL FOUNDATIONS OF BOTANICAL MEDICINE

Primates, Birds, and Butterflies
Shanidar
Ötzi
Herbals
Native American Medicinal Plants

INSIGHTS INTO EVOLUTIONARY SYSTEMS VIA CHEMOBIOLOGICAL DATA

The Phytochemical Discovery of Brazil
Chemical Variability: Puzzles of the Lauraceae
A Plant is no Factory
How does Nature Work?
What is Quantitative Chemo-Biology?

What are Natural Products?
Chemobiological Language: What are its Grammatical Rules?
Medicinal Plants
Ethnobotany: Evolutionary Patterns for Useful Plants
Phytochemistry: Regulatory Mechanisms of Plant Bioactivity
Antagonism: A Unifying Concept?
Perspectives

CONTEMPORARY METHODOLOGICAL APPROACHES IN THE SEARCH FOR NEW LEAD COMPOUNDS FROM HIGHER PLANTS

Approaches for the discovery of new drugs from higher plants
Selection of plant material
Biological and pharmacological targets
Chemical screening
Isolation of active principles and their structure determination

INTEGRATING ETHNOGRAPHIC AND ECOLOGICAL PERSPECTIVES FOR ETHNOPHARMACOLOGY FIELD RESEARCH

Anthropological (Ethnographic) Field Methods
Integrating Ethnographic and Ecological Field Methods

MANAGING ETHNOPHARMACOLOGICAL DATA: HERBARIA, RELATIONAL DATABASES, LITERATURE

Historical trends
Present trends

PROFESSIONAL ETHICS AND ETHNOPHARMACOLOGY

What are Professional Ethics?
External Standards Affecting Ethnopharmacologists
Remaining Challenges for Ethnopharmacology as a Profession

"MEDICINAL PLANTS IN THE EVOLUTION OF THERAPEUTICS" A CASE OF APPLIED ETHNOPHARMACOLOGY

Medicinal plants in the evolution of biomedicine
Disease Control in a cross-cultural context: A case of applied ethnopharmacology to common intestinal parasitism
Material and Methods
Results and analysis
Discussion: Health, sustainable development and socio-economic aspects of treating the most common parasitic disease in the world
Recommendations for further research
Policy implications

PLANTS AS A SOURCE OF ANTI-CANCER AGENTS

Plant-Derived Anti-Cancer Agents in Clinical Use
Plant-Derived Anti-Cancer Agents in Clinical Development
Targeting Natural Products
Plant-Derived Anti-tumor Agents in Preclinical Development
Cell Cycle Target Inhibition and Anti-cancer Drug Discovery

TRADITIONAL MEDICINAL PLANTS FOR THE TREATMENT AND PREVENTION OF HUMAN PARASITIC DISEASES

Protozoa
Helminths

PLANTS AND PLANT SUBSTANCES AGAINST AIDS AND OTHER VIRAL DISEASES

The plant kingdom as source of new antiviral agents

Antiviral test methodology

Plant-derived anti-human immunodeficiency virus (anti-HIV) agents

Plant-derived anti-herpes simplex virus (anti-HSV) and anti-cytomegalovirus (anti-CMV) agents

Plant-derived anti-influenza virus agents

BOTANICAL ANALGESIC AND ANTI-INFLAMMATORY DRUGS

Principal plants that have contributed to the development of modern analgesic and anti-inflammatory drugs

New plant-derived substances with potential antinociceptive or anti-inflammatory properties

Possible biological targets for botanical-derived substances with potential anti-inflammatory and antinociceptive properties

THE SEARCH FOR PLANTS TO MANAGE DIABETES

Need for Medicinal Plant Discovery for Type 2 Diabetes

Methods for Searching for Type 2 Diabetes Active Plants

Selected examples of medicinal plants under investigation for antidiabetic activity

Compounds often associated with hypoglycemic activity in medicinal plant research

MEDICINAL PLANTS FOR THE PREVENTION AND TREATMENT OF CORONARY HEART DISEASE

Artichoke (*Cynara scolymus*)

Garlic (*Allium sativum*)

Guggul (*Commiphora mukul*)

Ginkgo (*Ginkgo biloba*)

Hawthorn (*Crataegus* species)

Red wine (*Vitis vinifera*) and resveratrol

Saffron (*Crocus sativus*)

Tea (*Camellia sinensis*)

THE SEARCH FOR PLANTS TO MANAGE NEURODEGENERATIVE DISEASES

Plants and their constituents from Ayurvedic medicine

Plants and their constituents from Chinese traditional medicine (TCM)

Plants and their constituents from European herbal medicine

Plants and their constituents from African and South American traditional medicine

PSYCHOACTIVE BOTANICALS IN RITUAL, RELIGION, AND SHAMANISM

Shamanism, psychoactive plants, and the origins of religion

Psychoactive botanicals: A world overview

Contemporary issues

PRIMATES, PLANTS, AND PARASITES: THE EVOLUTION OF ANIMAL SELF-MEDICATION AND ETHNOMEDICINE

Animal self-medication and ethnomedicine

The impact of parasites on the evolution of self-meditative behavior

Food as medicine in animals and humans

Use of plants as medicine by chimpanzees in the wild

A link between animal self-medication and ethnomedicine

Tongwe ethnozoology and health care

Future studies and directions of research

ETHNOPHARMACOLOGY AND HEALTH CARE IN THE DEVELOPING WORLD

- Indigenous Plants in Western Medicine
- Biodiversity and Sustainability
- Safety and Efficacy of Medicines
- Pharmaceutical Anthropology

SAFETY OF TRADITIONAL REMEDIES

- Introduction? safety of phytotherapeutic preparations
- Examples of safety issue with traditional remedies
- How frequent are toxic effects of traditional remedies
- Quality control measures
- Toxicity of traditional medicines? a public health perspective

MEDICINAL PLANTS IN INTERNATIONAL TRADE: CONSERVATION AND EQUITY ISSUES

- Conservation and Sustainable Use of Medicinal Plants
- Equity Issues in the Medicinal Plant Trade
- The Botanical Medicine Industry
- The Pharmaceutical Industry

THE FUTURE OF ETHNOPHARMACOLOGY: SEEKING A TRANSDISCIPLINARY AND CULTURALLY GERMANE SCIENCE

- Introduction – Defining Ethnopharmacology
- Objectives of Ethnopharmacology Research
- Future Trends

PHYSICAL ANTHROPOLOGY

HUMAN EVOLUTION: A PALEOANTHROPOLOGICAL PERSPECTIVE

- Reconstructing Biological History: The Relationship of Humans and Apes
- The Human Fossil Record: Basal Hominins
- The Earliest Definite Hominins: Australopithecines
- Early Australopithecines as Primitive Humans
- The Australopithecine Radiation
- Origin and Early Evolution of the Genus Homo
- Explaining Early Hominin Evolution: Controversy and the Documentation-Explanation Dichotomy
- Early Homo erectus in East Africa and the Initial Radiation of Homo
- After Homo erectus: The Middle Range of the Evolution of the Genus Homo
- Neandertals and Late Archaics from Africa and Asia: The Hominin World Before Modernity
- The Origin of Modern Humans
- Closing Perspective

A MODEL FOR HUMAN ECOLOGY

- Human ecology as a science
- Human ecology, and environmental protection and nature conservation
- Monitoring of the biological status of a population
- Interaction and ecosystem modeling
- Origin and development of human ecology
- Four sections of human ecology
- Some contemporary research problems
- University education in human ecology

PHYSIOLOGICAL ANTHROPOLOGY: EFFECTS OF ARTIFICIAL LIGHT ENVIRONMENT ON THE HUMANS

Light and human

GROWTH AND DEVELOPMENT

Adolescent growth
Mathematical description of the growth process
Growth and maturation
Genetic factors
Polygenic model and heritability
Genetics of postnatal growth
Genetics of maturation
Secular trend in growth
Secular changes in adult size
Secular changes in tempo of growth

ANTHROPOLOGY OF AGING

Skin and epidermal tissue
Supportive tissues
Muscle mass
Bones
Teeth and oral cavity
Heart and blood vessels
Respiratory system
Digestive system
Liver
Kidneys
Blood and blood-producing organs
Endocrine system
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ANTHROPOLOGY AND ERGONOMY

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Biomechanics as the one Possibility of the Physiological Anthropology
Biomechanical Anthropometry
Harmonic Analysis of Anthropometrical Data
Measuring and Modelling Methods
Presentation of Different Models of Body Members
The Children Anthropomeasures
Methods of Work Analysis
Motion of Nucleus Pulposus
Virtual 3D Human Modelling and Digital Biomechanical analysis
Future Work and Conclusions

HUMAN BIOLOGY WITHIN THE FRAMEWORK OF PHYSICAL ANTHROPOLOGY

Introduction: Theory and history of human biology
Basic genetics- Mendelian & molecular genetics, mitosis & meiosis
Population genetics- Hardy Weinberg Principle, forces of evolution
Quantitative genetics and complex traits- IQ, stature, diseases of complex origin

Human Adaptation to Climate
Epidemiology of Human Disease
Human Nutritional Evolution
Human Growth and Development
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APPLIED ANTHROPOLOGY

Creating a Subfield
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FORENSIC ANTHROPOLOGY

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Identification of Skeletal Remains
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FORENSIC ANTHROPOLOGY

Introduction
Identification of Skeletal Remains
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Conclusion

DNA FORENSICS: A POPULATION GENETIC AND BIOLOGICAL ANTHROPOLOGICAL PERSPECTIVE

A Brief History of DNA Forensics
Generic Problems Handled in DNA Forensics
Desired Characteristics of DNA Forensic Markers
Present General Protocols used in DNA Forensics
Issues in Determining Statistical Strength of DNA Evidence
Role of Biological Anthropology in Assessing the Statistical Strength of DNA Forensic Evidence

BIOTECHNOLOGY

- Historical Development
- Present Development
- Future Development

FUNDAMENTALS IN BIOTECHNOLOGY

- Cell Characteristics
- Cell Cultivation
- Chemical Functions
- Mutation and Gene Technology
- Biosafety

MICROBIAL CELL CULTURE

- Nutrition
- Growth
- Cultivation Systems

ALGAL CELL CULTURE

- Cell culture characteristics
- Growth and nutrition
- Cultivation techniques
- Selected organisms
- Scale-up considerations
- Production system classified by product type
- Scale-up technology
- Molecular algal biotechnology

PLANT CELL CULTURE

- The Basics of Plant Cell Culture
- Propagation of Plant Material
- Plant Improvement
- Conservation
- Utilization of Plant Germplasm

MAMMALIAN CELL CULTURE

- A brief history of mammalian cell culture
- Primary and continuous cultures
- Methods in mammalian cell culture
- Applications of cell culture in virus production
- Application of cell culture in biopharmaceutical production
- Tissue engineering and cell culture

CELL THERMODYNAMICS AND ENERGY METABOLISM

- Concepts of Thermodynamics
- Concepts of Energy Production and Conservation
- Concepts of Membrane and Solute Transport
- Concepts of Energy Metabolism
- Concept of Enzyme Catalysis

BASIC STRATEGIES OF CELL METABOLISM

Polymer hydrolysis
Aerobic catabolism
Anaerobic catabolism
Anabolism (biosynthesis) of cellular components
Metabolic Regulation

THE IMPORTANCE OF MICROBIAL CULTURE COLLECTIONS AND GENE BANKS IN BIOTECHNOLOGY

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Plant Genetic Resources
Culture Collections, Gene Banks and Biotechnology
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BIOSAFETY IN BIOTECHNOLOGY

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General Principles of Risk Assessment
Contained Use
Deliberate Release of Transgenic Plants: Testing in the Environment and Placing on the (World) Market
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BIOINFORMATICS

Levels of information processing
Traditional information support in biosciences: bibliographic databases
Value added processing of databases
Factual databases in biosciences
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METHODS IN BIOTECHNOLOGY

Methods in biotechnology: A topic in its own right
What is a method?
When methods are used in biotechnology
Identifying the need for a method, finding, choosing, using and reporting methods in biotechnology
Methods in biotechnology – current state and future prospects

INSTRUMENTATION AND CONTROL OF BIOPROCESSES

Common Instruments for Process Automation
Advanced Instrumentation for Bioprocess Control and Automation
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CHEMICAL METHODS APPLIED TO BIOTECHNOLOGY

Methods for Protein Determination
Methods for the Determination of Carbohydrates
Methods for Determination of Lipids

Methods for Determination of Other Cell Components
Analysis of Other Low Molecular Weight Molecules

PHYSICAL METHODS APPLIED TO BIOTECHNOLOGY

The Characterization of Potential Feedstocks in Sugar Cane
Physical Methods used for the Characterization of Lignocellulosic Materials
Bioprocesses Based on Sucrose Consumption such as in Sugar Cane Juice
Bioprocesses Based on Lignocellulosics such as Sugar Cane Bagasse
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MATHEMATICAL MODELING IN BIOTECHNOLOGY

What Can Mathematical Models Do for Biotechnological Processes?
Overview and General Principles of Mathematical Modeling Biotechnological Processes
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Steps in the modeling process
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Case Study 3: A Metabolic Structured Model for Glucose-Limited Growth of a Single Cell of Escherichia Coli
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Gene Engineering with Polymerase Chain Reaction
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GENETIC MANIPULATION OF BACTERIA

Genetic manipulation in bacteria
Introduction of DNA into bacteria
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Site directed mutagenesis
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GENETIC ENGINEERING OF ALGAL SPECIES

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Genetic Engineering as a Tool to understand the Physiology, Biochemistry and Molecular Biology of Algae

Genetic Engineering of Algae: Examples of Environmental and Industrial Applications

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Transformation of monocotyledonous plants

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Promoter efficiency and tissue specificity

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Integration and stability of transgenes

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Cost-effective and sustained production of nutritious food

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The paradox of GMO regulation
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Characteristics of Genetic Information: The Claim of Genetic Exceptionalism
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Penicillin, Cephalosporin and Cephamycin Biosynthesis: An Overview
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- The Archaeological Record
- Doing Fieldwork in Archaeology
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- Foundations of Archaeological Inquiry
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- Archaeology in the Real World
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- Why Climates Differ
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- Aims and Approaches of Materials Analysis in Archaeology
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- Texts and historical archaeology
- Culture History, Processual, and Postprocessual Archaeology
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- Sites and Monuments in the Context of Landscape
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- Industrial Associations and Learned Societies
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- Social Organization: Intangible but Tractable?
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- Holocene Foragers
- Are Foragers Natural Conservationists?
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Education for Sustainability: the Evolution of a Concept
Growing Momentum for Educational and Cultural Change
The Content and Structure of this Theme

EDUCATIONAL SYSTEMS AND THE WORLD: STRUGGLE AND CONNECTION IN CONTEXTUAL DEVELOPMENT

THE AIMS OF EDUCATION IN AN AGE OF STASIS AND CHANGE

The Role of Theory in the Aims of Education
The Liberal Tradition
Competing Analysis of Educational Aims
Interdependence of Educational Aims

EDUCATION, SUSTAINABILITY AND ENVIRONMENTAL ECONOMICS

Utilitarian and Duty-Oriented Approaches to Environmental Issues
The Ecological Problem
The Limits of Gross Domestic Product (GDP) as a Measure of Well-Being
Sustainable Economies
Moving to a Steady-State Economy

THE POLITICS OF LEARNING AND SUSTAINABLE DEVELOPMENT

The Technocratic Perspective
The Paradigm Shift Perspective
Task-based Perspectives: Social, Environmental and Educative
The Globalisation Perspective
The Segments Perspective
The Metaphorical Perspective
The Pragmatic Perspective
Some Commonalities

SOCIAL AND CULTURAL ISSUES IN EDUCATION

Education as the Transmission of Culture
Formal Education: The School
Literacy and the Nation-State
Potential of Education Systems and the Future

POLICY, PLANNING AND MANAGEMENT IN EDUCATIONAL SYSTEMS : ESSENTIAL ELEMENTS IN THE ACHIEVEMENT OF EDUCATION FOR SUSTAINABILITY

Policy
Planning
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PROFESSIONAL KNOWLEDGE OF EDUCATION

EDUCATION, TRADITION, HISTORICAL KNOWLEDGE AND SUSTAINABILITY

What is the role of tradition in the creation of a sustainable culture and educational system?
What is the role of historical knowledge?
What is the relationship between tradition and history?
What should be the role and function of history and tradition in the educational system?

KNOWLEDGE OF THE FUTURE AND THE ROLE OF INSTITUTIONS IN CREATING ECOLOGICAL SUSTAINABILITY

Global Protests
Individualism and Ethnocentrism
Rights of Future Generations
Energy Sustainability
Paying for Externalities

Shifting to a New Mode of Agriculture
Implications for Schools
Students as Citizen Planners
Designing a World Future

CULTURAL KNOWLEDGE FOR THE PRESENT AND THE FUTURE

Cultural knowledge
Educating for dominant cultural knowledge
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Ecological solution finding

ESSENTIAL EARTH LEARNING CONCEPTS FOR TEACHERS AND STUDENTS

Essential Concepts

FORMAL STRUCTURES OF MODERN EDUCATION

EARTH ETHICS, EARTH LITERACY, AND THE COMMUNITY COLLEGE

The Community College Context
The Obligations
The Case of Miami Dade College
Earth Literacy
Earth Ethics
Earth Ethics Institute
The Next Steps

SUSTAINABILITY AND UNIVERSITIES

Promotion of Sustainability in Universities
Progress in Campus Operations
Progress in Curriculum
Engagement with the local community
Research in the Field

THE RED QUEEN EFFECT: ROLES FOR ADULT EDUCATION IN SOCIAL SUSTAINABILITY

The Learning Connection
Existing Demands for Learning
Learning for Sustainability
Differential Demand and Differential Sustainability
Provision of Learning Opportunities
Harnessing the Red Queen

EDUCATION, LIFELONG LEARNING AND LEISURE

Aims of Education
Ancient Origins of Education and Leisure
Modern Conceptions of Education and Leisure
Education for Leisure
Cultural Continuity
Barriers to Education for Sustainability
Leisure, Education and Sustainability

HOLISTIC EDUCATION

HOLISTIC EDUCATION: LEARNING FOR AN INTERCONNECTED WORLD

Historical Roots of Holistic Education

Holistic Learning
Examples of Holistic Education

THE ECOLOGICAL AND ENVIRONMENTAL DIMENSIONS OF THE HOLISTIC CURRICULUM

The nature of curriculum
Paradigm tensions
The ecological dimension
Curriculum schemes
Curriculum as part of the whole
Reorienting curriculum
A connective pattern - curriculum, learning and sustainability

EDUCATION FOR SUSTAINABLE DEVELOPMENT: CHALLENGING THE PRINCIPLES OF MODERNIZATION

EDUCATIONAL POLICY AND PRACTICE FOR SUSTAINABLE DEVELOPMENT

From Environmental Education to Education for Sustainability: A Troubled History
Education for Sustainability: A Troubled Present
Worrying Evidence
Reorienting Schools for Sustainability

DEVELOPMENT, EDUCATION AND GRASSROOTS MOVEMENTS FOR SUSTAINABILITY AND ENVIRONMENTAL JUSTICE

The Genocidal Nature of Development
The Rise of the Alien National Pattern (and Genocide) in Europe
The State and the Market Function of Compulsory Schooling
Compulsory Schooling as Cultural Genocide

EDUCATION POLICY AND GENDER ISSUES: A SUSTAINABILITY PERSPECTIVE

Exclusion from Education
Policy
History of International Conferences and Conventions Related to Education
Education and Development
Gender and Education
Equity and Equality
The Link between Education and Sustainability
Thresholds of Education and Sustainability
What is Education for Sustainability
Societal Barriers to Literacy and Schooling
Women and Adult Literacy Programs
Recent Progress and Lessons Learned

A COMPARATIVE STUDY OF CULTURAL CONSERVATION AMONG MINORITY GROUPS: THE BASQUES AND SUSTAINABLE ETHNICITY IN AN AGE OF GLOBALIZATION

The Fluid Nature of Nationalism and the Creation of the Rural
The Case for the Basque: Globalization and the Struggle for Rural Identity
Economic Backwardness – The Basque Example
Modernization: the Basque Response
Schooling and Politics – Preserving the Basque Language
Lessons for and perhaps from Present Basque Nationalism

INDIGENOUS AND NEOTRADITIONAL KNOWLEDGE SYSTEMS AND THEIR ROLE IN CREATING AND MAINTAINING ECOLOGICAL SUSTAINABILITY

- Indigenous and Neotraditional Knowledge
- The Development of Alternative Knowledge Systems
- Sustainable Development
- Traditional Ecological Knowledge
- Effects of Globalization on Indigenous and Neotraditional Knowledge Systems
- Valuing and Protecting Alternative Knowledge Systems
- The Role of IKS in Development and Education

EDUCATION, THE INDIVIDUAL, AND CONSUMERISM

- Technology in Education Reinforces Consumerism
- Consumerism Targets Students
- Globalization of Consumerism
- Individualism Leads to Consumerism

MASS MEDIA AND INFORMATION TECHNOLOGY IN EDUCATION

- Communication and Development
- Electronic Media and Open and Distance Education
- Challenges for Media Use in Open and Distance Learning
- Concluding Considerations: Comparing Media Use in Differing Contexts

CULTURE, CIVILIZATION AND HUMAN SOCIETY

- Basics
- Cultural Histories
- Memory
- Time
- Today in the Clothes of Yesterday
- Languages and Concepts of Culture
- Cultures and Civilizations
- Human Societies
- Powers and Everyday Life

THEORY AND HISTORY OF CULTURE

- Culture - phenomena, objects of investigation, and concepts
- Cultural theories
- Disciplinary views on culture

FOUNDATIONS AND CHARACTERISTICS OF CULTURE

- Characteristics of Culture
- Material Culture
- Intellectual culture
- Culture as social organization
- The value of culture

CULTURE AS A MANIFESTATION OF HUMAN ACTIVITY

- Culture: The Human Way of Life
- Origins of Culture
- Nature, Human Action, and Culture
- Culture and Cultures

SORTING OUT CULTURE BY TYPE OR OTHERWISE - TOWARDS A BETTER UNDERSTANDING OF CULTURE AND INTERCULTURAL RELATIONS

An ontological inventory of culture
The concept of culture and its delimitation
The cosmic influence on civilisation
Identification patterns of culture
To leave a living name behind
Culture building

INTERPRETATION OF SYMBOLS

Philosophy of Symbolic Forms
The Philosophical Analysis of Language and Text: Hermeneutics
Textual Content Analysis

CULTURAL HERITAGE

Cultural heritage as a discipline not an inheritance
Cultural heritage - impersonal social and historical rules
Every human society has its own discipline at the micro and macro level
The perpetuation of a discursive and a non-discursive practice
Stabilization and innovation - fossilization and anarchy
Cultural heritage as a resource of a community and of humanity
The political uses of the cultural heritage

DIVERSITY AND UNITY IN THE CULTURAL HERITAGE OF PEOPLES, STATES AND HUMANITY

Brief history of concept of cultural unity from Herder to Lenin
Historical definitions of cultural diversity
Contemporary definitions of culture
Hybrid cultures
Promoting a culture of mutual respect for cultural difference
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TRADITIONS, INNOVATIONS AND DISCONTINUATIONS IN THE DEVELOPMENT OF CULTURE

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PROTECTION OF CULTURAL HERITAGE AS SOCIAL, POLITICAL AND ECONOMIC ISSUES

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MASS CULTURE, POPULAR CULTURE AND CULTURAL IDENTITY

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Globalization and commercial mass culture
Identities within a global commercial mass culture
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CULTURE IN CONTEMPORARY CIVILIZATION

The Role of Custom and Tradition in Contemporary Civilization
High and Popular Culture
Multicultural and multi-ethnic societies

Cultural diversity and globalization
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MODERN AND TRADITIONAL CULTURES

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Do Traditional Cultures Exist?
Opposition between Traditional and Modern Cultures in Western Discourses and Practices
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IMPERIALISM, RESISTANCE, AND CULTURE

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STRUCTURE OF CULTURE AND COMMUNICATION FORMS

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KINDS, FORMS AND ATTRIBUTES OF CULTURAL ACTIVITY

Creation and Perception of aesthetic objects

CULTURAL INTERACTION

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Tones, Images, Narrations, and Scripts
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LOCAL CULTURES AND GLOBAL DYNAMICS

The impact of colonialism and globalization on local and national cultures
Dissipative structures in global economic and cultural relationships
The social and cultural costs of globalization

CULTURAL EXCHANGE

Belief systems, Law and Custom
Philosophy, Art and Science

WEST/EAST AND NORTH/SOUTH DIALOGUE OF CULTURES INTERCULTURALITY AND COMMUNICATION

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The Applied Semiotics of Intercultural Communication

GLOBAL INFORMATIONAL FLUXES AND NATIONAL CULTURAL VALUES

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CULTURAL INTEGRATION AND NATIONAL ORIGINALITY OF CULTURES

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TWENTIETH-CENTURY PERSPECTIVES ON CULTURE

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Concepts of culture in biology and anthropology
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Culture and the loss of stability and certainty
Culture and the taming of the unconscious
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ECOLOGY OF CULTURE

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- Electronic Distance Measurements (EDM)
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- Optimization through Solidification Processing
- Optimization through Mechanical Processing
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- Atomic Orbitals: their Origin and their Shapes
- Forming Bonds between like Atoms: Bonding and Anti-bonding Molecular Orbitals, Sigma and Pi-bonds
- Forming Bonds between Unlike Atoms: Polar Covalent and Ionic Bonds, Two Extremes of the Same Process
- A Simple Model for an Ionic Solid: A Balance between Coulombic Attraction and Short-range Repulsion
- From Hybridization to Conjugation to Band Structures: Why Diamond and Graphite have such Different Properties
- More about Bands: Metals, Insulators and Semiconductors
- Molecular Solids, van der Waals Solids and Hydrogen Bonding

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- Synthesis of Polymers
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- Additives
- Polymer Processing
- Polymers and the Environment
- Methods of Polymer Characterization
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- Statistical Molecular Theories
- Large Deformation Theory
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HIGH TEMPERATURE STRUCTURAL MATERIALS

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- Mechanical Working
- Polymer Matrix Composites
- Processing of Fibers
- Recycling and Reuse of Materials
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- Fundamentals of Processing from the Liquid State
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- Technical Advantages
- Example Applications
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MECHANICAL WORKING OF MATERIALS

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- Applications of Polymer-Matrix Composites
- Constituent Materials
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- Regenerated Cellulosic Fibers
- Melt-spun Synthetic Fibers
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- Why Reuse or Recycle?
- Current Practice
- Options for Near Term Improvement
- The Ultimate Goal: Recycling in a Steady State Economy

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- Defects in Solids

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DEFECTS INTRODUCED INTO METALS DURING FABRICATION AND SERVICE

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NON-DESTRUCTIVE TESTING AND EVALUATION OF METALS

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Responsive Materials in Engineering
Instrumented Structures: Add-ons for Smart Materials
Conventional Smart Materials
Micromechanics: MEMS
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Carbon: Nanotubes and Bucky Balls

MATERIALS FOR CLEAN ENERGY CONVERSION

Comparison between Combustion Processes and Fuel Cells for Energy Conversion
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Electricity as a Science: Electromagnetism and Circuit Theory
Engineering Electricity: Important Direct Current Devices
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Centralized Power: Battle of the Currents
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The Relationship between Digital And Analogue Images
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- The Image as a Representation
- The Image Processing Hierarchy
- The Pre-Processing Level
- Low Level Image Processing
- Medium Level Image Processing
- Image Interpretation
- Interpolation in Image Processing
- The Edge Detection Problem
- Applications of Image Processing
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- Principles of Modulation
- Detection and Receiver Structures
- Future Development, Economic and Environmental Implications

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- Conductive Materials, Wires and Cables
- Dielectric Materials and Devices
- Semiconductor Materials and Devices
- Magnetic Materials and Devices
- Superconducting Materials and Devices
- Fiber Optic devices and Systems

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- Basic concepts of electrical conduction
- Electronic band model
- Conductive materials
- Electrical wires
- Wire sizes
- Current carrying capacity
- Skin effect
- Types of electrical wire
- Cables components
- Cable performance in fire
- Environmental issues
- Conclusion: Sustainable Use of Metal Resources

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- Dielectric Materials
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MAGNETIC MATERIALS AND MAGNETIC TECHNIQUES

- Basics of Magnetism
- Magnetic Behaviour of Materials
- Types of Magnetic Materials
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- Promising Developments

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- Superconducting Properties
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GALVANOMETERS, ELECTROMECHANICAL VOLTMETERS AND AMMETERS

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ELECTRONIC VOLTMETERS AND AMMETERS

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Voltage and Current Transducers
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MAGNETIC MEASUREMENTS

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POWER AND ENERGY MEASUREMENTS

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- Motion Sensors
- Velocity Sensors
- Force Transducers
- Temperature Sensors
- Magnetic-Field Sensor
- Chemical Sensors
- New Research Trends

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- Instruments and Instrumentation Systems
- Digital Systems, Microprocessors, and Computers
- Networks and Communications in Instrumentation Systems
- Advanced Systems
- Applications of Instrumentation Systems

TELEMETRY

- Basic Telemetry Concepts
- Modulation Approaches
- Telemetry Applications

ELECTRO-TECHNOLOGIES

- Electro-technologies for Generation and Transmission of Electricity
- Electro-technologies for end-uses of electricity
- Electric Vehicles

DIRECT CURRENT MACHINES

- Magnetism and Electromagnetic principles
- Current Carrying Wires and Coils
- Basic Motor Principles
- Machine equations and circuits
- Types of dc Machine
- Stepper Motors

TRANSFORMERS

- Basic Operating Principles of a Transformer
- Induction Motors
- Surges caused by the Vacuum Circuit Breaker

SYNCHRONOUS MACHINES

- Types of Synchronous Machine
- Cylindrical-Rotor Synchronous Generators
- Synchronous Motors
- Excitation System

INDUCTION MOTOR AND SELF-EXCITED INDUCTION GENERATOR

- Basic Construction
- Principle of Action
- Power Relationship and Torque-Slip Characteristics
- Motor Starting
- Speed Control
- Motoring, Generating, and Plug-Braking Modes of Operation
- High-Torque Induction Motors

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ELECTRIC POWER ASSISTED STEERING SYSTEM FOR AUTOMOBILES

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Energy Storage Systems
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FACTS Plus Energy storage: Utility Application Performance
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- Plasma Physics
- Types of Plasma
- Plasma Diagnostics
- Plasma Surface Interactions
- Biomaterials
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- Distribution System Planning
- Distribution Lines and Substations
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ELECTRIC POWER SYSTEM ANALYSIS, OPERATION AND CONTROL

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- Modeling of Power System Components
- Load Flow Analysis
- Power System Dynamic Simulations
- Automatic Generation Control
- Power System Stability and Control
- Power Electronics and its Applications to Power System Control
- Voltage Control and VAR Management
- Sub-synchronous Resonance
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CIVIL ENGINEERING

- Historical Background of Civil Engineering
- Functions of Civil Engineering
- Social Development Of Civil Engineering
- Prospects for the Twenty-First Century

FIELDS WITHIN CIVIL ENGINEERING - PORTS AND CANALS AS WATERBORNE TRANSPORT FACILITIES

- Ports and Canals in the Ancient World
- Ports and Canals in the Seventh to Fifteenth Centuries
- Ports and Canals in the Sixteenth to Nineteenth Centuries
- Ports and Canals in the Twentieth Century
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TRANSPORTATION ENGINEERING

- Traffic Flow Fundamentals
- Transportation Planning
- Geometric Design of Highways
- Traffic Management
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URBAN AND COMMUNITY PLANNING

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- Spatial data analysis and output production
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- Linearity of the structural system.
- Definition of kinematics
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- Balance of linear momentum
- Material constitution
- Reduction of 3D constitutive equations for 2D plane problems.
- Deduction of Euler-Bernoulli Beams from Solid.
- Methods of structural analysis
- Discrete modeling of structures
- Matrix force method
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EARTHQUAKE PROTECTION

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- Structural Failures
- Inelastic Behavior
- Earthquake Energy Partitioning
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- Modified Seismic Coefficient Method
- Elasto-Plastic Response and Ultimate Strength of Structures
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- Ground Motion Characteristics in Soft and Liquefied Soils
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- Seismic Actions
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- The Shape of the land surface
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- Geological Maps
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- A Historical Review of Mining Engineering
- Features of Mining
- Development and Operation of Mine
- Mining and Mining Equipments in Underground Mine
- Mineral Transportation in Underground Mine
- Rock Pressure and Support System in Underground Mine
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- A New Consensus: The Railroad Era in the US
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- Prehistory of Goods Transportation
- The Middle Ages and the Development of Trade Economies in Europe

From 1500 to 1780: The Age of Sail, Worldwide Exploration, and Gains from Trade
The Impact of the Industrial Revolution on Goods Transportation, 1780–1870
Defining the Role of Modern Government: Goods Transportation from 1870 to the Present

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Trade, Technology, and Institutional Arrangements in International Transportation
Recent Transportation Institutional Evolution in the United States

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- Reliability Measures for Elements
- Statistical Estimation of Reliability Measures
- Series Configuration Systems
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- Complex Systems and Redundancy
- Fault Tree Analysis
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- General Concepts of Physical Reliability Theory
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- Failure as the First Excursion of a Random Process

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- Linear Fracture Mechanics
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- Traditional Approach to Fatigue Analysis
- Theory of Fatigue Crack Growth
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- Basic Concepts
- Relationship between Diagnostics and Reliability
- Diagnostics aspects at the Design Stage
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- Defects in Welds, their Causes and Removal

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TELECOMMUNICATION SYSTEMS AND TECHNOLOGIES

Telecommunications: Connecting the World
150 Years in a Blink of an Eye: a Very Short History of Telecommunications

What is between Two Telephones?

A Rapid Overview of Mechanisms, Technologies, and Models for Telecommunications Systems and Services

The Wireless World

The Convergence of the Internet and Telecommunication Networks

The Future of Telecommunications

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- Telecommunication Networks: Changes in Motion
- Network and Service Management Architectures
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- Analysis and Design of Feedback Control Systems
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- Open-loop Control and Closed-loop Control
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- The NARMAX model
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- Identification and Adaptive Control of Higher Order Systems
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- The Adaptive Control Problem (Relative Degree $n^* = 1$)
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- Nonlinear Geometric Methods
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- The Small-gain Theorem
- Passivity Theorems
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- Basics of Manifolds and Bundles
- Lie Derivatives and the Lie Bracket
- Distributions and the Theorem of Frobenius
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- Remarks on Symbolic Computation
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- Recursive computation of the kernels.
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- The Invariance Principle
- Linear Systems
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- Systems and Gains
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- State-feedback design for global stability
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- The problem of feedback linearization
- Normal forms of single-input single-output systems
- Conditions for exact linearization via feedback

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- The problem of output regulation
- Output regulation in the case of full information
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- Nonlinear Control System Paradigms
- Zero Dynamics in Control Systems
- Nonminimum Phase Control Systems: Difficulties and Partial Solutions
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- Equivalence and flatness
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- Control Lyapunov Function
- Lyapunov Design via Lyapunov Equation
- Lyapunov Design for Matched and Unmatched Uncertainties
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- Concept "Sliding Mode"
- Sliding Mode Equations
- Existence Conditions
- Design Principles
- Discrete-Time Sliding Mode Control
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- Observability
- Construction of Observers by Linear Approximation
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- High Gain Observers
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- Passivity: mathematically speaking
- Stability of passive systems
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- Features of Chaos
- Methods of Chaos Control
- Bifurcations Control
- Applications in Science
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- Bifurcation Control - The New Challenge
- Bifurcations in Control Systems
- Preliminaries of Bifurcation Theory
- State-Feedback Control of Bifurcations
- Some Other Bifurcation Control Methods
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- Notion of chaos
- Examples of chaotic systems
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- Models of controlled systems and control goals
- Methods of controlling chaos: continuous-time systems
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- Fuzzy systems
- Control of chaos in distributed systems
- Chaotic mixing
- Generation of chaos (chaotization)
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- Fuzzy Control -A Simple Example
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- Process of Data-Based Modeling
- Concepts for Fuzzy Modeling
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- Basic principles of optimisation
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- Dynamical Systems and Feedback Control
- Tracking Control Using Static Neural Networks
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- Expert systems approach to control system development
- Uncertainty management in expert control
- Supervisory expert control
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- More on supervisory expert control
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Relational and Logical Knowledge Representation

Statements and Solutions of Control Problems

Learning Processes in Knowledge-Based Control Systems

Descriptions of Initial Uncertainty

Related Problems

FUZZY EXPERT CONTROL SYSTEMS: KNOWLEDGE BASE VALIDATION

Integrated Control Systems

Fuzzy Expert Control System Methodology

Knowledge in Fuzzy Expert Control Systems

Main Design Issues

Objectives of Knowledge Validation for Control

Inference

Validation of Fuzzy Expert Controllers

Uncertain Models

Conclusions and Perspectives

BLACKBOARD ARCHITECTURE FOR INTELLIGENT CONTROL

Characteristics for Intelligent Control

Blackboard Architecture

Development of Blackboard Systems

The Structure of a Blackboard System

A Framework for Intelligent Control

Future Trends and Perspectives

GENETIC ALGORITHMS IN CONTROL SYSTEMS ENGINEERING

What are genetic algorithms?

How can GAs be of benefit to control?

Design applications

On-line applications

Future perspectives

DISCRETE EVENT SYSTEMS

Event-driven and Time-driven Systems

Abstraction Levels in the Study of Discrete Event Systems

Modeling Overview
Control and Optimization of Discrete Event Systems

MODELING OF DISCRETE EVENT SYSTEMS

Automata
Operations on Automata
Regular Languages and Finite-state Automata
Petri Nets
Process Algebras
Discussion on Timed Models
Introduction

SUPERVISORY CONTROL OF DISCRETE EVENT SYSTEMS

Control of Fully-Observed Discrete Event Systems
Control of Partially-Observed Discrete Event Systems
Avoiding Deadlock and Livelock
Controller Synthesis Techniques
Discussion
Introduction

SAMPLE PATH ANALYSIS OF DISCRETE EVENT DYNAMIC SYSTEMS (DEDS)

Perturbation Analysis
Markov Potential Theory Based Sample Path Sensitivity
Other Approaches: the Likelihood Ratio Method
Sample Path Based Optimization

HYBRID CONTROL SYSTEMS

What is a Hybrid Control System?
Analysis and Design of Hybrid Control Systems
Introduction

MODELING OF HYBRID SYSTEMS

Examples of Hybrid Systems
Mathematical Models for Hybrid Systems
Properties of Hybrid Systems
Software Tools

WELL-POSEDNESS OF HYBRID SYSTEMS

Model Classes
Solution Concepts
Well-posedness Notions
Well-posedness of Hybrid Automata
Well-posedness of Multi-modal linear Systems
Complementarity systems
Differential Equations with Discontinuous Right-hand Sides

STABILITY OF HYBRID SYSTEMS

Background and Motivation
Early Results
Stability via Multiple Lyapunov Functions
Further Results

BISIMULATIONS OF DISCRETE, CONTINUOUS, AND HYBRID SYSTEMS

- Bisimulations of transition systems
- Bisimulation of continuous systems
- Bisimulations of hybrid systems

OPTIMAL CONTROL OF HYBRID SYSTEMS

- Hybrid Dynamic Programming
- Related Theory and Special Cases

VERIFICATION OF HYBRID SYSTEMS

- Hybrid Model and Verification Methodology
- Verifying Continuous Systems
- Verifying Hybrid Systems
- Flight Management System Example

STABILIZATION THROUGH HYBRID SYSTEMS

- Switched Systems
- Supervisors
- Case Studies

CASE STUDY : AIR TRAFFIC MANAGEMENT SYSTEMS

- A short History of Air Traffic Control
- Organization of Air Traffic Control
- Levels of Automation in the Current System
- Conclusions

ARCHITECTURES AND METHODS FOR COMPUTER-BASED AUTOMATION

- Definition of some Basic Terms
- Degree of Automation and Computer Operation Types
- Automation of Technical Products and Technical Plants
- The Elements of a Industrial Automation System
- Levels of Process Management and Automation Functions
- Basic Types of Process Events in Technical Systems
- Examples for Industrial Automation Systems
- Effects of Industrial Automation on People, Society and Environment

SUPERVISORY DISTRIBUTED COMPUTER CONTROL SYSTEMS

- System and Component Structure
- General System Services
- Conclusions

FAULT DIAGNOSIS AND FAULT-TOLERANT CONTROL

- Fault Diagnosis: Basic Definitions and Concepts
- Model-free Approaches to Fault Diagnosis
- Principles of Model-based Fault Diagnosis
- Analytical Methods of Model-based Residual Generation
- Knowledge-based Approaches to Model-based Residual Generation
- Residual Evaluation
- Historical Review of Fault Diagnosis Approaches
- Fault-tolerant control
- Determining appropriate reactions to faults
- Analysis based on system structure
- Fault-tolerant control based on Diagnosis
- Conclusion

FAULT DIAGNOSIS FOR LINEAR SYSTEMS

- Model of the system, faults and uncertainties
- Methods of residual generation
- Parity space approach to residual generation
- Observer-based residual generation
- Fault analysis using parameter estimation
- Residual evaluation
- Conclusion and Perspectives

FAULT DIAGNOSIS FOR NONLINEAR SYSTEMS

- Model Classes
- Residual Generator Design
- Fuzzy Model Based Fault Detection for Nonlinear Systems
- Conclusion

DESIGN METHODS FOR ROBUST FAULT DIAGNOSIS

- Model-based methods for FDI
- Observer-based residual generation
- The need for robustness in FDI
- Robust FDI design using unknown input observers
- Robust FDI design using eigenstructure assignment
- Robust FDI design using H8 optimization
- Concluding Remarks

QUALITATIVE METHODS FOR FAULT DIAGNOSIS

- Basic properties of qualitative models
- The diagnostic principle
- Logic-based fault diagnosis
- Diagnosis of discrete-event systems
- Outlook

STATISTICAL METHODS FOR CHANGE DETECTION

- Foundations-Detection
- Foundations-Isolation
- Case Studies-Vibrations
- Introduction

INDUSTRIAL APPLICATIONS OF FAULT DIAGNOSIS

- Methods
- Application Examples
- Future Aspects
- Introduction and Overview

OFF-LINE METHODS FOR FAULT DIAGNOSIS AND INSPECTION

- Parameter Estimation
- Pattern Recognition for Fault Diagnosis

EXPERIENCE WITH KNOWLEDGE-BASED SYSTEMS FOR MAINTENANCE DIAGNOSIS

- Development Steps in Methodology
- Basic Characteristics of Early Fault Detection Methods
- Condition Monitoring for Improved Maintenance in Nuclear Power Plants
- Condition Monitoring for Improved Maintenance in Other Industries
- Conclusions

FAULT TOLERANT SYSTEMS

Control and Fault Tolerant Control
Model Matching and the Pseudo-inverse Method
Optimal Control: the LQ problem
System reconfiguration and Structural Properties
Example
Conclusion

FAULT-TOLERANT CONTROL USING LMI DESIGN

Active Fault-Tolerant control Systems Design Using LMI Design
Fault Diagnostic Observer Design Using LMI Design for Uncertain Systems
Conclusion

STRUCTURAL ANALYSIS FOR FAULT DETECTION AND ISOLATION AND FOR FAULT TOLERANT CONTROL

Structural model
Matching on a bipartite graph
Causal interpretation
System Decomposition
Observability
Monitorability
Fault tolerant estimation
Controllability
A simple example
Conclusion

FAULT ACCOMODATION USING MODEL PREDICTIVE METHODS

The Fault Accommodation Problem
Failure Modeling
Failure Accommodation
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CONTROL RECONFIGURATION

Example
State of the Art
Reconfigurability Analysis
Reconfiguration Based on a Qualitative Model
Reconfiguration Based on Model-matching
Observer-based Control Reconfiguration
Reconfigurable Model-predictive Control
Outlook

ADAPTIVE AND NEURAL APPROACHES TO FAULT-TOLERANT CONTROL

An Adaptive Approach to Actuator Fault Tolerant Control
A Neural Network Approach to Sensor Fault Tolerant Control
A Neuro-Adaptive Approach to Process Fault Tolerant Control
Conclusions

AUTOMATION AND CONTROL OF THERMAL PROCESSES

Thermal Processes
Structures and Technologies of Automation and Control Systems

Future Developments

STEAM GENERATORS AND STEAM DISTRIBUTION NETWORKS

Steam Generators

Steam Distribution Networks

Laws, Regulations, Guidelines, and Standards

Main Control Systems

Advanced Control Methods, Signal Processing, and Plant Management Systems.

Experience and Practical Suggestions

AUTOMATION AND CONTROL OF HVAC SYSTEMS

Conventional HVAC Control

Advanced HVAC Control

Conclusions

AUTOMATION AND CONTROL OF ELECTRICAL POWER GENERATION AND TRANSMISSION SYSTEMS

General

Unit Control

Stability and Voltage Regulation of Multi-machine Systems

System control

Sequence Control - Startup and Shutdown

CONTROL OF SYNCHRONOUS GENERATORS

Voltage Control of Individual Synchronous Generators

Voltage Control with Electronic Power Converters

Excitation with Auxiliary Generators

Compounding

Indirect Generator Control

GAS TURBINES

Power Plant Setups

Gas Turbine Components

The Ideal Gas Turbine Cycle

Gas Turbine Control

Turbine Control System

AUTOMATION AND CONTROL OF ELECTRIC POWER GENERATION AND DISTRIBUTION SYSTEMS: STEAM TURBINES

Functional Specifications

Turbine Controller Design

Future Developments

AUTOMATIC CONTROL FOR HYDROELECTRIC POWER PLANTS

Safety Systems for Hydropower Units

Standard Control Algorithms

Implementation issues

Advanced Control Features

Outlook: Driving Forces for Further Development

ELECTRICAL NETWORK CONTROL

Power system engineering

Evolution of electrical network control technology

System engineering aspects

Typical control center functions

COMBINED CYCLE AND COMBINED HEAT AND POWER PROCESSES

Elements of Combined Cycle / Combined Heat and Power Processes

Typical CC/CHP Configurations

Operation of CC/CHP Plants

Automatic Control in CC/CHP Plants

Control Philosophy in Future Combined Cycle Power Plants

Conclusions

Introduction

CONTROL OF LARGE NUCLEAR REACTORS BY STATE AND OUTPUT FEEDBACK TECHNIQUES

On certain Preliminaries on Nuclear Reactor

Modeling of Nuclear Reactors

Control of Nuclear Reactor

Application to a large Pressurized Heavy Water Reactor

Conclusion

AUTOMATION AND CONTROL IN PROCESS INDUSTRIES

Process Control History

Process Models and Dynamical Behavior of Processes

Feedback Process Control

Structure of Complex Process Control

Trends in Process Control

AUTOMATION AND CONTROL IN IRON AND STEEL INDUSTRIES

Overview of Processes in Integrated Steelworks

Control of Metallurgical Processes

Control of Rolling Processes and Processing Lines

Overall Automation Systems

Development Trends

AUTOMATION AND CONTROL OF CHEMICAL AND PETROCHEMICAL PLANTS

The Chemical and Petrochemical Industries

Historical Perspective

Overview of Industrial Process Control

Traditional Process Control Strategies

Control System Design

Advanced Control Techniques

AUTOMATION AND CONTROL IN CEMENT INDUSTRIES

Description of the Technology

Control Problems and Systems

Control Systems Technology

Application of the Advanced Control Theory

AUTOMATION AND CONTROL OF PULP AND PAPER PROCESSES

Pulping Processes

Paper Mill

Control of Mechanical Pulp Making

Control of Chemical Pulp Making

Control of Papermaking

Future Control Issues

AUTOMATION IN WASTEWATER TREATMENT

The urban water system
Wastewater Treatment Operation
Incentives for Automation
Automation today in Wastewater treatment
Modeling wastewater treatment
Automation components
Discussion

MODELING AND CONTROL OF COMPLEX RIVER AND WATER RESERVOIR SYSTEMS

Models of water plants
Control strategies for water plants
Conclusion

AUTOMATION AND CONTROL IN PRODUCTION PROCESSES

Manufacturing
Distributed Computer Systems in Production Automation
Automation and Control of Food Manufacturing Process
Machine Tool and Welding
Automatic and Control in Electronic Industry
Discrete Event Systems in Manufacturing
Automation in Fisheries and Aquaculture Technology
Advanced Control in Production Engineering
Conclusion and Outlook

AUTOMATION AND CONTROL IN FOOD PRODUCTION

Automation of Food Production on the Processing Oriented Levels
Future Trends in the Automation of Food Production Processes
Introduction

MACHINE TOOL

Machine tool Monitoring and Control
Machine Monitoring and Tool Inspection
Outlook

WELDING

Model Building of welding Process
Welding Control
Welding Sensors
Welding Robots
Monitoring and Inspection
Future Trends

AUTOMATION AND CONTROL IN ELECTRONIC INDUSTRIES

Design and Test Automation
Automated Test Equipment
Semiconductor Manufacturing
Automated Visual Inspection
Packages and Interconnections
Automated Assembly
Future Trends

ADVANCED TECHNOLOGIES AND AUTOMATION IN AGRICULTURE

Examples of Advanced Precision Agriculture Components: Combine Harvester, Sprayer, Fertilizer Spreader

Networks in Agriculture

AUTOMATION IN FISHERIES AND AQUACULTURE TECHNOLOGY

Traditional harvesting technology. Relations to instrumentation, mechanization, control and automation.

New harvesting concepts.

Processing of fish and other products.

Aquaculture. Relations to automation and control.

AUTOMATION AND CONTROL IN TRAFFIC SYSTEMS

General Aspects of Automation and Control of Traffic Systems

Global Infrastructure for the Automation of Traffic Systems

Onboard Means for the Automation of Traffic Systems

Machine Vision for Flexible Automation of Traffic Systems

Conclusions

AUTOMOTIVE CONTROL SYSTEMS

Potential of Alternate Fuels and Propulsion Systems

Basic Engine Operation

Lambda Control

Idle Speed Control

Knock Control in SI Engines

Vehicle Modeling

ABS Control Systems

Yaw Dynamic Control

INTELLIGENT CONTROL OF ROAD VEHICLES FOR AUTOMATED DRIVING: PATH ARCHITECTURE FOR AUTOMATED HIGHWAY SYSTEMS AND LATERAL GUIDANCE

AHS Architecture

Vehicle Models for Lateral Control

Road Reference System

Lateral Controllers for AHS

Modeling and Lateral Control of Heavy Duty Vehicles

Concluding Remarks

SHIP STEERING

Modeling

Automatic Steering

Review of the Different Controller Strategies for Different Classes of Ships

Introduction

Conclusions, Future Developments, and Further Reading

CONTROL FOR RAILWAY VEHICLES

Overview of Railway Vehicle, Vehicle Models and Track Inputs

Traction and Braking Control Systems

Pantograph Control

Suspension and Guidance

Conclusion and Trends

TRAIN AND RAILWAY OPERATIONS CONTROL

- Control system overview
- Single train control
- Multiple train control and protection on a single track
- Multiple train on multiple track (Network control)

AEROSPACE

- Control of Aeronautical Vehicles
- Aircraft Flight Control Systems
- The Principles of Flight Control
- Primary Flying Controls
- AFCS Modes
- Fly-by-Wire and "Fly-by-Light" Systems
- Flight Control Functions
- Future Flight Control Systems
- Conclusions

ELEMENTS OF AUTOMATION AND CONTROL

- Elements of the Control Loop
- Information Technology Elements of Automation
- Trends in Automation and Control
- Conclusions

SENSORS IN CONTROL SYSTEMS

- Sensor Fundamentals and Classifications
- Sensors in Control Systems
- Sensor Technology Developments
- Biological Systems, Chemical sensors, and Biosensors
- Sensor-Enabled Visions for the Future

SELF-SENSING SOLID-STATE ACTUATORS

- Solid-state transducers
- Measurement and power electronics
- Compensation and reconstruction filters
- Application example - piezoelectric micropositioning system with one degree of freedom
- Conclusions

BUS SYSTEMS

- General Reflections
- Parallel Bus Systems
- Serial Bus Systems

PROGRAMMABLE LOGIC CONTROLLERS

- Historical Aspects
- PLC Programming Languages
- Professional Practice
- Future Trends and Perspectives

COMPUTER-AIDED CONTROL SYSTEM ENGINEERING TOOLS

- CAD techniques
- Trends
- Introduction

HUMAN-MACHINE INTERACTION

Human Tasks with Automation and Control
Human-Machine Interfaces
Knowledge-Based Support
Design and Evaluation
Conclusions

CONTROL OF ELECTRICAL MACHINES FOR DRIVES

General Remarks on Electrical Machines
DC Drives
DC-Power Amplifier
Speed Control of DC Machines
Vector Representation for the Quantities of AC Machines
The Two-Axis Machine Model
The Park Transformation
AC-Power Converter
Vector Control of AC Machines

ROBOTICS

Historical Perspective
Mechanism and Components of Robots
Streams of Robotics
Robotics Applications

ROBOT KINEMATICS AND DYNAMICS

Kinematics
Dynamics
Dynamic Parameter Identification
Symbolic Modelling

TRAJECTORY AND TASK PLANNING

Path Planning for Mobile Robots
Trajectory Planning of Robot Manipulators
Task Planning
Optimization Methods for Motion Planning
Concluding Remarks

ROBOT CONTROL AND PROGRAMMING

Robot Dynamics
Motion Control
Force Control
Robot Programming

INTELLIGENT ROBOTS

Fuzzy Computing
Neural Computing
Evolutionary Computing
Reinforcement Learning
Intelligence on Robotics
Concluding Remarks

ROBOTIC APPLICATIONS TO LIFE SUPPORT SYSTEMS

Basic Technologies
Intelligent Wheelchair Control

Intelligent Manipulator Control
Programing by Demonstration
Agent Orientated Software Design

ORGANIC AND BIO-MOLECULAR CHEMISTRY

The Carbon atom
 Structure of organic compounds
 Classification of organic compounds, the functional groups
 Attractive interactions and molecular recognition
 Reactivity of organic compounds
 Molecules of life
 Organic compounds in the market.
 Isolation, purification and analysis of organic compounds
 Conclusions

ORGANIC SUBSTANCES AND STRUCTURES, NOMENCLATURE OF ORGANIC COMPOUNDS

Type(s) of Nomenclature Operations
 General Rules
 Parent Name
 Functional Groups
 Specific Classes of Compounds
 Numbering of Some Heterocyclic Rings
 Numbering of Multiple Ring Systems
 Name Construction

STEREOCHEMISTRY

Symmetry
 Chirality
 Stereogenicity
 Conformation and configuration
 Configuration descriptors
 Dependence of the properties of chiral molecules on the enantiomeric composition
 How to obtain stereoisomerically pure compounds

SYNTHETIC ORGANIC CHEMISTRY

Synthetic strategy
 Protection and deprotection
 Control of stereochemistry
 The convergent strategy
 Solid phase synthesis
 Combinatorial synthesis
 Environmental friendly synthetic procedures
 Introduction

ORGANIC CHEMICAL REACTIONS

The Organic Reaction
 Classification of Organic Reactions

ORGANIC CHEMISTRY AND BIOLOGICAL SYSTEMS -BIOCHEMISTRY

From molecules to living systems: complexity is obtained from simple building blocks
 Amino acids and proteins

Nucleotides and nucleic acids: information, energy transport, catalysis
Sugars : energy, structures, modulation of proteins properties
Lipids: energy, membranes, protein targeting and signal transduction

CHEMISTRY OF NATURAL COMPOUNDS

Chemistry of natural products: a general perspective
Lipids
Amino acids, peptides and proteins
Nucleosides, nucleotides and nucleic acids
Carbohydrates

MEDICINAL CHEMISTRY

From Bioactive Molecules to Drugs
The Basis for Drug Action
Drug Discovery and Development
Clinical Evaluation
Industrial Drug Development
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CHEMISTRY OF NUTRACEUTICS, FLAVORS, DYES AND ADDITIVES

Flavors
Dyes
Additives
Nutraceuticals

COMPUTATIONAL ORGANIC CHEMISTRY

Computational approaches based on classical physics: molecular mechanics and molecular dynamics
Molecular orbitals theory and its Hartree-Fock implementation
Density functional theory (DFT)
Semiempirical Methods

ORGANIC PHOTOCHEMISTRY

Photophysics: interaction of light with matter and photostimulated processes
Photochemistry
Technical and experimental aspects
Concluding Remarks

ORGANOMETALLIC CHEMISTRY

Organometallic compounds of the group IA and IIA
Transition metal-based organometallic compounds
Organoboranes

POLYMER CHEMISTRY AND ENVIRONMENTALLY DEGRADABLE POLYMERS

General structure of polymers
Synthesis of polymers
Environmentally degradable polymers

ORGANIC SPECTROSCOPY

Nuclear Magnetic Resonance
Mass Spectrometry

INORGANIC AND BIO-INORGANIC CHEMISTRY

FROM SIMPLE TO COMPLEX COMPOUNDS

Metal amine complexes: bonding and geometry
Metal complexes of multidentate ligands: deviations from regular geometries
Linkage isomerism: the nitro–nitrito interconversion
Multidentate ligands with more sophisticated shapes: rings and cages
The metal template synthesis of macrocycles
The metal template synthesis of catenanes
Self-assembling driven by metal centres: helicates and grids
Coordination assemblies made on PdII building blocks
The coordination chemistry of anions
Conclusion

CHEMISTRY OF METALS

Structural and physical properties of metals
General aspects of extracting metallurgy
Alloying behavior
Intermetallic phases

INORGANIC SYNTHESIS

Coordination compounds: generality
Coordination compounds: reactivity

RADICAL REACTIONS AND METAL COMPLEXES IN AQUEOUS SOLUTIONS

Radicals and Their Role in Chemical Processes with Emphasis on Biological Systems
The Chemistry of Radicals
Important Types of Radicals
The Role of Transition Metal Complexes in Radical Chemistry
Concluding Remarks

MAGNETIC AND OPTICAL PROPERTIES

Electronic structure of transition metal ions
The Ligand Field Approach
Principles of optical spectroscopy
Rationalization of Spectra
Spin Hamiltonian approach
Magnetic properties
Magnetism in polynuclear complexes
Highlights of recent research breakthroughs

INORGANOMETALLIC CHEMISTRY

Definition of Inorganometallic vs. Organometallic Chemistry
Inorganometallic Compounds Containing Transition Metal (TM) Main Group Metal (E) Bond
Synthesis, Structure and Reactivity
Inorganometallic Clusters
Inorganometallics and Catalysis
Special Applications of TM-E Compounds

HIGH TEMPERATURE MATERIALS AND SOLID STATE CHEMISTRY

The Importance of Solids
Chemical Classification of Solids
Bonding in Solids
Properties and Technological Applications

Selected Classes of Inorganic Solids
High Temperature Materials
Conclusions

INORGANIC BIOCHEMISTRY

Historical background
The philosophy of model chemistry
The role of metal cofactors
The role of special metal cofactors

INORGANIC REACTION MECHANISMS

Planning a Mechanistic Study
A Classification of Inorganic Reactions
Ligand Substitution Reactions
Ligand Substitution at Square-planar Complexes
Ligand Substitution at Octahedral Complexes
Stereochemical Nonrigidity of Ligands
Redox Reactions
Introduction

HOMOGENEOUS AND HETEROGENEOUS CATALYSIS

Homogeneous Catalysis
Heterogeneous Catalysis
Heterogenized Catalysts
Introduction

CLUSTERS AND POLYNUCLEAR COMPOUNDS

Clusters of the p-block Elements
Clusters of d-block Elements
Polynuclear Compounds

STRUCTURE AND BONDING IN INORGANIC CHEMISTRY

Introduction
Ligand-field Theory for Octahedral Complexes
Ligand-field Theory for Square Planar Complexes
Ligand-field Theory for Tetrahedral Complexes
Charge-Transfer Absorption Bands
Stabilities of Complexes
Current Work and Further Reading

SYNTHESIS AND SPECTROSCOPY OF TRANSITION METAL COMPLEXES

Synthesis of Transition Metal Complexes
Spectroscopy of Transition Metal Complexes

NANOSYSTEMS

Zero-dimensional nanosystems
One-dimensional nanosystems
Two-dimensional nanosystems
Three-dimensional nanosystems
Inorganic-organic hybrid nanosystems
Nanosystems in biochemistry
Introduction

COMPUTATIONAL INORGANIC CHEMISTRY

- General Considerations
- Basic Computational Tools
- Goals and Strategies of Computational Methods
- Derivation of Molecular Properties
- Types of Chemical Information from MO Calculations
- Architectures of Molecular Orbitals
- Energy Partitioning Analysis and Bond Dissociation Energy
- Molecular Dynamics
- Solids and Surfaces
- Analysis of the Electron Density (QTAIM Methods)

ENERGY AND INORGANIC CHEMISTRY

- General background
- Molecular level energy conversion devices
- Inorganic Photovoltaics
- Photoelectrochemical solar cells
- Photoelectrochemical hydrogen production

ENVIRONMENTAL AND ECOLOGICAL CHEMISTRY

FUNDAMENTAL ENVIRONMENTAL CHEMISTRY

- Greenhouse Gases and Global Warming
- Chemistry of Organic Pollutants
- Secondary Pollutants
- Tropospheric Ozone Pollution
- Stratospheric Ozone Depletion
- Radioactive Compounds in Soil, Water and Atmosphere
- Pollution Control Using Accelerated Biodegradation

GREENHOUSE GASES AND GLOBAL WARMING

- Greenhouse Effect
- Greenhouse Gases
- Radiative Forcing of Climate Change
- Non Greenhouse Gas Radiative Forcing
- Climate Models
- Predictions of Future Climate

CHEMISTRY OF ORGANIC POLLUTANTS

- Aliphatic Compounds
- Cyanide and Carbon Monoxide
- Aromatic Carbocyclic Compounds
- Aromatic Rings containing Nitrogen, Oxygen or Sulfur
- Abiotic Reactions
- The Natural Environment

TROPOSPHERIC OZONE POLLUTION

- Historical Development of the Ground-Level Ozone Problem
- Photochemical Sources and Ozone Sinks
- Diurnal Variations of Ozone in Urban Areas
- Ozone and Atmospheric Oxidising Capacity
- Ozone and Urban Air Pollution: Some General Observations

CHEMISTRY OF STRATOSPHERIC OZONE DEPLETION

Formation and Distribution of Stratospheric Ozone
Chemistry of Stratospheric Ozone Depletion
Trends of Stratospheric Ozone and Ultraviolet Radiation
Expected Development of Stratospheric Ozone

RADIOACTIVITY IN LAND, WATER AND ATMOSPHERE

Radioactivity and Radiation
Biological Effects of Radiation
Natural Radioactivity
Anthropogenic Radioactivity
Behavior of Radioactivity in the Environment

ATMOSPHERIC CHEMISTRY

Emissions
Transport
Tropospheric Chemistry
Stratospheric Chemistry
Deposition
Lifetimes of Pollutants
Impact of Air Pollutants
Abatement Measures

SUSPENDED MATERIAL / AEROSOL

Generation
Fundamentals
Aerosol properties related to environmental effects
Epilogue

OXIDES OF CARBON

Carbon Monoxide
Carbon Dioxide

SULFUR DIOXIDE AND SULFUR CYCLES

Introduction: Atmospheric Sulfur Distributions, Cycles, and Global Material Balances
Sources, Concentrations, and Chemistry of Sulfur Compounds in the Atmosphere
Atmospheric Deposition Processes
Atmospheric Residence Times, Spatial Scales, and Global Models

OXIDIZED AND REDUCED NITROGEN IN THE ATMOSPHERE

Emissions
Chemical Transformations and Transport
Deposition processes
Effects of nitrogen emissions on our environment
Effect of policies to reduce emissions and future perspectives

ACID DEPOSITION

Introduction/The Problem
Emissions
Atmospheric transport and Chemical Conversion
Wet and Dry Deposition
Life Times and Transport of Acidifying Compounds.
Effects of Acid Deposition and Eutrophication

GAS-PHASE (PHOTO) CHEMICAL PROCESSES IN THE TROPOSPHERE

Tropospheric Chemical and Photochemical Reactions
The Oxidizing Capacity of the Troposphere: Global Change

HYDROCARBONS IN THE ATMOSPHERE

Sources
Fate
Analysis
Concentrations

FORMATION AND EFFECTS OF SMOG

Brief History of Smog
Plant Effects
Health Effects
Materials Effects
Megacity and Regional Impacts

EMISSION PURIFICATION TECHNOLOGIES

Introduction to Combustion-Generated Pollutants
Control of Pollutants from Internal Combustion Engines
Control of Pollutants from Stationary Power-Plants and Industrial Furnaces

SOIL CHEMISTRY

Soil Composition
Chemical Processes in Soil
Chemical Behavior and Reactions in Normal and Contaminated Soils

ACIDITY AND ALKALINITY OF SOILS

World Distribution of Acidic and Alkaline Soils
Soil pH and pH Buffering Capacity
Soil Properties and Processes Controlling Acidity and Alkalinity
Plant – Soil Systems
The Importance of Scale and Variability in Soil Acidification and Alkalinization Processes
The Future Need for Management of Soil Acidity and Alkalinity

PERSISTENT ORGANIC WASTES

Sources
Effects
Fate and Transport
Treatment
Case Study: PCBs

TRACE ELEMENTS

Sources and occurrence of Trace Elements in Soils
Physico-chemical and biochemical processes in soils
Bioavailability in the Soil-Plant System
Transfer to aquatic systems
Volatilization of trace elements
Bioavailability through human ingestion

SPECIATION OF HEAVY METALS AND RADIOISOTOPES

Defining Speciation
Sources of Heavy Metals and Radioisotopes in Soils

Soil Processes and Speciation of Heavy Metals and Radioisotopes
Measurement and Interpretation of Heavy Metal and Radioisotopes Speciation in Soils
Predicting Speciation by Modeling
Future Challenges

BIOREMEDIATION FOR SOIL RECLAMATION

Principles of Biodegradation
Site Assessment
Bioremediation Technology Selection and Design
Common Bioremediation Technologies
Monitoring Bioremediation Performance
Bioremediation Costs
Future Trends in Bioremediation

AQUATIC CHEMISTRY

WATER QUALITY

Water Resources
Categories of Water Use
Microbiological Quality Parameters
Physico-Chemical Quality Parameters
Toxicity Testing
Priorities and Trends in Water Quality and Management

INFLUENCE OF COLLOIDS AND SEDIMENTS ON WATER QUALITY

Overview of Significance
Sources and Characteristics of Particulate Material
Colloid and Sediment Dynamics in Surface Water Systems
Colloid Dynamics in Groundwater Systems
Contaminant Sources
Trace Elements Fate and Transport
Fate and Transport of Hydrophobic Organic Contaminants

BIOCHEMICAL OXYGEN DEMAND

Theory
Measurement
Typical values for waters and wastewaters
Alternatives
Applications

EUTROPHICATION AND ALGAL BLOOMS

Eutrophication
Algal Blooms
Consequences of Eutrophication
Control and Remediation of Eutrophication

CHEMISTRY OF WASTEWATER

Wastewater Analysis
Wastewater Composition
Wastewater Quantities

OIL POLLUTION AND MICROBIAL REGULATION

Measuring the Amount of Oil

Oil Pollution of the Sea
Hydrocarbon Contamination of Coastal and Estuarine Waters and Sediments
Petroleum Contamination of Soil, Freshwater and Groundwater
Physical Processes of Oil Degradation
Microbial Degradation
Toxicity and Environmental Effects
Effects on Different Organisms
Depuration and Metabolism
Clean-up and Bioremediation
Future Trends

THERMAL POLLUTION IN WATER

Second Law of Thermodynamics
Modeling Methods
Empirical Models
Numerical Models
Integral Models
Visual Plumes (VP)
Heat Loss Calculations
Restrictions and Accuracy

REMEDICATION OF GROUNDWATER CONTAMINATED WITH RADIOACTIVE COMPOUNDS

Adsorption and Ion Exchange Processes
Reactive Sorption in In Situ Treatment Walls
Precipitation
Reverse Osmosis
Stripping of Volatiles
Typical Radionuclides in Contaminated Groundwater and Treatment Methods

ECOLOGICAL CHEMISTRY

Release of Chemicals in the Environment
Transport Processes
Transformation Processes
Predictive Methods for Fate Determining Processes
Modelling Fate and Exposure

PATHWAYS OF ORGANIC CHEMICAL CONTAMINATION IN ECOSYSTEMS

Sources and input of organic pollutants to the environment
Transport pathways within ecosystems
Degradation pathways
Spatial scales of pollutant transport pathways
Use of geochemical tracers to track contaminant pathways through ecosystems
Future directions

ECOTOXICITY, GENOTOXICITY, AND CYTOTOXICITY OF PESTICIDES AND THEIR DEGRADATION PRODUCTS

Pesticide Usage and Distribution
General Factors of Ecotoxicology
Ecotoxicology of Pesticides
Genotoxicity and Cytotoxicity of Pesticides

Mechanisms of Genotoxicity and Cytotoxicity
Importance and Implications of Genetic and Cytotoxic Damage

AIR POLLUTION DAMAGE TO VEGETATION

Historical Development of Interest
The Mechanisms of Pollutant Damage to Vegetation
Experimental Methods for Investigating Air Pollutant Effects on Vegetation
Examples of the Impacts of Air Pollutants on Vegetation
The United Nations Efforts to Reduce the Impacts of Pollutants on Vegetation
Future Perspectives

ECOLOGICAL CHEMISTRY OF FOREST PEST CONTROL

Introduction and Historical Pesticide Use
Forest Pests
Chemical Pest Control Methods
Detailed Case Study

ASSESSMENT OF CONTAMINATED SOILS

Risk Assessment
Risk Management

CHEMISTRY OF ORGANIC POLLUTANTS INCLUDING AGROCHEMICALS

Types and Properties of Organic Pollutants
Chlorohydrocarbons - Insecticides, Industrial and Waste Chemicals
Petroleum and Polycyclic Aromatic Hydrocarbons
Herbicides
Oxygen, Nitrogen and Phosphorus Containing Insecticides
Plastics – Polymers and Monomers
Soaps and Detergents
Organometallic Compounds with Mercury, Tin and Lead

ORGANIC POLLUTION FROM AGROCHEMICALS

Use of Pesticides
Contamination of the Environment
Ecotoxicological and Toxicological Effects
Alternatives for Higher Efficiency in Agriculture

MULTIMEDIA FATE AND TRANSPORT OF ORGANIC POLLUTANTS

Mass Balance Models
Persistence and Long-Range Transport Potential
Assessment of Models
Strengths and Limitations of Multimedia Models

WASTEWATER TREATMENT AND REUSE FOR IRRIGATION

Worldwide Sanitation Perspective
Wastewater Composition and Characteristics
Wastewater Treatment
Advanced Treatment of Effluents
Land Irrigation
Public Health and Environmental Aspects

STRATOSPHERIC OZONE DEPLETION

Stratospheric Ozone

Destruction of Ozone by CFCs
The Antarctic Ozone Hole
Ultraviolet Radiation and Ozone Depletion
Biological Effects of Ultraviolet Radiation
Human Health Effects
International Agreements Related to Ozone Depletion

CHEMICALLY-BASED COMMODITIES INTO THE TWENTY-FIRST CENTURY

Responsible Care
Landfill versus Incineration and the Introduction of "Externalities"
Mineral Mining as an Essential and Future Commodity
Food Commodities: Tanzania
Land Mines
How Biotechnology Contributes to Sustainable development

THE WORLD OF CHEMISTRY

Centrality of Chemistry in Human Activities, Life, and Culture
The Impact of Chemistry on Technological Development
Peculiarities of Chemical Processes
Relevance of the Molecular Approach
Molecular Dynamics
Engineering of Industrial Processes
Polymeric Materials
Advanced Materials, Nanostructures, and Mechanical Electronics

HISTORY AND FUNDAMENTALS OF CHEMISTRY

A HISTORY OF CHEMISTRY

The Birth of Chemistry as a Science
Definition of the Building Blocks of Chemistry
The Elements
Thermodynamics
Chemical Dynamics
The States of Matter
Valence Theory
Spectroscopic Analysis
Stereochemistry
Electrochemistry
Organic Chemistry
Discoveries of New Products and Less Expensive Processes

CHEMICAL MATTER: ELEMENTS AND THEIR CLASSIFICATION THROUGH THE PERIODIC SYSTEM

Introduction to the Electronic Structure of Atoms
The Building Up of the Periodic Table
The Periodical Trends of Some Physical Properties
Some Periodical Trends of the Chemical Behavior

THE CONTRIBUTION OF NOBEL LAUREATES TO CHEMISTRY

The Discovery of New Elements
The Properties of Atoms
The Properties of Molecules

The Dynamics of Chemical Reactions
New Synthetic Routes for Useful Products
The Understanding of Natural Processes
The Identification of Chemical Entities
The Expansion of Thermodynamics

CHEMICAL EXPERIMENTATION AND INSTRUMENTATION

CHEMICAL LABORATORY TECHNIQUES

Common Laboratory Apparatus
The Reaction
Isolation and Purification Techniques

GAS AND LIQUID CHROMATOGRAPHY

Evolution and Classification of Chromatography
Chromatographic Theory
Gas Chromatography
High Performance Liquid Chromatography
Analytical Objectives

VOLUMETRIC AND CALORIMETRIC TECHNIQUES

Volumetric Methods
Calorimetric Methods and Instruments
Applications in Life Sciences

NMR SPECTROSCOPY

Classical Description
Quantum Description
Multidimensional NMR
Dynamic Aspects of NMR
Spatial Information from NMR
Solid, Liquid, and Partially Oriented Samples
The Impact of NMR

THEORETICAL APPROACH TO CHEMISTRY

SCHRÖDINGER EQUATION AND QUANTUM CHEMISTRY

The Schrödinger Equation
Quantum Chemistry

MOLECULAR ENERGETICS: VALENCE BOND AND MOLECULAR ORBITAL METHODS. DENSITY FUNCTIONAL THEORY OF ATOMS AND MOLECULES

Methods for obtaining approximate electronic wavefunctions
Density functional theory of atoms and molecules

MOLECULAR DYNAMICS: COLLISIONAL AND STATISTICAL APPROACH TO REACTION RATE

Definitions and Models
Theoretical Aspects of Collision Dynamics
Experimental Techniques
Phenomenology

OPTIMAL CONTROL OF MOLECULAR SCALE PHENOMENA

Theoretical Principles of Quantum Control
Quantum Learning Control

Laboratory Realizations of Quantum Control
Control-Assisted Extraction of Microscopic Information
The Future of Quantum Control

CHEMICAL THERMODYNAMICS

THERMODYNAMIC SYSTEMS AND STATE FUNCTIONS

Thermodynamic Systems
Internal Energy and First Law of Thermodynamics
Thermodynamic Equilibrium and Second Law of Thermodynamics
Equilibrium Conditions in Simple Systems
Graphical Representation of Equilibrium States
Stability of Thermodynamic Equilibrium States
Eulero and Gibbs–Duhem Equations
Entropy and Transformation of Heat into Work
Entropy and its Absolute Value: Third Law of Thermodynamics
Other State Functions for Equilibrium Conditions in Chemical Systems: Enthalpy and Free Energies
Relationships among State Functions
State Functions for Multicomponent Systems: Molar and Partial Molar Functions

ENERGY BALANCE OF REACTING SYSTEMS

Historical Perspectives
Rules for Writing Down the Energy Balance
Energetic Properties of Chemical Reactions
Calculation of State Functions Involved in Energy Balances
Evidencing Reactions Contributions to Energy Balances

EQUILIBRIUM IN MULTIPHASE REACTING SYSTEMS

Equilibrium conditions from thermodynamic laws
The phase rule and the Duhem's theorem
The chemical potential
Equilibrium constant
Applications

STATISTICAL APPROACH TO THERMODYNAMICS

Microscopic behaviour of ideal gases.
Internal energy and zero point energy.
Statistical interpretation of the first law of thermodynamics.
Probability, entropy and laws of thermodynamics.
Properties of the ideal monoatomic gas.
Boltzmann distribution law.
Translational partition function.
Gibbs approach to statistical mechanics.
Ideal polyatomic gases.
Monoatomic solids.
Interacting systems.
Charged Particle Systems.
Stability of matter.
General treatment of real fluids.
Phase transitions

IRREVERSIBLE PROCESSES: PHENOMENOLOGICAL AND STATISTICAL APPROACH

The Boltzmann equation
Transport coefficient for gaseous mixtures
Onsager's Reciprocity Relations from the Boltzmann equation
The macroscopic theory of irreversible processes
The reciprocity relations
Irreversibility, patterns and chaos

CHEMICAL KINETICS AND DYNAMICS

RATES OF CHEMICAL REACTIONS: THEIR MEASUREMENT AND MATHEMATICAL EXPRESSIONS

Reaction Rate, Kinetic Equation, Catalysis
Dependence of the Rate on Temperature
Measurement of Rates

MICROKINETICS VERSUS MACROKINETICS: THE ROLE OF TRANSPORT PHENOMENA IN DETERMINING REACTIONS RATES

Summary of Basic Concepts
Fluid-Solid Interphase Diffusion and Reactions
Intraphase Diffusion and Reactions
Fluid-Fluid Homogeneous Reactions

DYNAMIC BEHAVIOR OF COMPLEX REACTING SYSTEMS: ROLE OF NON-LINEARITY

Rate Law of Chemical Reactions
Material and Energy Balances of Reacting Systems
Simulation of Stationary Plug Flow Reactors
Dynamic Treatment of a Reacting System
Steady States and their Stability
Autocatalytic Processes
Analogies with Phase Transitions and Critical Phenomena
Turing Patterns and Self-Organization
Symmetry Breaking in Chemical Reacting Systems

CHEMICAL SYNTHESIS OF SUBSTANCES

INORGANIC AND METAL-ORGANIC SYNTHESIS

General Properties
Descriptive Chemistry

ORGANIC SYNTHESIS

Organic Reactions
Rate and Selectivity Control
Multistep Reactions
Organic Synthesis based on Weak Interactions: Self-Assembly
Bio-Inspired Organic Synthesis
Synthetic Planning and Strategies
Perspectives

SYNTHESIS OF NANOPHASES

Structure and Properties of Nanophases
Synthesis of Quantum Wells
Synthesis of Quantum Wires
Synthesis of Quantum Dots

POLYMERS AND THEIR SYNTHESIS

The synthesis of macromolecules
The shape of macromolecules
The crystalline and the amorphous state
Application of polymers

BIOCHEMICAL METHODS OF SYNTHESIS

Early Employment of Enzymes in Organic Synthesis
Biotransformations in Organic Synthesis
CarbonCarbon Bond-Forming Reactions
Glycosyl-Transfer Reactions
Halogenation Reactions
Abzyme-Catalyzed Reactions
Reactions Catalyzed by Artificial Enzymes

MAIN BRANCHES OF CHEMISTRY

CHEMICAL ANALYSIS: ANALYTICAL CHEMISTRY, QUALITATIVE AND QUANTITATIVE ANALYSIS

METROLOGY IN CHEMICAL ANALYSIS

Metrological characteristics of methods and procedures in chemical analysis
Analytical signal: Conducting of a measurement
Errors in chemical analysis: Data treatment
Sensitivity factor, detection limit, and Dynamic range
Analysis of variance, correlation and regression analysis (a general overview)

ELEMENTAL ANALYSIS

Chemical qualitative elemental analysis
Physical methods of qualitative elemental analysis
Chemical quantitative elemental analysis
Physical methods of quantitative elemental analysis
Test methods
Applications of elemental analysis

ORGANIC REACTIONS

Types of organic reactions
Organic reactions in life-support processes
Organic reactions and ecology

ELECTROCHEMISTRY: FUNDAMENTAL ASPECTS

Ionic conductors and their conductivity
Electrodes and electrode reactions
Electrode Potentials
The structure of the electrode/electrolyte interface
The Volta problem in Electrochemistry
Electrochemical kinetics
Outlook

CONTRIBUTIONS OF CHEMISTRY TO SUSTAINABILITY IN CHINA

Chemistry Basis for Zero Pollutant Effluents
Processing Low-grade and Complex Ores
Rational Use of Coal

CHEMICAL ECOLOGY

PRINCIPLES OF CHEMICAL ECOLOGY

BIOSYNTHESIS OF CHEMICAL SIGNALS DE NOVO SYNTHESIS AND SECONDARY METABOLITES

- Polyketide pathway: fatty acids and polyketides
- Shikimate pathway
- Mevalonic acid pathway: Isoprenoids

INTER AND INTRASPECIFICITY OF CHEMICAL COMMUNICATION

- Terms used in chemical communication
- Interspecific chemical communication
- Intraspecific chemical communication

ALLELOPATHY AND CHEMICAL DEFENCE

- Primary and Secondary Metabolites
- Biological Activity
- Chemical Defense in Plants
- Chemical Defense of Microorganisms
- Chemical Defense of Animals
- Beyond Chemical Defense: Secondary Metabolites and Biodiversity

CHEMICAL DEFENSE AND MAMMALIAN HERBIVORES

- Plant Metabolism
- Phytochemical Variation in Plants
- Plant Defense Theory
- Mammalian Metabolism of Phytochemicals
- Mammalian Herbivory

FORAGING AND FOOD CHOICE IN PHYTOPHAGOUS INSECTS

- The occurrence of phytophagy
- Diet breadth
- Foraging strategies
- Plant secondary compounds; the determinants of diet breadth
- Avoiding the effects of plant secondary compounds
- Odors of plant secondary compounds
- Pharmacophagy
- Secondary compounds and insect evolution

CHEMICAL DEFENCE IN INVERTEBRATES

- Mechanisms of acquiring chemical defenses
- Delivery of chemical defenses
- Introduction
- Conclusions

CHEMICAL MIMICRY

- Propaganda
- Stealth: Escaping detection
- Discoveries of chemical mimicry

CHEMICAL ECOLOGY OF ANIMAL INTERACTION

CHEMICAL TRIGGERS IN BREEDING CYCLES

- Sex Pheromones as Reproductive Stimuli

Glandular Origins of Sex Pheromones
Sex Pheromones as Eclectic Natural Products
Parsimony of Sexual Pheromones
Plant Compounds and Sexual Attractants
Distribution of Plant and Animal Sex Pheromones

CHEMICALS IN HOST-PARASITOID AND PREY-PREDATOR RELATIONS

Semiochemicals influencing the behaviour of parasitoids and predators
Pesticides influencing the host-parasitoid and prey-predator populations
Chemical defenses
Conclusions

CHEMICAL SIGNALS AS ATTRACTANTS, REPELLENTS AND AGGREGATION STIMULANTS

Classification of Chemical Signals
Detection and Decoding of Semiochemicals
Approaches to the Isolation and Identification of Semiochemicals
Attractants
Repellents
Aggregation stimulants
Semiochemicals and Parsimony
Practical Applications
Conclusions

CHEMICAL ECOLOGY OF PLANT-ANIMAL INTERACTIONS

Why plants apparently play the losing role
How plants survive under a herbivore dominated world
Considerations from evolution
Secondary metabolites and the need to communicate
The counterattack of herbivores
Plant Chemical defenses as feeding flags
Plant volatiles in multitrophic interactions
Old and emerging paradigms

CHEMICAL ECOLOGY IN AQUATIC ECOSYSTEMS

THE ECOLOGICAL AND PHYSIOLOGICAL ROLES OF BACTERIAL CELL-CELL SIGNALLING

Bacterial Signalling systems
Ecological role of bacterial signals
Natural defences against quorum sensing
Conclusions

CHEMICAL ECOLOGY OF MARINE BACTERIA AND ALGAE

Ecological Roles of Bacterial and Algal Compounds
Temporal and Spatial Variability of Defensive Compounds
Case Study: Dictyota spp.
Conclusions

CHEMICAL SIGNALS IN CORAL REEFS

Chemical signaling in coral reefs
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CHEMICAL COMMUNICATION IN FISH

Communication, or Spying?
The Olfactory Sense in Fish
Reproductive Responses to Pheromones
Chemically-Mediated Anti-Predator Strategies
Aggregation and Migration

CHEMICAL DISRUPTION OF BIOLOGICAL PHENOMENA

Biological Responses to Chemicals in the Environment
Detection and Assessment: Biomarkers
Risk Assessment
Future Perspectives

ENVIRONMENTAL ENDOCRINE DISRUPTION: CAN THE ENDOCRINE DISRUPTION HYPOTHESIS BE VALIDATED IN THE INVERTEBRATE PHYLA?

Endocrine Disruption: A Threat to Ecosystem Health?
Endocrine Disrupting Chemicals
Xenoestrogens: Mechanism of Action
Endocrine Disruption in Invertebrates
Regulatory Considerations
Detection and Assessment: Bioassays and Biomarkers
A Strategy for the Detection of Endocrine Disruption in Invertebrates
Conclusion and Future Perspectives

CHEMICAL SIGNALS IN VERTEBRATES AND HUMAN COMPLEXITIES

THE CHEMICAL ECOLOGY OF MUSTELIDS

Scent marking in Mustelids
The Eurasian or European Otter (*Lutra lutra*)
The European Badger (*Meles meles*)
The Future of Mustelid Chemical Ecology Research.

APPLICATIONS OF CHEMICAL ECOLOGY

CHEMICAL ECOLOGY AND PEST MANAGEMENT

Semiochemicals and their application in insect pest management
Semiochemicals and their application in vertebrate pest management
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CHEMICAL ECOLOGY IN RELATION TO MEDICINE AND PHARMACEUTICALS

Chemical Defenses
Symbiosis
Parasitism: A New Approach to Studying the Biochemistry of Defenses
Leads
Natural Products with a Narrow Biological Function
When the Mechanism of Action of a Compound is More Important than its Biological Function
The Management of Vectors: a Control Tool for Vector-Borne Diseases
New Windows for Pharmaceutical Industries
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CHEMICAL ENGINEERING

FUNDAMENTALS OF CHEMICAL ENGINEERING

THERMODYNAMICS OF CHEMICAL PROCESSES

Introduction
Fundamental Laws of Thermodynamics
Properties of Pure Fluids
Phase Equilibrium Thermodynamics
Chemical Reacting Mixtures and Chemical Reaction Equilibrium
Calculation of Fugacities and Activities
Conclusions

UNIT OPERATIONS - FLUIDS

DISTILLATION OR RECTIFICATION

Fundamentals
Equipment
Separation Processes

MASS TRANSFER OPERATION - MEMBRANE SEPARATIONS

An overview on the most industrialized membrane separation processes and emerging applications
Sustainable growth and integrated membrane operations
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UNIT OPERATIONS - SOLIDS

HEAT AND MASS TRANSFER OPERATIONS - CRYSTALLIZATION

Solid-Liquid-Equilibria
Kinetics
Properties of Crystals
Crystallization Technology

HANDLING OF SOLIDS - TRANSPORT

History
Characterization of Bulk Solids
Storage of Bulk Solids
Transport

PARTICLE GROWTH AND AGGLOMERATION PROCESSES

Product properties
Rate Processes
Regime maps
Population Balance equations
Granulation Equipment
Equipment Design
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CHEMICAL REACTION ENGINEERING

IDEAL MODELS OF REACTORS

The Thermodynamic State of a System
The Plug Flow Reactor
The Perfectly Mixed Tank Reactor
The Batch Reactor
The Cascade of Tank Reactors
Comparison of Different Types of Reactors

CATALYTIC REACTORS: A REVIEW

Fixed Bed Reactor
Fluidized Bed Reactor
Biocatalytic Reactors
Unconventional Reactors
Conclusion

POLYMERIZATION REACTORS

Polymers
A short history of polymer reaction engineering
Polymerization mechanisms
Polymerization reactors
Towards product-inspired polymer reaction engineering

ELECTROCHEMICAL REACTORS

Backgrounds of electrochemistry
Transport and transfer phenomena in electrochemical processes
Technology of electrochemical reactors
Current distribution in electrochemical cells
Design of electrochemical cells: an introduction
Current trends in electrochemical engineering

MULTIFUNCTIONAL REACTORS

Reactive Separation Processes
Mechanical Integrated Processes
Heat Integrated Processes
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PROCESS MODELLING, OPTIMIZATION AND CONTROL

SOLUTION OF MODEL EQUATIONS

Classes of Problems and Computer Methods
Algebraic Equation Systems
Ordinary Differential Equation Systems
Differential-Algebraic Equation Methods
Partial Differential Equation Systems (PDEs)
Optimization Methods
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PROCESS ANALYSIS AND OPTIMIZATION

Steady State Simulation of a Chemical Process
Solving a System of Nonlinear Equations
Process Optimization
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DATA RECONCILIATION

Scope, aims and benefits of Data Reconciliation
Exploiting redundancy
Mathematical formulation of the validation problem
Applications
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PRODUCT CENTERED PROCESS DESIGN

Systematic Framework for the Manufacture of Chemical-Based Products

- Product Conceptualization
- Identification of Product Quality Factors
- Selection of Ingredients and Product Microstructure
- Generation of Process Alternatives
- Product and Process Evaluation
- Example: Shampoo and Conditioner in One Product
- Conclusions

PROCESS MANAGEMENT

PROCESS SAFETY

- Terminology
- Safety Assurance Techniques
- Safety in Design
- HAZOP
- Quantitative Risk Assessment
- Safety in Operation
- Safety in Maintenance

PROCESS RISK ANALYSIS

- Introduction
- Terminology Used in This Chapter
- Application of safety/risk techniques
- Hazard identification and safety/risk analysis techniques
- Frequency/Probability Modeling Techniques
- Consequence Analysis Techniques
- Safety Concepts in Process Development and Plant Design
- Safety and Risk Analysis
- Hazard, Safety and Risk Management in Plant Design and Operation

THE FUTURE OF CHEMICAL ENGINEERING

CHEMICAL PRODUCT DESIGN

- Needs
- Ideas
- Selection
- Product Manufacture
- Conclusions

MULTI-SCALE MODELING

- Multi-Scale Structures in Chemical Engineering
- Approaches to Analyze Multi-Scale Structures
- Descriptive Multi-Scale Methodology
- Correlative Multi-Scale Methodology
- Analytical Multi-Scale Methodology
- Applications in Industries
- Prospects

CHEMISTRY PAST, PRESENT, AND FUTURE

- Chemistry Past
- Chemistry Present
- Chemistry Future
- Transitions to the Future

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ELECTROCHEMISTRY

ELECTRON TRANSFER AND SINGLE MOLECULAR EVENTS

Introduction

The Theories of Marcus and Hush

Gerischer's Formulation

Energy of Reorganization

Quantum Theory

Beyond First Order Perturbation

From Non-adiabatic to Adiabatic Reactions

Electron Transfer through Single Molecules

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ELECTROCHEMICAL ENERGY CONVERSION AND STORAGE - BATTERIES, FUEL CELLS AND ELECTROCHEMICAL CAPACITORS

Introduction

Electrochemical Capacitors

Batteries

Hybrid Supercapacitors

Fuel Cells

"Hybrid" Batteries/Fuel Cells

Microbial Fuel Cells (MFC's)

Conclusion

CORROSION AND SURFACE TREATMENT

Scope and Economic Importance of Metal Corrosion

Why Metals Corrode

Rate of Corrosion Reactions

Oxide films

Corrosion Cells Resulting in Non-Uniform Corrosion

Environment Induced Cracking

Corrosion Protection and Surface Treatment

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RADIOCHEMISTRY AND NUCLEAR CHEMISTRY

The beginnings of RC&NC and the timeline of nuclear science

Nuclides and nuclei - isotopes, isobars, isotones, and isomers

Nuclear starter - concepts, quantities and units

Kinetics of radioactive decay and activation

Aftereffects of radioactive decay and nuclear reactions

Interaction of nuclear radiations with matter

Conclusions

ISOTOPE EFFECTS, ISOTOPE SEPARATION AND ISOTOPE FRACTIONATION

Introduction

Isotope Effects

Isotope Separation

Isotopic Fractionation in Nature

Conclusions

RADIOMETRIC DATING AND TRACING

Major concerns
Limitations
Radioactive decay
Chemical separation techniques
Mass spectrometry
Methods and applications
Conclusions

RADIOCHEMICAL TECHNIQUES

Characterization of the radioactive targets and sources
Separation techniques of radioactive elements
Activity measurements
Decontamination

RADIONUCLIDES IN CHEMICAL RESEARCH

Introduction
Neutron Activation Analysis
Radiotracers
Gamma Spectroscopy
X-ray Fluorescence Analysis
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NUCLEAR METHODS IN MATERIAL RESEARCH

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Methods Based on the Absorption of Radiation
Scattering Methods
Particle-induced X-ray Emission (PIXE)
Mössbauer Spectroscopy
Positron Annihilation Spectroscopies
Muon Spin Spectroscopies

RADIATION CHEMISTRY

Introduction, Short History
Absorption of Radiation Energy
Radiation Sources, Dosimeters
Techniques in Radiation Chemistry, Pulsed Radiolysis
Radiation Chemistry of Some Classes of Compounds
Radiation Technology
Hot Atom Chemistry

RADIATION BIOLOGY AND RADIATION PROTECTION

Introduction
Dosimetry
Radiation Biology
Radiation Protection
Risk Assessment

RADIOCHEMISTRY AND RADIOPHARMACEUTICAL CHEMISTRY FOR MEDICINE

Introduction
Production of Medical Radionuclides
Radiopharmaceutical Chemistry for Non-invasive Molecular Imaging
Radiopharmaceutical Chemistry for Endoradiotherapy

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CHEMISTRY OF THE ACTINIDE ELEMENTS

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Sources of Actinide Elements

Electronic Structure and Oxidation States

The Metallic State

Actinide Compounds

Actinide chemistry in solution

Environmental Actinide Chemistry

Hazards

Biological Behavior of Actinides

Toxicology

PRODUCTION AND CHEMISTRY OF TRANSACTINIDE ELEMENTS

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Brief History of Discovery

Production and Nuclear Decay Studies of Transactinides

Chemical Properties of Transactinides Element

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NUCLEAR WASTE MANAGEMENT AND THE NUCLEAR FUEL CYCLE

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Classification of Radioactive Wastes

Who is Responsible for Radioactive Wastes?

Splitting the Atom for Energy

Status of Nuclear Power World-wide

Nature of HLW as a Function of Time

Fast Reactors

The Nuclear Fuel Cycle

Important Characteristics of Actinides

Separations Technologies for the Nuclear Fuel Cycle

Advanced Fuel Cycle Concepts and Partitioning and Transmutation (P&T)

Aqueous Chemical Processing

Non-Aqueous Chemical Processing

Transmutation Devices for the Advanced Fuel Cycle

Strategies for Implementation of an Advanced Fuel Cycle

Generation IV Nuclear Energy Systems

Future of P&T

HIGH-INTENSITY LASERS IN NUCLEAR SCIENCE

Laser induced Photo-Reactions and Photo-Fission

Laser induced heavy ion fusion

Sample preparation

Laser generation of protons and neutrons

Laser generation of positrons

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NUCLEAR FORENSICS

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General Approach

Analytical Methodology
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SUBATOMIC PARTICLES, NUCLEAR STRUCTURE AND STABILITY

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Particles and Forces - the Standard Model in a Nutshell
Characterization of the Atomic Nucleus
Systematics of Stable Elements, Nuclides and Nuclei
Mass and Energy
Towards Greater Stability - Radioactive Decay

THE HYDROLOGICAL CYCLE

- Composition of the Hydrosphere
- Schematic Diagram of the Hydrological Cycle
- Water Exchange in Nature
- On Man's Activity Effects on the Hydrological Cycle
- World Water Balance
- Conclusions

EXCHANGES OF WATER IN THE HYDROSPHERE

- General information and classification of hydrosphere waters
- Water exchange and water balance of ocean
- Water exchange in the ocean-atmosphere system
- General circulation of atmosphere and horizontal moisture transfer
- Water exchange between reserves
- Prospects for further investigations

TRANSFER OF ATMOSPHERIC MOISTURE

- Methodology for determination of horizontal moisture transfer components
- On interpreting advective and eddy flows of moisture
- Factors for water vapor flow formation
- Distribution of moisture flows over the Earth
- Peculiarities of atmospheric moisture transfer in polar areas
- Prospects for further investigations

WATER EXCHANGE BETWEEN LAND AND ATMOSPHERE

- Interrelation of moisture exchange processes in the atmosphere - land system
- Equation of relation between atmospheric and land surface water balances
- General information about moisture circulation in the atmosphere
- Land surface moistening
- Prospects for further investigations

WATER EXCHANGE BETWEEN LAND AND OCEANS

- Global water exchange
- Regional aspects of water exchange
- Prospects for further investigations

SURFACE AND GROUNDWATER INTERACTION

- Typical schemes of surface and ground water interaction
- Surface and groundwater interaction in areas with different natural conditions
- The role of groundwater function in the water balance of the land
- Groundwater interaction with seas and big lakes
- The impact of human activities on surface and ground water formation

HYDROSPHERE COMPONENTS

HYDROSPHERE STRUCTURE AND ITS RELATIONSHIP TO THE GLOBAL HYDROLOGICAL CYCLE

- Components of the hydrosphere
- Role of individual components of the hydrosphere in the global hydrological cycle
- Conclusion

ENERGY BALANCE AND THE ROLES OF THE SUN, EARTH, OCEANS AND ATMOSPHERE

- Solar radiation
- The heat balance
- Distribution of the Energy Balance Components
- Energy Balance and Climate Changes
- Conclusion

HYDROLOGICAL REGIONS AND WATER BALANCE

- World Ocean and Continents of the Earth
- Principles of hydrological regionalisation
- Other methodological approaches to regionalisation of territories
- Multipurpose hydrological regionalisation
- Conclusion

ANTHROPOGENIC EFFECTS ON THE HYDROLOGICAL CYCLE

- On possible change in hydrological cycle components
- Classification of human activity factors
- Transformation of vegetation cover and the Earth's surface
- Freshwater use
- Human impact on climate by changing atmospheric characteristics
- Conclusion

OCEAN-LAND INTERACTION IN COASTAL ZONES AND EFFECT OF OCEAN-LEVEL CHANGE

- Classification of the interaction processes between sea and river water
- Classification of ocean-level oscillations
- Short-term level oscillations
- Local level oscillations related to vertical movements of coastal areas
- Principal directions of further research

WORLD WATER BALANCE

- Water Balance Equations
- Methods for Water Balance Components Computation
- Water Balance of Land
- Fresh Water Balance of Oceans
- Global Water Balance
- Conclusion

ATMOSPHERIC PRECIPITATION OF THE EARTH

- Atmospheric precipitation over oceans
- Atmospheric precipitation on the continents and islands
- Conclusion

EVAPORATION FROM THE SURFACE OF THE GLOBE

- Evaporation from the surface of the World Ocean.
- Evaporation from land.
- Conclusion

RIVER RUNOFF TO OCEANS AND LAKES

- Basic Data and Methodological Approaches
- Dynamics of River Water Inflow to Oceans from Continents
- Dynamics of Freshwater Inflow to the World Ocean

Fresh Water Inflow to Endorheic Seas and Lakes
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GROUNDWATER DISCHARGE INTO THE WORLD OCEAN

Present-day concept of groundwater discharge into seas and oceans
Main notions and definitions
Methods for studying and assessing groundwater discharge into the sea
Quantitative assessing of groundwater discharge into the World Ocean

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Background
Instruments and Methods to estimate natural evaporation
Transpiration

EVAPORATION FROM LAND, EVAPOTRANSPIRATION

Experimental methods for determining evaporation from land
Comparative assessment of contemporary experimental methods for determining evaporation from land
Design methods for determining evaporation from land
Comparative assessment of design Methods for computation of evaporation from land
Conclusions

EVAPORATION FROM OPEN WATER SURFACE AND GROUNDWATER

Evaporation from free water surface
Ground water evaporation

TRANSPIRATION

Cuticular transpiration
Stoma opening and transpiration
Transpiration measurements
Transpiration rate
Seasonal variability
Daily variations
Transpiration control
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Conclusion: transpiration and mineral nutrition of plants

PRECIPITATION

Spatial distribution of precipitation field
Measurement of precipitation
Precipitation process
Precipitation types
Snowfall and snow cover
Precipitation in changing climate
Artificial Precipitation

FORMATION OF PRECIPITATION

Basic information about precipitation
Relationship between precipitation and clouds
Dynamic factors of precipitation formation
The role of the entrainment of the ambient air into the cloud
Comparison of observations and theory
Synoptic vortexes and precipitation

Microphysical processes of precipitation formation

TYPES AND CHARACTERISTICS OF PRECIPITATION

Precipitation forms

Characteristics of precipitation regime

Classification of precipitation types by annual and daily variations

Classification of precipitation by genesis

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Statistical characteristics

Hurricanes

Spouts

Dust storms

Monsoons precipitation

Frontal precipitation

SNOW AND ITS DISTRIBUTION

Methods of snow survey

Global scale distribution

Mountainous areas

Landscape zones

Spatial distribution at a local scale

Informative-mapping analysis

Snow under forest canopy

Metamorphism of snow crystals

Snow melting

Impact on business

Snow management

Purposes of future investigations

ARTIFICIAL RAINFALL

History

Scientific basis

Hygroscopic seeding

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Groundwater origin
Basic law for groundwater filtration
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Snow and ice in the Nature system of the Earth
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Morphological classification of glaciers. Mountain glacierization
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Velocities of glacial motion

Glacier tectonics

Glacial erosion and accumulation

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Engineering-glaciology problems

Artificial intensification of melting of mountain glaciers

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INTERACTION BETWEEN GLACIATION AND CLIMATE

Global climatic role of the snow cover

Sea ice as a part of the global glaciation

The Influence of snow and ice on climate

Thermal non-equilibrium of the nival-glacial system

Glaciological forecast

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WATER HAZARDS CAUSED BY NATURALLY-OCCURRING HYDROLOGIC EXTREMES

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- Localized Points of Exchange between Groundwater and Surface Water
- The Contributions of Deep Groundwater
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- Discharge of water by vegetation
- Groundwater dependent ecosystems
- Climate and a catchment water balance – a case study
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- Groundwater Flow Systems
- Flow System Extensions
- Sources and Mechanisms of Recharge
- Conceptual Models of Recharge
- Methodologies for Recharge Estimation
- Factors Influencing Recharge, Predictive Relationships, and Recharge Regionalization
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- Unconsolidated sediments
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- Karst
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- Heat Transport in Mountainous Regions
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- Karstification Process
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- Groundwater Recharge
- Hydrogeological Domains
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- Soil Biotic Components Affecting Attenuation
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- Mobile Subsurface Colloids
- Organic Contaminants
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- Concept of Groundwater Pollution Vulnerability
- Aquifer Pollution Vulnerability in a Groundwater Protection Program
- Groundwater Pollution Vulnerability in Different Climatic Conditions
- Methods for Groundwater Vulnerability Cartography
- The Future of Groundwater Pollution Vulnerability Methods

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- Sources of Organic Pollutants
- Major Categories of Organic Pollutants
- Transport of Organic Pollutants in the Subsurface
- Measures for Minimization of Pollutants
- Natural Organic Compounds in Soil
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- Surveying
- Water demand assessment
- Water quality
- Wells and Trenches
- Design, operation and optimisation of groundwater monitoring networks
- Mathematical modeling
- Special scenarios and forthcoming groundwater development

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- Surveying Guidelines
- Geologic And Geomorphologic Exploration
- Geophysical Methods
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- Types of Groundwater Monitoring Networks
- Scale of Monitoring Networks
- Planning and Design of Networks
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- Land Subsidence
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- Quantitative Evaluation of Saltwater Behavior
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GROUNDWATER DEVELOPMENT IN HARD ROCKS

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GROUNDWATER USE AS POTABLE WATER SUPPLY

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Quality and Vulnerability of Groundwater Intended for Drinking
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GROUNDWATER CONTAMINATION, PROTECTION AND REMEDIATION

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Contamination of subterranean waters.
Contamination classification systems.
Principal groundwater contaminant types and processes.
Role of the unsaturated zone in the behaviour of polluting agents.
Groundwater protection and prevention
Aquifer remediation technologies
The Concept of Vulnerability of Aquifers.
The Protection of Groundwater Wells.
The development of protection perimeters around wells.
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ARTIFICIAL GROUNDWATER RECHARGE

Artificial Groundwater Recharge (AGR)
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Chemical and Isotopic Methods for Quantifying Recharge Rates and Identifying Recharge Areas
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Groundwater scarcity: demand and supply side factors

Principles of Groundwater Management

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Groundwater Management approaches

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The Complex and Varied Concept of Overexploitation

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The ownership of groundwaters.

Organisation of users.

Management of groundwaters.

Environmental considerations. Environmental impact assessment legislation.

Groundwaters and the European Union. International groundwaters.

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The Urban Hydrogeological Cycle: Quantification of Groundwater Resources

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"IN SITU" GROUNDWATER TREATMENT

Origin, physicochemical factors and water regulations
Biological oxidation and reduction
Removal of iron and manganese from groundwater
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ON CONTROLLING THE CHEMICAL CONTAMINATION OF GROUNDWATER

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WASTEWATER RECYCLE, REUSE, AND RECLAMATION

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Sources of Water Pollution
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Water Treatment for Drinking Water Supplies: A Reuse Strategy

RECYCLE AND REUSE OF DOMESTIC WASTEWATER

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Waste Streams of Metal Finishing Industries
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Opportunities for Waste Minimization

Profitability of Process Modifications—a Feasibility Study in Bangkok, Thailand

Water Reclamation from Small-scale Metal Pickling Units—a Feasibility Study in Delhi, India

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Internal Purification

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Basic Principles of Fluid Motion: Continuity, Energy, and Momentum
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- The Fundamental Equations of Fluid Flow
- Flow Head-Loss Relationships
- Water Hammer
- System Requirements
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- Design of Surge Chambers
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- Phenomena Causing Air Entrainment in Free Surface Flows

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- Historical sustainable design for river sedimentation
- The importance of water-sediment two-phase flow
- Sediment characteristics
- Modes of sediment transport
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- Brief History of Hydraulic Methods and Modeling
- Contextual Framework for Hydraulic Processes and Phenomena
- Philosophy and Concepts of Modeling
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- The Reynolds Averaged Navier-Stokes Equations
- Energy Cascade and Length-Scales in a Turbulent Flow
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- Brief History of Hydraulic Modeling
- Model Criteria Dimensional Analysis and Process Functions
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- Statistics, Probability and Model Selection
- Stochastic Models

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- Discharge Measurements
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- Different Types of Dredging
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- Uncertainty Analysis
- Design of a Flow Measuring System

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- Categories of Flow Meters and Important Definitions
- Types of Flow Meters
- Differential Pressure Meters: Principles of Operation
- Direct-Reading Types of Flow Meters
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- Chemical Flow Measuring Techniques
- Flow Meters for Free Surface Flow Conditions
- Indicating, Recording, Telemetry and Processing of Flow-Meter Data
- Free-Surface Flow (Open-Channel Flow) Measurement
- Rated Sections, Weirs and Bridge Sections
- Stream Gauging by the Direct Velocity-Integration Method
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- Flow Hydrographs
- Pressure and Depth Recording of Stages of Flow or Heads over a Gauging Structure
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- Theory and Principles of Control
- Design Principles
- Typical Examples
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- Concluding Remarks Concerning Water Conveyances
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- Clear Water Reservoirs
- Hydraulic Design of Dams and Control Works
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- Quality Control and Acceptance Tests
- Control Systems and Choice of Number of Pumps and Drive Units
- Pump Selection and Intake Design
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- Water Quality and Standards for Different Sectors and Use
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- Drinking water quality standards and their development
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- Drinking water quality standards
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- Water quality management in emergency water supply
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Environmental pollution by the final disposal site leachate
Environmental standard item and detection status of the groundwater in Japan

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- Inorganic Substances in Industrial Waste
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MICROBIAL/BIOLOGICAL CONTAMINATION OF WATER

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- Sustainable development of environmental health
- Health problems and their resolution
- Quality standards for drinking water
- Water quality consideration in various water uses
- Design and operation of water treatment and sanitation facilities

RURAL AND URBAN WATER SUPPLY AND SANITATION

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- Development cost of water supply and sanitation
- Economic analysis
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- System options

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- Quality standards for potable water
- Analysis of disinfection
- Disinfection by-products and their safety

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Effect on endocrine disrupting chemicals for reproduction in aquaculture

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Historical review of human excreta handling
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CONSTRAINTS TO IMPROVING WATER AND SANITATION SERVICES

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Risk management of waterborne diseases
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The Paradigm of Integrated Water Resources Management (IWRM)
A Vision and a Strategy

WATER ORGANISATIONS AND LEADERS

BIOGRAPHIES OF EMINENT WATER RESOURCES PERSONALITIES

Sextus Julius Frontinus, 40 103 A. D., Roman administrator and water commissioner
Leonardo da Vinci, 1452 1519, Italian philosopher, painter and inventor
Daniel Bernoulli, 1700 1782, Swiss mathematician and educator

Antoine Chezy, 1718 1798, French Civil Engineer and water expert
 De Witt Clinton, 1769-1828, American statesman and entrepreneur
 Edwin Chadwick, 1800 1890, English social reformer
 James Leslie, 1801 1889, Scots Water Engineer
 Robert Manning, 1816 1897, Irish hydraulic engineer
 William Unwin, 1838 1933, English engineer and educator
 Osborne Reynolds, 1842 1912, English hydraulic engineer and educator
 Robert Koch, 1843-1910, German bacteriologist, water filtration innovator and educator
 Hubert Engels, 1854 1945, German professor of engineering, researcher and educator in hydraulics
 Sir Alexander Houston, 1865-1933, English physician and bacteriologist, pioneer of the chlorination of water supplies
 Robert E. Horton, 1875-1945, American engineer and hydrologist
 Jean Aubert, 1894 1984, French Civil Engineer and inland navigation expert
 Lon Jean Tison, 1895 1982, Belgian hydrologist and Secretary-General of IAHS
 Thomas Blench, 1906 1993, Canadian Civil Engineer and river expert
 Hunter Rouse, 1906 1996, American researcher and educator in hydraulic engineering
 Howard Penman, 1909 1984, English soil physicist and research hydrologist
 James Dooge, 1922 , Irish hydrologist, educator and politician
 J. Eamonn Nash, 1927 2000, Irish hydrologist and educator
 Philip Monro, 1946 - , English biologist, inventor of water purification process by osmosis

GOVERNMENT AGENCIES AND INSTITUTIONS

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Climate Change and Hydrological modeling
Sea Level Rise
Climate Impacts on Water Demand
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ENVIRONMENTAL MANAGEMENT AND WATER QUALITY AND QUANTITY

Environmental Management
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Management Mechanisms
Geographic Parameters
Public Participation of Stakeholders
Types of Environmental Management
Water Resources Management Degrees of Social Responsibility
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Water Quality and Quantity Information Management Systems
The Guiding Principle: Sustainable Development

FOOD & AGRICULTURE/WATER INTERACTIONS

WATER RESOURCES FOR AGRICULTURE AND FOOD PRODUCTION

Surface Water Resources
Underground Water Resources
Integrated Resources
Water Resources Availability
Water Resources Development and Management.
Preserving Water Quality
Challenges and Opportunities

WATER BALANCE IN AGRICULTURAL AREAS

Net Water Requirements
Gross Water Requirements
Improving the Water Balance for Agriculture

WATER CONTAMINATION FROM RURAL PRODUCTION SYSTEMS

Water Pollutants in rural areas
Water pollution in rural production systems
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SUSTAINABLE DEVELOPMENT/WATER INTERACTIONS

Introduction. What is Sustainable Development?
Planning Concepts

Sustainable Development Concepts and Procedures
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HUMAN DEVELOPMENT AND WATER

The concept of human development
The Human Development Index
The concept of sustainable development
Water resources for human development

ECONOMIC DEVELOPMENT AND WATER

Water and Economic Development at the National Level: General Principles
Sector Use of Water and Economic Development
Water Use in Irrigated Agriculture for Economic Growth
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HUMAN INTERACTION WITH LAND AND WATER:A HYDROLOGIST'S CONCEPTION

Freshwater: Our Joint Lifeblood
Man and the Water Cycle
The Water Scarcity Syndrome
Overcoming the Sectorization Scourge
Challenge for the Future: Handling Complexity

FUTURE CHALLENGES OF PROVIDING HIGH-QUALITY WATER

Global and Regional Freshwater Resources
Emerging Global Patterns in the Provision of High Quality Water
Global Awareness of the Challenges of Providing High Quality Water
The Role of Global Governance Agencies in the Provision of High Quality Water
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Global Water Values
Water and International Security
The Use of Internet and Technology
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Demographics, Water Availability and Demand
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GLOBAL AND REGIONAL FRESHWATER RESOURCES

A Change in the Perception of Water
Perspectives of Global and Regional Freshwater Resources
Freshwater Quantity, Quality and Distribution Across the Globe and in Regions
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PERSPECTIVES OF GLOBAL WATER BALANCE AND REGIONAL WATER RESOURCES

An Altering Water Paradigm
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GLOBAL FRESHWATER QUANTITY, QUALITY AND DISTRIBUTION

The Living Planet
Global Freshwater Quantity and Distribution

Global Freshwater Quality
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GLOBAL WATER NEEDS FOR THE FUTURE

Drivers of Water Use
Present Global Water Needs
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THE IMPACT OF CLIMATE CHANGE ON WATER RESOURCES: AN OVERVIEW

The Atmosphere and the Hydrological Cycle
Causes of Global Climate Change
Different Dimensions of Climate Change
Impacts of Global Climate Change on Water Resources
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CLIMATE CHANGE AND ITS AFFECTS ON FRESHWATER RESOURCES, FLOODING, AND DROUGHT WITH RELATED EFFECTS ON SOME ECONOMIC SECTORS

The Global Water Budget and its Distribution
Impact on Freshwater Resources
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THE IMPACT OF EL NIÑO ON WATER RESOURCES

El Niño-Southern Oscillation (ENSO) and La Niña
Impact of El Niño on the World's Weather
El Niño's Impact on Freshwater Resources
A Political Response on El Niño 1997: The Case of South Africa
Conclusion

THE IMPACT OF GLOBAL WARMING ON SEA-LEVEL RISE

Global Warming and Sea-level Rise
The Effects of Sea-level Rise on the Environment and Human Society
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THE IMPACT OF CLIMATE CHANGE ON WATER MANAGEMENT

Global Climate Change
Water as an Important Resource
Coping with Global Climate Change in the Water Sector
Conclusion

THE ETHICAL CONSIDERATIONS OF GLOBAL CLIMATE CHANGE AND WATER RESOURCES

Ethical considerations
Implications for Water Resource Development and Use
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INTERNATIONAL PROTOCOLS REGARDING GLOBAL CLIMATE CHANGE AND THE IMPACT ON WATER RESOURCES

The need for international protocols: The tragedy of global commons
The different climate change protocols operating in the International System
Impact of the Kyoto Protocol
The implications for water resources
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THE IMPACT OF DEMOGRAPHY ON GLOBAL AND REGIONAL WATER RESOURCES

Population Growth; Past, Present and Future
Distribution of the Worlds Population
Reasons for Demographic Dynamics
Different Views on Population
Impact on Global and Regional Water Resources
Conclusion

WATER AS A FACTOR IN SOCIOECONOMIC DEVELOPMENT: FUTURE TRENDS

Historical role of water in development
Current context
Future challenges facing the role of water in development
What can be done?
Conclusion

BETWEEN THE GREAT RIVERS: WATER IN THE MIDDLE EAST AND NORTH AFRICA

Physical Sources of Stress
Quantity: Economic Stress
Water Quality: Ecological Stress
Equity: Political Stress
Conclusion

TYPES AND PROPERTIES OF WATER

Water Types
Physical Properties of Water, Including its Three Phases
Chemical Properties of Water
Biological Characteristics

CHARACTERISTICS OF WATER AND WATER BODIES IN THE NATURAL ENVIRONMENT

Atmospheric water
Surface water: oceans, interior seas, coastal zones and estuaries
Surface water: rivers, streams, lakes and wetlands

ATMOSPHERIC WATER

Water Sources
Atmospheric Circulation and Air Masses
Anthropogenic Enhancement and Global and Local Climate Change

SURFACE WATER: OCEANS, INTERIOR SEAS, COASTAL ZONES AND ESTUARIES

Stratification
Water Masses and Mixing
Waves
Estuaries

SURFACE WATERS: RIVERS, STREAMS, LAKES AND WETLANDS

Rivers
Reservoirs
Lakes
Wetlands

TIPIFICATION OF GROUNDWATER CHARACTERISTICS

Types of water in rocks
Typification of gravitational groundwater by conditions of its occurrence

Typification of groundwater by conditions of its recharge and discharge
Typification of groundwater by intensity of subsurface water exchange
Typification of groundwater by origin
Groundwater typification by chemical composition and mineralization
Typification of groundwater by types of its use

INTERCONNECTION OF SURFACE AND GROUNDWATER

Standard schemes of surface and groundwater interaction.
Surface and groundwater interaction in areas with different natural conditions.
Groundwater interaction with seas and big lakes
Impact of anthropogenic activity on surface and groundwater interconnection.

GLACIERS, ICEBERGS AND GROUND ICE

Ice in Space
Glaciers
Ice Sheets
Ice Caps of Arctic and Antarctic Islands
Mountain Glaciers
Hydrology of Glaciers
Surges
Jokulhlaup
Icebergs
Iceberg Interaction with Sea Ice
Ice Shelves
Stability of the Antarctic Ice Sheet
Ice Core Studies
Lake, River and Sea Ice
Ground Ice
Ice Wedges
Water source of ice-wedge ice
Massive Ice Bodies
Mountain Permafrost
Global climate change and changes in glaciers and ground ice

PROPERTIES OF ATMOSPHERIC WATER

Physical Properties including the Three States of Water
Chemical Properties
Biological and Microbiological Properties
Global Variations in the Chemistry of Atmospheric Water

THE PHYSICAL PROPERTIES OF ATMOSPHERIC WATER, INCLUDING ITS THREE PHASES

Dry Air
Water Substance
Atmospheric Aerosol
Clouds

MOLECULAR STRUCTURE AND CHEMICAL PROPERTIES OF ATMOSPHERIC WATER

The water molecule
Water aggregates
Aqueous particles and water droplets

Atmospheric water as a solute
Ion water clusters

BIOLOGICAL AND MICROBIOLOGICAL PROPERTIES OF ATMOSPHERIC WATER

Link in the global hydrologic cycle
A habitat
Transport and other processes

GLOBAL VARIATIONS IN THE CHEMISTRY OF ATMOSPHERIC WATER

Background
Stratospheric aqueous-phase chemistry
Tropospheric aqueous-phase chemistry

PROPERTIES OF OCEANS, INLAND SEAS, COASTAL ZONES, AND ESTUARIES

Oceans
Seas
Coastal zones
River mouth areas
Marine pollution
Science and the World Ocean

PHYSICAL PROPERTIES OF SEAWATER, INCLUDING ITS THREE PHASES

Liquid phase
Solid phase: sea ice
Gas phase: vapor

CHEMICAL PROPERTIES OF THE WORLD OCEAN

Geochemical formation of the World Ocean and its salt composition.
Appearance of photosynthetic organisms and a cardinal change in the oceanic geochemistry.
Modern salt composition of seawater. "Law of the basic macroion composition stability".
Seawater as the unique natural formation and the cradle of Life on the Earth.
Organic compounds and nutrients of seawater.
Chemical peculiarities of inland seas, coastal zones, and estuaries
Seawater dissolved gases.

PROPERTIES OF OCEANS, INLAND SEAS, COASTAL ZONES AND ESTUARIES. BIOLOGICAL PROPERTIES

The Ocean
Inland Seas
Estuaries

GLOBAL VARIATIONS OF CHEMICAL COMPOSITION OF OCEANS, INLAND SEAS, COASTAL ZONES, AND ESTUARIES

Salinity distribution in the World Ocean.
General regularities of nutrient distribution.
Subsurface maximum and deep-water minimum of oxygen, and deep-water maximum phosphates and nitrates.
Major chemical and oceanographic areas of the World Ocean
Anaerobic zones. Chemical peculiarities.
Hydrochemical processes in estuaries

PROPERTIES OF RIVERS, STREAMS, LAKES AND WETLANDS

Physical aspects of water

Chemical aspects of water
Suspended sediment
Density
Other physical and chemical parameters
Biological factors

PHYSICAL PROPERTIES OF WATER IN VARIOUS AGGREGATIVE STATES

Common information
Physical properties of water

WATER CHEMICAL COMPOSITION OF RIVERS, LAKES AND WETLANDS

Chemical Composition of Natural Waters.
Formation of Natural Water Chemical Composition.
Rivers
Lakes.
Wetlands

BIOLOGICAL PROPERTIES OF FRESHWATER BODIES

Main Features of Biological Structure of Fresh Waters
Biological Productivity
Biodiversity
Biological Self-purification of Water Bodies
Biogeochemical Properties
Structural and Functional Peculiarities of Water Ecosystems
Consequences of Anthropogenic Impacts
Biological Properties of Freshwater for Life-Support Systems

VARIATION IN THE CHEMICAL COMPOSITION OF RIVERS, LAKES AND WETLANDS

Anthropogenic impact on land surface waters
The Rhine river
The Great Lakes
Wetlands

GROUND AND SOIL WATER CHARACTERISTICS

Water structure and its physical characteristics.
The processes of groundwater chemical composition formation.
Groundwater biological characteristics.
Anthropogenic influence on ground water chemistry

PHYSICAL PROPERTIES OF SOIL AND GROUND WATERS

Soil moisture transition coefficient determination methods
Information Support Preparation of Different Soils According to Hydrophysical Characteristics for Soil and Ground Water Dynamics Calculations
Biosphere Role of Soil and Ground Water from Physical Point of View
Water Equilibrium State in Soil
Soil moisture transition determination methods
Water Transition in Soil

CHEMICAL PROPERTIES OF SOIL AND GROUND WATERS

Approaches to the study of chemical properties of soil and ground waters
Origin and occurrence of soil and ground waters
General characterization of chemical properties of soil and ground waters
Geographical zonality of chemical properties of soil solutions and ground waters

Ecological value of soil solutions and ground waters
Conclusion

BIOLOGICAL PROPERTIES OF SOIL AND GROUND WATERS

Soil Water as a Condition for the Existence of Soil Biota
Microbiology of Lithospheric Water
Biotic Components of Water and Sustainability of the Lithosphere

GLOBAL VARIATIONS IN THE CHEMISTRY OF GROUND WATER

The origin of common natural constituents in ground water
Pollutants in ground water
Policy options in ground-water quality management

PROPERTIES OF GLACIAL, ICEBERG AND PERMAFROST WATER

Palaeoclimatic studies
Physical Properties
Chemical Properties
Biologic property
Dating of the Ice Cores and Palaeoclimatic Studies in Glaciers, Ice Sheets and Ground Ice
14C-dating of air bubbles in the ice
10Be/36Cl –dating
Ground ice dating
Tritium
The oldest ice of the Earth
Reconstruction of past atmospheric CO₂ by ice core analysis
Methane
Comparison of isotope records of cryosphere objects
Catastrophes' record in the ice

PHYSICAL PROPERTIES OF GLACIAL AND GROUND ICE

History of glacier study
Structure of ice crystal
The transformation of snow to ice
Glacier classification
Variations of density with depth
Disappearance of air bubbles
Mechanical properties
Mass balance of a glacier
Distribution of temperature in glaciers and ice sheets
Temperature of a temperate glacier
Distribution of temperate glaciers
Ice structures and fabrics in glaciers and ice sheets
Ground ice crystallography
Thaw unconformities
Mechanical Properties
Electrical properties

CHEMICAL PROPERTIES OF GLACIAL AND GROUND ICE

Ionic composition in glaciers
Ice and snow chemistry
Ion migration in ice and frozen soils

Methane hydrate
Chemical physics of air clathrate hydrates in ice core
Chemistry of ice in dependence of electrical conductivity
Ionic composition in ground ice
Subpermafrost water geochemistry
Heavy metals in glaciers
Heavy metals in ground ice
Stable oxygen and hydrogen isotope of the ice
Temporal variations of isotopic composition of glacial-river water during summer; Oxygen isotope composition of water sources
Stable isotope composition in glaciers
Stable isotopes in ground ice
Isotope composition of ice–wedge ice

BIOLOGICAL PROPERTIES OF GLACIAL ICE

Plant Remains
Diatoms
Pollen and Spores in Glaciers
Pollen and Spores in Ground Ice
Enzymatic Activity
Enzymatic Activity in Glaciers
Enzymatic Activity in Ground Ice
Proteolytic Activity in Ground Ice
Microbes in Permafrost and Ice
Ice Man
Mammoth Carcasses

FRESH SURFACE WATER

Liquid Water on Planet Earth
Availability of Fresh Water
Water Use and the Environment
Topics on Fresh Surface Water

ORIGIN, RESOURCES AND DISTRIBUTION OF RIVERS AND STREAMS

Origin and Evolution of River Systems
Factors Determining Evolution of the Contemporary Hydrographic Network and River Runoff Regime
Studies of River Systems and Renewable Water Resources
River Runoff: Distribution over Area and Variations in Time
Dynamics of Water Use in the World
Renewable Water Resources and Water Withdrawals
Conclusion

ORIGIN AND EVOLUTION OF RIVER SYSTEMS

Primary stage of the occurrence of river systems
Development of rivers in the Paleozoic
Change of hydrography in the Mesozoic
Modification of river systems in the Cenozoic
Water balance change of the river basins in the Mesozoic-Cenozoic
Features of dynamics of the hydrographic network and channel deformations

Hydrography and water resources of the rivers of Eurasia during the period of the last Ice Age and in the Holocene
Processes of the formation and development of rivers
Conclusion

REGIONAL DISTRIBUTION OF RIVERS AND STREAMS IN NORTH AND CENTRAL AMERICA

Introduction: General Information about the Continent
Factors Affecting Network Development and Runoff Regime
Socio-Economic conditions. Hydrological Network. Regionalization of the Territory
Major River and Lake Systems; Streamflow Distribution and Variations
Water Availability and Water Use
Conclusion

REGIONAL DISTRIBUTION OF RIVERS AND STREAMS IN SOUTH AMERICA

Factors determining the development of the hydrographic network and the hydrological regime of rivers during the present period
Hydrography, hydrological knowledge, river runoff, water use and water availability
Conclusion

REGIONAL DISTRIBUTION OF RIVERS AND STREAMS IN EUROPE

Factors determining the development of hydrographic network and hydrological river cycle at the present time.
Hydrography, hydrological knowledge, river runoff, water consumption and water availability.
Conclusions

REGIONAL DISTRIBUTION OF RIVERS AND STREAMS IN ASIA

Introduction: General Information about the Continent
Factors, Affecting a Development of the Hydrographic Network and Runoff Regime
Socio-Economic Conditions. Hydrological Network. Regionalisation of the Territory
Major River and Lakes Systems; Streamflow Distribution and Variations
Water Use and Water Availability
Conclusion

REGIONAL DISTRIBUTION OF RIVERS AND STREAMS IN AFRICA

Introduction: General Information about the Continent
Factors Determining a Development of the Hydrographic Network and River Runoff Regime
Socio-Economic Conditions. Hydrological Network; Regionalisation of the Territory
Major Rivers and Lakes; Streamflow Distribution and Variations
Water Use and Water Availability
Conclusion

REGIONAL DISTRIBUTION OF RIVERS AND STREAMS IN AUSTRALIA AND OCEANIA

Physical-geographical characteristics. Factors determining the development of the hydrographic network and distribution of rivers
Economic characteristics. Hydrological network. Main river systems.
River runoff distribution over the territory and in time
Use of the river runoff, water availability and water consumption
Conclusion

CHARACTERISTICS OF RIVER SYSTEMS

History of relations between human societies and rivers

Present situations
Towards sustainability of river systems
Features of river systems

RIVER MORPHOLOGY AND CHANNEL PROCESSES

Channel Processes
Drainage Patterns
Channels in Alluvial Plains

CHEMICAL CHARACTERISTICS OF RIVERS

Chemical characteristics and water quality
Natural origins pathways and levels of river borne chemicals
Anthropogenic impacts on river chemistry
Spatial distribution of river quality in impacted basins: the Seine River example
Time variability of river water chemistry
Trends in river chemistry
Conclusion: human responses to river quality degradation

BIOLOGICAL CHARACTERISTICS OF RIVERS

Biota of streams and rivers
Autotrophic organisms
Microbes and protista
Macroinvertebrates
Adaptation and characteristics of aquatic insects
Feeding and trophic characteristics of macroinvertebrates
Fish
Habitat and habitat partitioning
River continuum concept
Ecological spiraling in running water

TYPES OF RIVER ECOSYSTEMS

Characteristics of riverine ecosystems
Four-dimensional perspective of river systems
Ecological river concepts
Discussion and conclusions

BIOGEOCHEMICAL CHARACTERISTICS OF RIVER SYSTEMS

Geochemical Approach -Mass Balance
Biogeochemical Approach -Metabolism and the Biogeochemical Cycles
Biogeochemical Characteristics Using Ecological Modeling
Conclusion and Future Issues

TRANSPORT PROCESSES IN RIVER SYSTEMS

Catchments
Conservation Laws
Rivers
River Systems
Transport Processes

RIVER FLOW

The Near-Bed Boundary Layer
Bulk flow in Straight Channels
Bulk Flow in Curved Channels

Initial Motion of Loose Bed Sediment
Bed-form phase existence fields
Suspension Dynamics
Transport of Bed Materials

THERMODYNAMICS OF RIVERS

The basic laws and equations of thermodynamics
Example: mixing two rivers with different temperature
Free or natural convection
Surface heat exchange
Case Study: Forced and natural thermal regime of a river

CONSTITUENT TRANSPORT

Physics of constituent transport.
Turbulence in river flow.
Theories of turbulence.
Retardation of constituent transport
Mass balance in a river
Three-dimensional approach
Two-dimensional approach
One-dimensional approach.
Dead-zone model.
Tracer studies.
At the turn of millennium.

TRANSPORT OF SEDIMENTS

Bed-Load Transport
Suspended-Load Transport
Total-Load Transport
Introduction

CHEMICAL TRANSPORT IN RIVERS

Hydraulic Mechanisms
Physical, Chemical and Biological Transformations
Reactor Kinetics
River Models
Trends in River Modelling

RIVER ECOSYSTEMS

Evolution of the scientific paradigms in river ecosystem ecology
Ecohydrology – an integrative and interdisciplinary approach for scientific research and watershed management.
Cumulative impact on water resources
Threats for river ecosystem due to climate instability
Threats for river ecosystem due to improper river basin management

BIOGEOCHEMICAL PROCESSES IN RIVER SYSTEMS

Part 1: Key biochemical processes in river systems (by F. J. Triska)
Part 2: Factors affecting biogeochemical processes in rivers (by L.W.G. Higler)

DYNAMICS AND CYCLING OF MATERIALS IN RIVER SYSTEMS

Primary sources of materials
Materials and the hydrological cycle

A discontinuous transport flux
Transport down the lower reaches of rivers
Phosphorus and Nitrogen cycles contrasted

BIOLOGY AND BIODIVERSITY OF RIVER SYSTEMS

Ecological characteristics along the course of running waters
A general faunistic zonation pattern of benthos in pristine streams

ECOTONES OF RIVER SYSTEMS

Typology of ecotones of river ecosystem
Roles of Ecotones of riverine ecosystem
Vertical ecotones
Longitudinal ecotones
Lateral ecotones

RIVER ECOSYSTEMS REHABILITATION

Concepts in stream restoration ecology
Ecohydrology Concept—an approach for river restoration

THE USES OF RIVER WATER AND IMPACTS

Historical Overview
Rivers as Sustainable Life Support Systems
Uses of River Systems
General Supplementary Comments
The Principal Categorical Uses of Water in Rivers and Streams
The Impacts of River Water Uses
Examples of the Uniqueness of River Systems
Review of Classical River Basin Developments
The Impacts of Rivers on Humanity
Concluding Remarks Regarding the Uses and Impacts of River Water
More Detailed Aspects of River Water Uses and Impacts

RIVER NAVIGATION AND ASSOCIATED STRUCTURES

River Morphology and Sediment Transport
Locks and Dams
River Training
Sediment Movement Caused by Navigation Traffic
Species Population Impacts
Chemical Spills
The Future of Inland Navigation

DREDGING IN RIVERS AND ESTUARIES

River Water and Uses
Control of a River
Navigation on a River
General Specifications of Some Ports
Capital Dredging
Maintenance Dredging
Water Injection Dredging
Environmental Dredging
Conclusions

SEDIMENTATION OF RIVERS, RESERVOIRS AND CANALS

Sediment Problems
Estimation of Sediment Yield
Carrying Capacity of Lined Canals and Sediment Control
Sediment Transport of Uniform Material
Transport of Non-uniform Sediments
Non-equilibrium Effects
Conclusions
Introduction

SEDIMENT EXCLUSION AT RIVER INTAKES

Sediment Transport in Rivers
River Intakes
Control of Bed Load at River Intakes
Control of Suspended Load at River Intakes
Concluding Remarks

RIVERS AND HUMAN DEVELOPMENT

Rivers as Sources of Water Supply
Rivers as Sinks for Wastes
Rivers as Sources of Energy
Rivers and Ground Water
Contemporary Issues in River Water Development
Conclusion

POTABLE WATER

Potable Water Supply
Urban Water Use
Wastewater Impact
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DISPOSAL OF SEWAGE

Disposal Methods
Sewage Treatment
Industrial Effluent Disposal, Agricultural Run-off and Solid Waste Removal
Conclusions

SUSTAINABLE INDUSTRIAL WATER USE IN SOUTHERN GERMANY

The Region and the River - Characteristics, Properties, Features
Water Usage in the Middle-Neckar Region - Problems and Solutions
Flood Protection
Fresh Water Supply in the Middle-Neckar Region
Deficiencies on the Ecological Side
Striving for Sustainable River Water Use
Synopsis, Lessons Learnt and Future Outlook
Conclusions

WATER CONSUMPTION, FISHERIES AND WATER-RELATED RECREATIONAL FACILITIES

Consumptive Uses of Water
Conservative Uses
Impacts of Consumptive Uses of Water
The Impacts of Conservative, Non-consumptive Uses

Possible Adverse Effects of the Joint Recreational and Commercial Uses of Rivers, Dams and Reservoirs
Preventative Measures
River Management and Future Water Uses
Historical Review of Domestic Water Supply
Water Supply: The Current State of Affairs
The Division of International Water by the Helsinki Rules
Conclusions

HUMAN MADE LAKES AND RESERVOIRS : THE IMPACT OF PHYSICAL ALTERATIONS

Turning rivers into lakes
Changes downstream of dams
Beyond the down-rivers – a final remark

WATER SCIENCE AND TECHNOLOGY:HISTORY AND FUTURE

The Ancient World
Medieval Europe
The High Renaissance
The Nineteenth Century
The Twentieth Century
The Future
Introduction

WATER AND DEVELOPMENT: SOME SELECT ASPECTS

Issues Raised by Contributions Under This Theme
Insights from Contributions and Additional Issues

IMPACT OF CLIMATE CHANGE AND VULNERABILITY ASSESSMENT ON WATER RESOURCES

THE FUTURE OF BIG DAMS

Environmental Sustainability in Hydro Dams
Transparency and Participation
Environmental Least-Cost Ranking
Involuntary Resettlement
Irrigation Dams
Greenhouse Gas Emission Damage Costs
The Future of Dams
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WATER AND ENVIRONMENT INTERACTION

THE DUBLIN PRINCIPALS: INSTITUTIONAL AND LEGAL ARRANGEMENTS FOR INTEGRATED WATER RESOURCE MANAGEMENT

Overview and introduction
Fresh Water as Finite and Vulnerable Resource
Water Development and Management
Water as an Economic Good

WATER, AGRICULTURE AND FOOD INTERACTIONS

The forces that shape agriculture
Characteristics of water use for food production
How much water to produce food?
The outlook of water for agriculture

Adapting to water scarcity
Rural poverty, water and food security
The special role of groundwater
Food production and the aquatic environment

WATER MANAGEMENT ISSUES IN DRYLANDS IN THE TWENTY-FIRST CENTURY

Nature of Dryland Environments
Population Growth in the Twentieth Century
Water Usage
Water Resource Availability
Water Use in the Twenty-First Century
New Sources of Water
Water and Conflict
Transboundary Rivers
Conclusion

BEST MANAGEMENT PRACTICES TO REDUCE WATER POLLUTION: THE CASE OF MARICULTURE

Introduction: Water Pollution and Agro-Industries
Single Best Management Practices for Improved Mariculture Water Quality
The Costs & Benefits of Reduced Exchange
Costs and Benefits of Single Water Exchange Practices
Future Implications: An Integrated Approach to Best Management Practices
Conclusions and Questions around the Adoption of Best Management Practices

FOOD AND WATER DEMAND AND SUPPLY IN 2025

The PODIUM Model
What can be done to Change Future Water Use

INSTITUTIONAL REQUIREMENTS FOR EFFECTIVE WATER MANAGEMENT

From Administrative to Service Delivery Organizations
Conversion of Irrigation Systems into Multi-use Water Service Systems
Transcending the Infrastructure Dependency/Deterioration Trap
Establishing Appropriate Legal and Regulatory Frameworks
Implementing Integrated Management of Water

WATER AND SUSTAINABLE DEVELOPMENT: A SOUTHERN PERSPECTIVE

Defining Sustainability in Dynamic Political Economies
Challenges to Achieving Sustainable Development

VALUATION OF WATER: OPTIONS FOR SUSTAINABLE DEVELOPMENT IN DEVELOPING COUNTRIES

Scarcity of Water Resources: An Increasing Concern
Rationale for Valuation of Water: The Need for Price Reforms
Methods of Valuation
Future Directions for Sustainable Water Use in Developing Countries

WATER AND CONFLICT

Water Scarcity
Water Scarcity and the Risk for International Conflict
Water Scarcity and the Risk for Conflicts within Countries

WATER AND SUSTAINABILITY IN MEXICO CITY

Natural Environment

- Population
- Expansion of the City
- Transformation of the Ecosystem
- Supply of Potable Water
- Water Consumption
- Leaks
- Wastewater Treatment
- Future Scenarios
- Final Remarks

IRRIGATION, DOMESTIC WATER SUPPLY AND HUMAN HEALTH

- Global Water Scarcity
- Water and Health
- Improving Water Supply and Sanitation
- Domestic Use of Irrigation Water
- Situation Analysis
- Critical Issues to be Addressed in the Twenty-First Century
- Two Cases of Multiple Use of Irrigation Water
- Lessons Learned

CONTRIBUTIONS OF WOMEN IN THE UNITED STATES IN THE FIELD OF WATER RESOURCES

- Mothers Against Toxics
- Women's Civic Groups
- The Professional and Political Women
- The Future

WATER AND WASTEWATER TREATMENT

- Water Quality Regulations and Standards
- Sources and Types of Polluting Substances in Natural and Wastewater
- Methods for Treatment of Natural Water
- Wastewater Treatment
- Processing of Wastewater Sludge

WATER QUALITY REGULATION AND STANDARDS

- Water Quality Regulation and Standards
- Standardization of water bodies
- Potable water supply
- Agriculture water supply
- Water supply for industry
- Water quality analysis

CODES OF PRACTICE AND STANDARDS

- Standardization of objects

DRINKING WATER SUPPLY

- Selection of water sources and their protection
- Standardization of potable water quality
- Influence of water pollutants on its quality
- Methods and technological layouts for water quality improvement
- Monitoring

WATER SUPPLY FOR AGRICULTURE

- Water supply of rural units

Water quality in cattle breeding
Water quality in irrigation

WATER SUPPLY FOR INDUSTRY

Classification of utilized waters and general requirements for water quality used in industry
Thermal power industry
Mining industry
Ferrous metals metallurgy
Non-ferrous metals metallurgy
Metallurgy of rare, rare-earth and radioactive metals
Chemical industry

PERSPECTIVES ON WATER QUALITY

Protection of water systems
Water purification
Control of water bodies
Monitoring
Water quality regulations
Control of water quality, standardization and certification
Legal basis

ANALYSIS OF WATER QUALITY

General methods of waste water analysis

WATER TREATMENT: EQUIPMENT AND PROCESSES

The requirements to the quality of the purified water
Field of application of the methods for water purification
Selection of technological layout of water purification processes
Technical and economical basis of the investments for projects of water purification stations
Optimization of the complex of technological processes of water purification

HYDROLOGICAL SYSTEMS MODELING

UNSTEADY FLOW ON RIVER BASIN SLOPE AND IN THE RIVER CHANNELS

Introduction
The Two-Dimensional Models of Overland Flow
The Equations of One-Dimensional Channel Flow
Simplification of the St. Venant Equations
Linearization of the St. Venant Equations and Solution of Linear Equations
Kinematic Wave Equations and Their Application
Numerical Solution of the Unsteady Flow Equations
Application of Finite Elements Methods
Lumped Linear Models of Routing in the River Basin
Lumped Linear Time Invariant Models of Routing
General Approach to Determining of the Unit Impulse Response
Nonlinear Lumped Hydrological Systems
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Brief Prospect for Coal Exploration and Mining

COAL GEOLOGY

History of Coal Geology Research
Recent Advance in Coal Geology

CLASSIFICATION OF COAL

Parameters of coal classification
Classification systems in some main coal industry countries
International classification of coals

ORGANIC AND INORGANIC GEOCHEMISTRY OF COAL

Organic Geochemistry of Coal
Inorganic Geochemistry of Coal

MINERAL MATTER IN COAL

Minerals in coal
Trace elements in coal
Origin of mineral matter in coal
Methods of analysis and determination of mineral matter in coal
Significance of research on mineral matter in coal

COAL TECHNOLOGY I

Coal Structure and Properties
Preparation and Transportation
Clean Coal Technology
Desulfurization of Coal
Environmental Problems Arising from Coal Handling and Processing

COAL STRUCTURE AND PROPERTIES

Characterization of Coal
Macromolecular Structure
Coal Properties

PREPARATION AND TRANSPORTATION OF COAL

Coal Preparation
Transportation of Coal

CLEAN COAL TECHNOLOGY

PCC with flue gas cleaning units
Fluidized bed combustion (FBC) technology
Integrated gasification combined cycle (IGCC)
Combined heat and power (CHP) applications

DESULFURIZATION OF COAL

Sulfur in Coal
Coal Cleaning for Sulfur Removal
In-bed Desulfurization
Flue Gas Desulfurization

ENVIRONMENTAL PROBLEMS ARISING FROM COAL HANDLING AND PROCESSING

Origins, Modes of Occurrence, and Emissions of Pollutants
Environmental Impacts
Regulations and Standards
Control Measures

COAL TECHNOLOGY (II)

Coal Combustion and Combustion Products
Thermal Decomposition of Coal
Carbonization of Coal
Gasification of Coal
Coal Liquefaction

COAL COMBUSTION AND COMBUSTION PRODUCTS

Basic Process of Coal Combustion

Coal Combustion Technology and Facilities
Coal Combustion Products

THERMAL DECOMPOSITION OF COAL

Fundamentals of Thermal Decomposition of Coal
Parameters Affecting Thermal Decomposition of Coal
Processes of Thermal Decomposition

CARBONIZATION OF COAL

Coal Preparation for Coke-oven Use
High-temperature Coke
Coke Oven
Byproduct Recovery and Gas Purification
Prospect

COAL GASIFICATION

Chemistry of Coal Gasification
Coal Gasification Process
Applications of Coal Gasification

LIQUEFACTION OF COAL

Direct Liquefaction
Indirect Coal Liquefaction

OIL SHALE

Resources
Origin and Formation
Mining
Properties and Composition
Pyrolysis
Retorting Technology
Shale Oil and Its Products
Combustion
Shale Ash Utilization
Environmental Problems
Economic Problems
History of Oil Shale Industry
Current Status

ORIGIN AND RESOURCES OF WORLD OIL SHALE DEPOSITS

Definition of Oil Shale
Origin of Organic Matter
Oil Shale Types
Thermal Maturity
Recoverable Resources
Determining the Grade of Oil Shale
Resource Evaluation
Descriptions of Selected Deposits
World Resources
Future of Oil Shale

MINING OF OIL SHALE

Oil Shale Mining in Estonia and Russia

Oil Shale Mining in China
Oil Shale Mining in the USA
Oil Shale Mining in Brazil

EXTRACTION OF OIL SHALE: SURFACE AND IN-SITU RETORTING

Surface Retorting Processes
In Situ Retorting Processes

CHEMISTRY OF SHALE OIL AND ITS REFINING

Composition and Properties of Shale Oil
Shale Oil Refining
Shale Oil Processing in the World

CHEMICALS AND OTHER PRODUCTS FROM SHALE OIL

Shale oil cracking products
Separation products
Products of compounding and chemical treatment of shale oil fractions
The products on the basis of shale oil water soluble phenols
Potential new fields on using of shale oil phenols
Products from Kashpir shale oil (Russia)

ENVIRONMENTAL IMPACTS OF OIL SHALE AND POLLUTION CONTROL TECHNOLOGIES

Wastewater Composition and its Treatment
Air Pollution due to the Emissions from Oil Shale Plant
Shale Ash Disposal and Utilization

NATURAL BITUMEN (TAR SANDS) AND HEAVY OIL

Natural Bitumen (Tar Sands) and Heavy Oil
Chemistry and Physics of Natural Bitumen and Heavy Oil
Geology and Mineralogy of Natural Bitumen and Heavy Oil Reservoirs
Mining Technology for Natural Bitumen and Heavy Oil
Extraction Technologies for Natural Bitumen and Heavy Oil
Upgrading and Refining of Natural Bitumen and Heavy Oil

GEOLOGY OF NATURAL BITUMEN AND HEAVY OIL RESOURCES

Distribution and Structure of the Reservoir Deposit
Origin of Bitumen and Heavy Oil
Tar Sand Structure
Tar Sand Properties

CHEMISTRY AND PHYSICS OF NATURAL BITUMEN AND HEAVY OIL

Character
Composition
Chemical Composition and Chemistry
Properties

GEOLOGY AND MINERALOGY OF NATURAL BITUMEN AND HEAVY OIL RESERVOIRS

Geology and Mineralogy of Natural Bitumen and Heavy Oil Reservoirs
Permeability and Porosity
Mineralogy
Bitumen Saturation

MINING TECHNOLOGY FOR NATURAL BITUMEN AND HEAVY OIL

Mining Technology for Natural Bitumen and Heavy Oil
Oil Mining
Open Pit Mining

EXTRACTION TECHNOLOGIES FOR NATURAL BITUMEN AND HEAVY OIL

Enhanced Oil Recovery
Chemical Methods
Thermal Methods
Hot Water Process
Other Processes
Environmental Aspects

UPGRADING AND REFINING OF NATURAL BITUMEN AND HEAVY OIL

Coking Processes
Product Upgrading
Other Processes
The Future

PEAT AND PEATLANDS

Concepts of Peat and Peatland
Reserve and Distribution of Global Peat
Peat Formation and Development
Classification on Peat and Peatland
Peat Compositions and Chemical and Physical Properties
Exploitation And Utilization of Peat
Peatland Utilization
Environmental Impacts of Peatland Exploitation
Other Research into Peat and Peatlands

CLASSIFICATION OF PEAT AND PEATLAND

Characteristics of peat and peatland
The main components of peat
Composition of peat-forming plants
Peat stratigraphy
Classifications systems

CONDITIONS OF PEAT FORMATION

Geological and Geomorphic Factors
Hydrological Factors
Soil Conditions

PHYSICAL AND CHEMICAL PROPERTIES OF PEAT

Physical properties of peat
Chemical properties of peat
Physiochemical properties of peat
Peat properties in some countries of the world

THE GLOBAL DISTRIBUTION OF PEAT

Distribution Pattern of Global Peatland

CUTTING AND PROCESSING OF PEAT

Peat accumulation
Assessment of peat layers

- Harvesting of peat
- Energy use of peat
- Conversion
- Non-energy use of peat
- Environmental aspects of peat extraction and removal

ENVIRONMENTALLY-FRIENDLY ALTERNATIVES TO PEAT

- Peat as growing medium
- Composting
- Peat as a bedding material of animals
- Cleaning of waste waters
- Biological air purification
- Oil absorbing peat
- Activated carbon
- Peat balneology
- Peat textiles
- Other potentialities

ENVIRONMENTAL AND ECOLOGICAL ASPECTS OF PEAT CUTTING AND REMOVAL

- Impacts into watercourses
- After use of cutover areas

NUCLEAR ENERGY MATERIALS AND REACTORS

NUCLEAR PHYSICS

- Fundamental Concepts
- Atomic Structure
- Radioactivity
- Binding Energy

NUCLEAR INTERACTIONS

- Neutron Interactions
- Nuclear Cross Sections
- Neutron Scattering and Capture
- Neutron Moderation
- Fission and Fusion

NUCLEAR REACTOR THEORY

- Neutron Diffusion Characteristics
- Neutron Diffusion Equation
- One Group Reactor Equation
- Reactor Equation Applications
- Neutron Flux and Power

NUCLEAR REACTOR DESIGN

- Basic Principles
- Basic Theory
- Neutron Energy Production
- Fast Fission and Resonance Absorption
- Neutron Leakage
- Output Enhancement
- Reactor Configuration

NUCLEAR REACTOR KINETICS

- Reactor Kinetics
- Reactor Operation
- Critical Conditions
- Nuclear Reactor Startup

REACTIVITY CHANGES

- Introduction
- Fission Product Effects
- Fuel Effects
- Temperature Effects

NUCLEAR POWER PLANTS

PRESSURIZED WATER REACTORS

- General Configuration
- Core Arrangement
- Fuel Characteristics and Management
- Heat Transport
- Steam Cycle
- Operational and Safety Aspects

BOILING WATER REACTORS

- General Configuration
- Core Arrangement
- Fuel Characteristics and Management
- Heat Transport
- Steam Cycle
- Operational and Safety Aspects

ADVANCED GAS COOLED REACTORS

- General Configuration
- Core Arrangement
- Fuel Characteristics and Management
- Heat Transport
- Steam Cycle
- Operational and Safety Aspects
- Safeguards and Future Prospects

LIGHT WATER GRAPHITE REACTORS

- Introduction
- General Configuration
- Core Arrangement
- Fuel Characteristics and Management
- Heat Transport
- Steam Cycle
- Operational and Safety Aspects
- Engineered Safeguards and Safety Aspects

HIGH TEMPERATURE GAS COOLED REACTORS

- General Configuration
- Core Arrangement
- Fuel Characteristics and Management

Heat Transport
Steam Cycle
Operational and Safety Aspects

RADIATION, NUCLEAR CYCLES AND NUCLEAR WASTE

RADIOACTIVE WASTES, ORIGINS, CLASSIFICATION AND MANAGEMENT

Radioactivity and Radioactive Wastes
Categories Of Radioactive Wastes
Radioactive waste management and disposal options

NUCLEAR REACTOR OVERVIEW AND REACTOR CYCLES

Nuclear Reactors and an Overview of Nuclear History
Nuclear Reactions
Nuclear Reactors and Nuclear Reactor Development
Commercial Reactor Types
Reactor Cycles

THE NUCLEAR REACTOR CLOSED CYCLE

The Closed Nuclear Cycle
Uranium Mining, Processing, Refining
Conversion to UF₆
Enrichment
Depleted Uranium
Fuel Fabrication
Reactor Operation, Maintenance Wastes, and Spent Fuel
Spent Fuel Interim Storage, Prior to Reprocessing or Disposal
Fuel Reprocessing, Fuel Re-cycling and Advanced Reactors

PIPELINE ENGINEERING

PIPELINE OPERATIONS

Pipeline Operation
Gas Pipeline Operation
Liquid Pipeline Operation

ENERGY CARRIERS AND CONVERSION SYSTEMS WITH EMPHASIS ON HYDROGEN

Energy Resources
Proposed Systems and the Elementary Technologies
Metal Hydrides and Hydrogen
Safety

PRELIMINARIES OF HYDROGEN ENERGY SYSTEMS

Introduction: From Fossil Fuel to Hydrogen
Meaning of Water-splitting Technology
Four Innovative Hydrogen Production Technologies
Four Noble Hydrogen Conversion Systems

PHYSICAL AND CHEMICAL PROPERTIES OF HYDROGEN

Introduction
Physical and Chemical Properties

STATISTICS ON HYDROGEN PRODUCTION AND CONSUMPTION

Statistics

INTERNATIONAL PROGRAMS

- Hydrogen Production
- Hydrogen Storage and Transport
- Hydrogen Utilization
- Transition to Hydrogen Economy
- International Centre for Hydrogen Energy Technologies

CULTURAL DEVELOPMENT AND THE KEY TECHNOLOGIES OF HYDROGEN ENERGY SYSTEMS- AN INTRODUCTORY REVIEW FOR THE BEGINNERS

- Formation of Hydrogen energy systems
- Review of Elemental Technologies
- Innovative WSS systems
- Hydrogen storage
- Fuel cells (FCs)
- Annotations

HYDROGEN PRODUCTION FROM FOSSIL FUELS

- Steam Reforming of Natural Gas (Methane)
- Parted Oxidation (POX) of Hydrocarbons
- Coal Gasification
- Steam-Iron Process
- Thermal Cracking of Natural Gas (Methane) and Hydrocarbons
- Comparison of the Major Hydrogen Production Processes

HYDROGEN PRODUCTION FROM WATER

- Direct Thermal Decomposition
- Thermochemical Cycles
- Electrolysis
- Photolysis (Photoelectrochemical Method)
- Mechano-catalytic Splitting

THERMODYNAMICS OF WATER SPLITTING

- Introduction: Fundamentals
- Electrolysis of Water
- Thermochemical Water Splitting

ALKALINE WATER-ELECTROLYSIS

- Structure of Alkaline Water Electrolyzers
- Advanced Water Electrolyzers
- High Temperature, High Pressure Operation
- Structural Materials
- System Design
- Control System
- Examples of Advanced Electrolyzers
- Cost of Alkaline Water Electrolysis

SPE WATER ELECTROLYSIS AND STEAM ELECTROLYSIS

- SPE Water Electrolysis: Introduction
- High Temperature Steam Electrolysis (HTE)

PHOTOVOLTAIC CELL-WATER ELECTROLYSIS SYSTEM

- Total System
- Requirements of Electrolyzer

Operation

INNOVATIVE HYDROGEN PRODUCTION FROM WATER

Definition of "Innovative Technology"

Renewable Energy Resources

Five Innovative Hydrogen Production Technologies

Algae and Bacteria Hydrogen Systems

Hydrogen Production from Biomass

THERMOCHEMICAL CYCLES

Thermochemical Cycles

THERMOLYSIS

Thermolysis and Direct Thermal Decomposition

PHOTOCHEMICAL AND PHOTOELECTROCHEMICAL WATER SPLITTING

Photoelectrochemical Approaches

Photochemical and Photocatalytic Processes

HYDROGEN FROM BIOMASS (1)

Photobiological Hydrogen Production by Photosynthetic Microorganisms (Bacteria)

Biological Hydrogen Production by Non-Photosynthetic Microorganisms

Photobiological Hydrogen Production by Mixed Culture with Non-Photosynthetic Bacteria

HYDROGEN FROM BIOMASS (2)

Overall Scope

Thermochemical Biomass Gasification

Biomethanation

Hydrothermal Gasification

HYDROGEN SEPARATION AND HANDLING

Separation and Purification of Hydrogen

Hydrogen and Natural Gas Mixture

Handling and Safety of Hydrogen

SEPARATION AND PURIFICATION OF HYDROGEN

Partial Condensation

Absorption Methods

Adsorption Methods

Membrane Separation

Separation by Metal Hydrides

HYDROGEN AND NATURAL GAS MIXTURE

Burner Combustion of Natural Gas Mixed with Hydrogen

Hydrogen-Natural Gas Mixtures for Internal Combustion Engines

HANDLING AND SAFETY OF HYDROGEN

Safety Aspects of Gaseous Hydrogen

Safety Aspects of Liquid Hydrogen

Safety Aspects of Metal Hydrides

Materials for Safe Handling

Detection of Hydrogen and its Fires

Basic Measures for Safe Handling

HYDROGEN AS A TRANSPORT FUEL: PAST AND PRESENT USAGE

Historical Review of Efforts Leading to the Hydrogen-Fueled Engine
Hydrogen As a Fuel
Some Further Observations on Hydrogen Power in Various Modes of Transport

VEHICLES WITH HYDROGEN-AIR FUEL CELLS

Proton Exchange Membrane Fuel Cells
Fuel Cell System
Propulsion Configurations
Systems with Onboard Reforming
Fuel Cell and Fuel Cell System Efficiency
Automotive Fuel Cell Technical Specifications: Status and Targets
Prototype Fuel Cell Vehicles

SOME INFORMATION ON THE HYDROGEN COMBUSTION PROCESS AND ROCKET PROPULSION SYSTEMS

Hydrogen Combustion Data
Space Rocket and the Hydrogen Fuel
Design of Supersonic (Hypersonic) Aircraft
An Experiment of Hydrogen/Oxygen Turbine for Power Plant

HYDROGEN STORAGE

Gas Storage in a Gaseous State
Storage as Liquid Hydrogen
Hydrogen Storage by Chemical Hydrides

PRESSURIZED HYDROGEN STORAGE

Pressurized Hydrogen Storage
Safety Points
Technical Development of Storage Vessels for Pressurized Hydrogen and Actual Examples of Pressurized Hydrogen Storage
Web Sites for Reference

HYDROGEN STORAGE BY CHEMICAL HYDRIDES

Metalhydrides, Energy Storage, and Other Applications
Hydrogen Storage by Using Organic Compounds, etc.

HYDROGEN STORAGE BY GLASS MICROSPHERES AND OTHERS

Activated Carbon
Graphite Nanofibers and Carbon Nanotubes
Glass Microspheres
Zeolite

HYDROGEN LIQUEFACTION

Process of Refining Source Hydrogen
Ortho-Para Conversion Method
Liquefaction Process

LIQUID-HYDROGEN STORAGE

Insulation of Liquid Hydrogen Tank
Selection of Liquid Hydrogen Storage Tanks by Purpose
Type and Shape of Liquid Hydrogen Storage Facilities
Carriers for Liquid Hydrogen Transportation

HYDROGEN TRANSPORTATION

Hydrogen Transportation by Pipeline
Batch Transportation of Hydrogen
Ocean Transportation of Hydrogen

TRANSPORTATION OF HYDROGEN BY PIPELINE

Distinctive Features of Pipeline Transportation System
Equipment Constituting Pipeline Transportation System
Operation of Pipeline

BATCH-SYSTEMS OF HYDROGEN TRANSPORTATION

Pressurized Hydrogen Gas Batch Transportation System
Liquid Hydrogen Transportation System
Metal Hydride Transportation System

OCEAN TRANSPORTATION OF HYDROGEN

Liquid Hydrogen Property for Cargo
Problems of Liquid Hydrogen Tankers
Performance of Energy Transportation

AMMONIA ENERGY SYSTEM

Features of Ammonia Energy
Tanker Transportation
Ammonia Energy System
Ammonia Direct Use

ALCOHOL ENERGY SYSTEMS

Feature of methanol Energy system
Methanol Energy Systems
Methanol Direct Use

METAL HYDRIDES

Hydrogen Storage Metal
Properties of Hydrogen Storage Alloys
Use of Hydrogen Storage Alloys
Properties Required for Hydrogen Storage Alloys for the Practical Use

PHYSICS OF METAL HYDRIDES

The Stability of Hydrides
Crystal Structures of Metal hydrides
Examples of Crystal Structure of Ternary Hydrides
The Relation between Crystal Structure and Thermodynamic Properties
Electronic Properties of Ternary Hydrides
Electronic Structures of LaNi₅ and its hydride

KINDS AND CHARACTERISTICS OF HYDROGEN STORAGE ALLOY

Classification of Hydrogen Storage Alloys
Characteristics of A₂B Alloys
Characteristics of AB Alloys
Properties of AB₂ Alloys
Properties of AB₅ Alloys
Novel Materials

METAL HYDRIDE AIR-CONDITIONING

Alloys Used for Metal Hydride Air-Conditioning (heat pump, heat storage)

Theme of R&D for MH Heat Pump System
Practical Applications

METAL HYDRIDE BATTERIES

General Background
Battery Structure and Performances
EV Application

OTHER APPLICATIONS (ACTUATOR, HYDROGEN PURIFICATION AND ISOTOPE SEPARATION)

Actuator
Hydrogen Purification
Isotope Separation

FUEL CELL SYSTEMS

Fuel Cell Structure and Principle of Operation
History
The Allure of Fuel Cells
Fuel Cell Types
Fuel Cell Power Generation Systems
Lifetime
Application Areas for Fuel Cells

ELECTROCHEMISTRY OF FUEL CELL

Principle of Electricity Generation by Fuel Cells
Electricity Generation Characteristics of Fuel Cells
Fuel Cell Efficiency

REFORMING SYSTEMS FOR FUEL CELLS

Steam Reforming of Hydrocarbon Fuels
Fuel Processing System

ALKALINE FUEL CELLS

Background
Cell Structure
Features of Alkaline Fuel Cells

PROTON EXCHANGE MEMBRANE FUEL CELLS

Principle of Operation
Construction
Features
System Configuration
Fuel Cell Electric Vehicles
Direct Methanol Fuel Cells

PHOSPHORIC ACID FUEL CELLS

Cell Structure
Features of Phosphoric Acid Fuel Cells
Cell Lifetime
Plant Experiences

MOLTEN CARBONATE FUEL CELLS

Principle of Operation and Construction of MCFCs
Electric Power Generation System

Power Generation Characteristics
Gradation Phenomena
Problems in MCFC Development

SOLID OXIDE FUEL CELLS

Cell Component Materials
Cell Structure
Applications

POTENTIAL APPLICATIONS OF FUEL CELLS

Commercial Applications
Distributed Regional Installations
Electric Utility Applications
Industrial Applications
Application in Mobile Power Sources
Home-use Power Sources
Emergency-use Power Supplies
Integrated Hydrogen Energy System Combined with Renewable Energy Sources

ENERGY STORAGE

Types of Energy Storage, en Route from Resources to Utilization
Transport and Conversion of Energy
Technical and Economical Performance of Energy Storage Systems
Thermal Energy Storage
Mechanical Energy Storage
Storage of Electrical Energy
Storage of Chemical and Nuclear Energy

INTRODUCTION AND CLASSIFICATION OF APPLICATIONS

RATIONALE OF ENERGY STORAGE AND SUPPLY/DEMAND MATCHING

Thermodynamic Considerations. Energy and Exergy (Availability)
Cases
Computational Tools

STORAGE OF THERMAL ENERGY

Methods of Thermal Energy Storage
Sensible Heat Storage
Thermal Stratification and its Capability to Store Exergy
Phase Change Energy Storage
Bond Heat Storage
High Temperature Thermal Energy Storage
Cold Storage
Comparison of Storage System Types Including Economic Aspects

STORAGE OF SENSIBLE HEAT

Classification and Principles of Storage of Sensible Heat
Solid Storage Materials
Liquid Storage Materials
Gaseous Storage Materials
Applications
Examples of Large Stores and Experience
Small Water Stores

High Temperature Thermal Storage, Regenerators (Cowper)

STORAGE OF THERMAL ENERGY BY CHANGE OF PHASE

Phase Change Thermal Energy Storage Systems

The Thermodynamic Analysis of a Phase Change Thermal Energy Storage System
Results

BOND ENERGY

Basic considerations and definitions

Heat storage and heat transformation

Examples of storage systems and applications

MECHANICAL ENERGY STORAGE

Characteristics, Efficiencies, Control and Economic Evaluation of Mechanical Energy Storage Systems

Pumped Hydro Energy Storage

Compressed Air Energy Storage (CAES)

Flywheels and Super Flywheels

Other Mechanical Energy Storage Applications

COMPRESSED AIR ENERGY STORAGE

Comparison of Energy Storage Technologies

CAES Technology - World-wide Status

Thermodynamics Aspects of CAES Technology

Techno-economical Aspects of CAES Technology

Turbo-machinery and Above-Ground Plant

Below-Ground Reservoir

Novel CAES Alternatives

PUMPED WATER ENERGY STORAGE

Matching Demand and Supply in Electrical Power Systems

Types, Economic Considerations and Historical Development

Characteristics of Pumped Water Storage Plants

Main Components of Pumped Water Storage Plant

An Example Pumped Water Storage Plant

System Hydraulics

Example Calculations

FLYWHEELS AND SUPER-FLYWHEELS

Applications

Flywheel design

Historical perspective of flywheel design

Stress Analysis and Specific Energy Calculations of Flywheels

Sample Solutions for Design Optimization of Flywheels

Discussions of Design Optimization

STORAGE OF ELECTRICAL ENERGY

Batteries

Capacitors

Superconducting Inductive Coils

SMES Coils and Batteries for Spinning Reserve

Comparison of Electrical Energy Storage Techniques

BATTERIES AND THEIR CHEMISTRY

- Secondary Batteries
- Battery Storage System
- Electric Vehicle Batteries

SUPERCONDUCTING INDUCTIVE COILS

- Principle of Operation
- Importance of Energy Storage
- A Brief History of Superconductivity and SMES Systems
- General Structure of SMES Systems
- Application Areas of SMES Systems
- Advantages and Benefits of SMES Systems
- Examples of Practical Applications
- Design Considerations
- A Case Study
- Future of SMES Systems

CAPACITIVE STORAGE

- Linear and Nonlinear Capacitors
- Capacitance Definitions for Linear Capacitors
- Capacitance definitions for nonlinear capacitors
- Charging of a capacitor as an RC circuit
- Discharging of a capacitor as an RCL circuit
- Energy storage capacitors

SPINNING RESERVES

- Utility System as a Spinning Reserve
- Batteries
- Flywheel - Generator Combination as Spinning Reserve
- Superconductive Magnetic Energy Storage (SMES)
- Applications
- Future Perspective and Conclusions

STORAGE OF CHEMICAL ENERGY AND NUCLEAR MATERIALS

- Storage of Energy in the Chemical Bond
- Alternative Pathways of Chemical Energy Utilization for Electricity Generation
- Issues Concerning Chemical Energy Storage
- Alternative Technologies: Future Outlook
- Chemical Energy Perspectives in Sustainable Development
- Energy Conservation

STORAGE OF HYDROGEN

- Gaseous Hydrogen
- Liquid Hydrogen
- Slush Hydrogen
- Metal Hydrides
- Liquid Hydrides
- Cryogenic Adsorption
- Carbon Nanostructures
- Hydrogen Producing Systems
- Comparison among Storage Systems

STORAGE OF FOSSIL FUELS (GASEOUS AND LIQUID)

- Storage of gaseous fossil fuels
- Storage of liquid fossil fuels

STORAGE OF COAL: PROBLEMS AND PRECAUTIONS

- Methods of Coal Stacking
- Problems Faced in Coal Stacks
- Low Temperature Oxidation of Coal and Spontaneous Combustion
- Factors Affecting the Spontaneous Combustion of Coal
- Early Detection of Spontaneous Combustion in Stacks
- Measures to be taken against the Phenomenon
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STORAGE OF RADIOACTIVE MATERIALS

- Radioactivity and Fission
- Storage of Fuel
- Transportation of Radioactive Materials
- Volume Reduction of Low Level Wastes
- Solidification
- Radioactive Materials Produced in Nuclear Reactors
- Fuel Waste
- Controlled Release of Waste
- Long Term Storage of Solid Wastes

ENERGY TRANSPORTATION

- Energy Distribution System and Network
- Modes of Energy Transportation
- Transportation of Hydrogen
- Environmental Issues
- Safety Issues of Energy Transportation
- Energy Transportation in the Twenty-First Century

PROCESSING OF PRIMARY AND SECONDARY FUELS: PERSPECTIVE ON PETROLEUM REFINING

- Types of Refineries
- Types of Crude Oil to be processed.
- Refinery Process
- Major Separation Processes used to Produce Primary Fuels from Crude Oil
- Major Conversion Processes for Upgrading Primary Fuels into Secondary Fuels
- Refining Products
- Refinery Operation
- Future of the Petroleum Refining Industries
- Natural Gas Processing

ELECTRICAL ENERGY SYSTEMS

HISTORY OF ELECTRIC ENERGY SYSTEMS AND NEW EVOLUTION

- Introduction: Electrical Energy
- History and Recent Progress of Electric Motors and Generators
- History and Recent Progress of Electric Power Generation
- History and Recent Progress of Electric Power Systems and Their Utilization
- Distributed Generation - the New Tendencies

ELECTRICAL POWER GENERATION

- Electromechanical Basis of Electric Machines
- Synchronous Machines
- Excitation System
- Governors and Speed Control
- Induction Generators
- Protection of Electric Machines

COMPONENTS AND SUBSTATIONS FOR ELECTRICAL TRANSMISSION AND DISTRIBUTION SYSTEMS

- Capacitors and their Applications
- Cables in Electrical Energy Systems
- Transformers: Types, Design and Performance
- Transformer Audible Noise and Vibrations
- Transformer Substations
- Integrated Substation Protection (Relaying) and Control
- Safety and Grounding

ELECTRIC POWER TRANSMISSION

- Power Transmission
- Overhead Power Transmission
- Underground Power Transmission
- Ultra High Voltage Power Transmission
- High Voltage Direct Current Power Transmission
- Cryogenic Power Transmission
- Environmental Considerations

TRANSMISSION AND INTERCONNECTION NETWORKS

- Role of Transmission and Interconnection Networks
- History of the Development
- Constitution of Networks, Equipment, Structures
- Technical Choices
- Planning Methods
- Planning Tools
- Changes in the Rules of the Game: The responsibility of power Systems Developers

NIKOLA TESLA AND THE GLOBAL PROBLEMS OF HUMANKIND

- The Life and Work of Nikola Tesla
- Tradition and Knowledge
- Global Problems of Humankind Today

SOLAR ENERGY CONVERSION AND PHOTOENERGY SYSTEM

SOLAR RADIATION ENERGY (FUNDAMENTALS)

- Energy Emitted by the Sun
- Sun-Earth Geometry - Time
- Sun Geometry Perceived by an Observer - Radiation at the Top of the Atmosphere
- Concepts of Scattering and Absorption - Terrestrial Radiation
- Radiative Transfer in the Atmosphere - Spectral Distribution of the Radiation
- Radiative Components at Ground Level

PHOTOVOLTAICS

- Introduction

- What We See Today
- History
- Photovoltaic Generation
- The Solar Resource
- Photovoltaic Applications
- Technology
- The Future of PV

LOW TEMPERATURE SOLAR COLLECTORS

- Low Temperature Solar Collectors
- Thermal Analysis of Collectors
- Performance of Solar Collectors
- Solar Collector Applications

MEDIUM TEMPERATURE SOLAR CONCENTRATORS (PARABOLIC TROUGHS COLLECTORS)

- Parabolic-trough Collectors: Working Principle and Components
- Optical, Thermal and Geometrical Losses in a Parabolic-trough Collector
- Energy Flow and Thermal Energy Delivered by a Parabolic-trough Collector
- Design of Solar Fields with Parabolic-trough Collectors
- Different Ways to Couple a Parabolic-trough Solar Field with an Industrial Process
- The Direct Steam Generation Technology
- Thermal Energy Storage Systems for Parabolic-trough Collectors
- Electricity Generation with Parabolic-trough Collectors

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- What is a Solar Pond?
- The Design and Performance of Solar Ponds
- Experimental and Demonstration Solar Ponds
- Applications of Solar Ponds
- State of the Art and Future Directions

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- Factors Affecting Photosynthetic Microorganisms
- Photobioreactors
- Biomass and Product Recovery
- Industrial Applications

SOLAR PHOTOCATALYSIS AND WATER TREATMENT: DEXTOXIFICATION AND DISINFECTION

- Fundamental Parameters in Solar Photocatalysis
- Factors Affecting Solar Photocatalysis
- Solar Photocatalytic Degradation of Contaminants
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MATHEMATICAL MODELS OF SOLAR ENERGY CONVERSION SYSTEMS

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- Properties of Radiation Fluxes
- Concentration of solar radiation
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Emulsion Treatment and Dehydration of Crude Oil
Desalting of Crude Oil
Stabilization and Sweetening of Sour Crude Oil
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- Underwater apparatus propulsive quantities investigation
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- Steam turbines and steam turbine units
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- Basic equations for the gas dynamic compressor design
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- Blade (vane) and duct design
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- Combustor arrangement in gas turbine system.
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- Basic Parameters of Nozzles
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- Social Costs of Energy Use
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- Evolving Energy Policies in Developing Countries
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- Market Failure and Energy Efficiency Standards
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Removal in Water Treatment
Risk Assessment
Water and the Food Industry
Regulatory Aspects
Current Limitations and Future Developments
Role for Education and Effective Interaction

SPORTFISH CONSUMPTION: SOCIO-CULTURAL AND ECONOMIC ASPECTS, ETHNICITY AND EFFECTIVENESS OF HEALTH ADVISORIES

Ethnicity/Social-cultural considerations of fish consumption
Economics of fishing and fish consumption
Effectiveness of health advisories
Compliance with advisories and public perception
Impact of compliance with advisories and reality
Public awareness of advisories
Communication and outreach
California experience

IMPACT OF SOCIOECONOMIC FACTORS ON RESIDENTIAL INDOOR AIR QUALITY AND HUMAN HEALTH

Socioeconomic Factors and their Influence on the Association Between Indoor Exposures and Human Health
Selected Important Indoor Exposures
Important Building Characteristic Affecting Indoor Exposures: Ventilation
Future Perspectives

SOCIAL CONCERNS FOR ENVIRONMENTAL EXPOSURES TO TOXIC SUBSTANCES

Assessing and Communicating Risks from Environmental Exposures
Equity, Health Disparities, and Environmental Justice
Policy Approaches for Global Challenges

ENVIRONMENTAL JUSTICE AS A COMPONENT OF ENVIRONMENTAL DECISION-MAKING

Existing Framework for Environmental Decision-Making
Environmental Justice Perspective on Environmental Decision-Making
Incorporating Environmental Justice into Environmental Decision-Making

MARINE ECOLOGY

Introduction: The Sea as an Ecosystem
Marine Biodiversity and Marine Habitats
Marine Ecology: Definition and Goals
The Formation and Destruction of Organic Matter in the Sea: Primary Producers and Respiration
Transformations of Organic Matter: The Structure and Dynamics of Marine Food Webs

External Drivers of the Function and Structure of Marine Food Webs
Profiles of Marine Ecosystems
Services Provided by Marine Ecosystems to Society
Human Alteration of Marine Ecosystems

PRODUCTIVITY OF THE OCEANS

Photosynthetic processes of planktonic cells.
Computation of global and regional productivity in the ocean.
The ecological geography of productivity
What are the anticipated consequences of the response of phytoplankton as atmospheric carbon dioxide progressively increases?

OCEAN CURRENTS AND THEIR IMPACT ON MARINE LIFE

Impacts on nutrient circulation and productivity of the oceans
Other impacts of ocean currents on marine life

ROLE OF MARINE MICROBES IN CARBON AND NUTRIENT CYCLES

Microbes in the sea. Defining the subject of study in marine microbiology.
The role of microbes in the cycles of nutrients and carbon. A historical view.
The end of the black box approach to the study of the ecology of plankton microbes.
Evolving perceptions on the role of microorganisms in the organic matter fluxes in planktonic food webs.
Evolving perceptions on the role of microorganisms in the inorganic nutrient fluxes.

OCEAN FOOD WEBS AND TROPHIC DYNAMICS

The pelagic food web
Benthic food webs

ECOLOGY, BEHAVIOR AND PRODUCTIVITY OF MARINE FISH

Fish life history
Population dynamics
Fish behavior
Fish communities
Production and fisheries

HARVESTING THE OCEAN

History of human harvesting technology
Harvesting marine biological resources
Future challenges and scenarios

ADAPTATIONS TO LIFE IN THE OCEANS

ADAPTATIONS TO LIFE IN THE OCEANS. PELAGIC MACROFAUNA

The distribution of pelagic macrofauna
Sensorial physiology
Feeding and metabolic rates
Reproduction and life histories

MARINE BENTHIC FLORA

Diversity of benthic marine flora
Adaptations of benthic marine flora.
Human uses
Short term changes
Long term changes

Conservation

LIFE IN EXTREME OCEAN ENVIRONMENTS: ANCHIALINE CAVES

The anchialine environment: a subterranean marine/freshwater ecotone

The marine condition of anchialine caves

Typology and distribution of anchialine environments

Sources of organic matter and trophic relationships in anchialine caves

Characteristics of the anchialine fauna

Origin of the anchialine fauna

Conservation aspects

PLANKTON

POPULATION DYNAMICS OF PHYTOPLANKTON

Reproduction

Losses

Perennation

The balance between reproduction and loss

Seasonality

NITROGEN METABOLISM IN PHYTOPLANKTON

Availability and use of different forms of nitrogen

Assimilation pathways

Accumulation and storage

Nutrient classification and preferences

Plasticity in cell composition

Overflow mechanisms: excretion and release processes

Recycling of nitrogen within the cell

Degradation pathways

From uptake to growth: time-lag phenomena

Relationships with carbon metabolism

Future directions

VIRUS AND HETEROTROPHIC MICROPLANKTON

The main players

Future perspectives

ZOOPLANKTON ECOLOGY

Zooplankton in the context of marine life

Trophic ecology

Zooplankton production

Zooplankton and marine food webs

SWIMMING DYNAMICS OF ZOOPLANKTON

How do they swim?-The study of zooplankton locomotion

Why do they swim?-The study of swimming behavior

INDUCTION OF SETTLEMENT IN MEROZOOPLANKTON

Biological and environmental challenges faced by merozooplankters

Settlement cues and signal transduction

Overview of natural settlement cues

A case study: Settlement induction in barnacles

Future challenges

ECOLOGY AND BEHAVIOR OF SEABIRDS

- Prologue
- Taxonomy and distribution of seabirds
- Feeding ecology of seabirds
- Seabird migration
- Life cycles and breeding behavior of seabirds
- Population dynamics and regulation of seabird colonies
- Conservation of seabirds

MARINE REPTILES: ADAPTATIONS, TAXONOMY, DISTRIBUTION AND LIFE CYCLES

- The fossil marine reptiles
- Physiological adaptations to sea life
- Sea Turtles
- Marine Iguana
- Sea Snakes

COASTAL ZONE AND ESTUARIES

- The Coastal Zone
- Estuarine Environments
- Coastal Management
- New Techniques in Coastal Science

COASTAL DYNAMICS

COASTAL EROSION

- Causes of Erosion
- Special Cases
- Solutions to Coastal Erosion
- The Future

WAVES AND SEDIMENT TRANSPORT IN THE NEARSHORE ZONE

- Definition of nearshore zone
- Wave shoaling
- The surf zone
- Sediment transport

EPISODIC PROCESSES(STORM SURGES AND TSUNAMIS)

- Sea level
- Storm surges
- Tsunamis

SEDIMENT TRANSPORT IN ESTUARIES

- Estuarine Hydrodynamics
- Estuarine Sediment Characteristics
- Cohesionless Sediment Transport
- Cohesive Sediment Transport
- Bed Exchange Processes
- Measurements
- Modeling
- Morphology
- Human Impacts

COASTAL SYSTEMS

ROCKY COASTS

- Origin of rocky coasts
- Processes
- Geomorphology
- Cliff erosion and retreat
- Shore platforms
- Cliff retreat and landslide hazard

COASTAL BARRIERS

- Physical Description
- Global Distribution and Tectonic Setting
- Barrier Types
- Barrier Coast Morphology
- Prograding, Retrograding, and Aggrading Barriers
- Barrier Stratigraphy

COASTAL SAND DUNES AND BARRIER ISLANDS

- General features
- Environmental characteristics
- Flora and fauna of sand dunes and barrier islands
- Human perspectives
- Coastal management and conservation. Policies and professional practice

MORPHOLOGY AND MORPHODYNAMICS OF SANDY BEACHES

- Sandy beach morphology
- Environmental boundary conditions and external hydrodynamic forcing
- Morphological change
- Beach morphodynamics and classification
- Management of sandy beaches
- Future trends and perspectives

MORPHOLOGY AND MORPHODYNAMICS OF GRAVEL BEACHES

- Gravelly Beach Morphology
- Hydrodynamics of gravel beaches
- Morphosedimentology of Gravel Beaches
- Stratigraphy of Gravel Beaches
- Gravelly beach responses to external forcing
- Future directions

BEACH PLAINS: FORMATION, EVOLUTION AND ECOLOGICAL SIGNIFICANCE

- Beach-plain stratigraphy and morphology
- Beach-plain sediments and sediment sources
- Modes and processes of beach-plain formation
- Post-formational morphological modifications
- Hydrology and soil development in beach plains
- Vegetation on beach plains

ESTUARINE SYSTEMS

RIAS AND TIDAL-SEA ESTUARIES

- General Processes
- Morphology and Sedimentology
- Sedimentary Infilling

The Rías Baixas infilling: a case study
Environmental features on rías and estuaries
Introduction
Conclusion

COASTAL LAGOONS

Definition and importance of coastal lagoons
Origin and size of coastal lagoons
Climatic setting
Grain size and sedimentation rates
Dominant processes
Barriers
Inlets
Flood and Ebb deltas
Primary production in coastal lagoons
Ecology, fisheries and aquaculture
Pollution and eutrophication
Evolution and alteration of coastal lagoons

PRIMARY PRODUCTION IN COASTAL LAGOONS

Measurement of primary production
Temporal and spatial variations
Physical setting and primary producers
Primary production in Mexican coastal lagoons

DELTA

Subenvironments
Life Support Products
Threats to Environment
Policy Drivers

TIDAL SALT MARSHES AND MANGROVE SWAMPS

Definition and Distribution
Climate
Soil Accretion and Geomorphic Evolution
Values
Human Impacts

COASTAL TRENDS

COASTAL EVOLUTION

Plate tectonics and coastal evolution
Sea-Level Change and Coastal Development
Development of Coastal Environments

ANTHROPOGENIC IMPACTS

ANTHROPOGENIC IMPACTS ON THE STRUCTURE AND FUNCTION OF THE COASTAL BIOTA

Anthropogenic effects on fish and shellfish stocks of the continental shelves
Anthropogenic effects on coral reef communities
Anthropogenic effects on kelp beds
Anthropogenic effects on seagrass beds

Anthropogenic effects on Mangroves
Anthropogenic effects on salt marshes
Anthropogenic effects on intertidal sandflats and mudflats

ANTHROPOGENIC IMPACTS ON ESTUARIES

Physical impacts
Chemical impacts
Biological impacts
Aesthetic changes
Discussion

ENVIRONMENTAL EDUCATION AND AWARENESS

The Problem in Context— Some of the Man-Made Environmental Problems with Potentially Catastrophic Consequences for Life on Earth
How did we get here? Evolution of Human Attitude to Nature and the Natural Environment
Cause-effect Relationship
Efficacy of Science and Technology to Deliver Global Environmental Sustainability and Sustainable Development
Objective and Scope of Environmental Education and Research
Environmental Education for Children
Development of Environmental Curricula for Children with Learning Disability
Environmental Education for Undergraduate Students
Instilling Environmental Awareness in Undergraduate Students
Environmental Education for Graduate Students
Proposal for the Environmental Curricular Content for Graduate Students

FORMAL ENVIRONMENTAL EDUCATION AT PRESCHOOL, PRIMARY AND SECONDARY LEVELS

Importance of Teaching Environmental Education at an Early Age
Role of Religion, Mythology and Morality Tales in Instilling Moral Values in Children for Environmental Protection
Formal Curricula for Children's Environmental Education

IMPORTANCE OF TEACHING ENVIRONMENTAL EDUCATION AT AN EARLY AGE

Approaches to early childhood education
Importance of education at an early age
Psychological perspectives on parenting, motivation and learning
Socio-cultural and related issues

ENVIRONMENTAL CURRICULA DEVELOPMENT FOR EACH AGE GROUP

Some affective factors of personality
Basic criteria for curriculum development
Curriculum development
Mechanisms to introduce environmental curricula into secondary schools

METHODS OF ENVIRONMENTAL TEACHING AND LEARNING

Some psychobiological factors influencing teaching and learning
Teacher personality and effective teaching
Guidance for effective teaching and learning

PARTICIPATION IN COMMON ENVIRONMENTAL ACTIVITIES IN AND OUT OF SCHOOL

Children's play and related issues

Design and implementation of common environmental activities

SPECIAL ENVIRONMENTAL EDUCATION FOR THE LEARNING DISABLED

Key Features of a Special Educational Environment

Working with the Environment

Principles of the Environmental Curriculum

Curriculum Content and Approaches

Using Resources

FORMAL ENVIRONMENTAL EDUCATION AT THE UNDERGRADUATE LEVEL

Some of the Related Issues

Development of Environmental Curricula for Undergraduate Students

Instilling Environmental Awareness in Undergraduate Students

CURRICULA DEVELOPMENT FOR UNDERGRADUATE UNIVERSITY STUDENTS

Basic criteria for curriculum development

The "Content" Element Of Environmental Curricula

Development of the "pedagogic" element of environmental curricula

Quality control

Some practical difficulties

INSTILLING ENVIRONMENTAL AWARENESS IN UNDERGRADUATE UNIVERSITY STUDENTS

What is it that undergraduate students should be aware of?

Instilling environmental awareness in undergraduate students

SOME PRESSING GLOBAL ENVIRONMENTAL PROBLEMS OF OUR TIME AND STRATEGIES FOR MITIGATING THEIR IMPACTS

Global Warming and Climate Change

Acidification of the Oceans

Poverty Eradication

Observations

FORMAL ENVIRONMENTAL EDUCATION AT THE GRADUATE LEVEL

Sustainable development and related issues

Proposal for the environmental curricular content for graduate students

CURRICULA DEVELOPMENT FOR GRADUATE STUDENTS

Lack of Progress towards Agenda 21 Objectives

Sustainable Development and Environmental Sustainability

Proposal for a Unique Operational Definition of Sustainable Development

Science, Technology and Environmental Sustainability

Proposed Environmental Subjects for Students in different Disciplines

CONSTRAINTS AND OPPORTUNITIES FOR THE WORK OF THE ENVIRONMENTAL MANAGER

What is an Environmental Manager?

Constraints External to the Enterprise

Constraints Internal to the Enterprise

Future Trends

NEED FOR ENVIRONMENTAL RESEARCH

How did we get here? Evolution of the "consumption culture"

Cause-Effect Relationship

Criteria for Research
Suggested Areas of Environmental Research

MODERN AND INNOVATIVE TECHNIQUES FOR ENVIRONMENTAL EDUCATION

NATURAL HISTORY FILMS

Brief Historical Background to Natural History and Naturalism
Evolution of Natural History films
Pre-eminent Pioneers of Modern Natural History films
Observations

INTERACTIVE WORKSHOPS, GAMES, AND SOFTWARE: EXERCISES IN ENVIRONMENTAL EDUCATION

The draining accident
The Production Capacity Enlargement Exercise
The Greenhouse Effect Exercise
Environmental Pollution Unit (EPU) Exercise
How to produce 20 MWE?
Not making Tea: an Energy Waste?

PROFESSIONAL ENVIRONMENTAL EDUCATION

Some Of The Issues All Environmental Professionals Need To Be Aware Of
Environmental Planning; What Environmental Planners Ought To Know
Environmental Management and the Environmental Manager
Environmental Impact Assessment
Environmental Monitoring

PREPARATION FOR ENVIRONMENTAL PLANNERS

The Nature of Work of the Environmental Planner
Career Opportunities and Job Description
Case Studies Showing the Participation Of The Environmental Planner

PREPARATION FOR ENVIRONMENTAL MANAGERS

Skills and knowledge requirements for the environmental manager
Typical requirements of professional education and training for environmental managers
Case Studies of Professional Education and Training
Future Trends

PREPARATION FOR ENVIRONMENTAL IMPACT EVALUATORS

Objectives of Environmental Impact Assessment
Nature of EIE's Work
Career Opportunities and Job Description
Education/Training
Cases in which the Environmental Impact Evaluator Would Participate
Conclusion

PREPARATION FOR ENVIRONMENTAL MONITORING CAREERS INCLUDING ANALYSIS AND STATISTICAL ASSESSMENT OF DATA

Sampling
Chemical Analysis of Samples
Reporting Analytical Data

CONTINUING EDUCATION

The Role of Continuing Education

Types of Continuing Education
Formal Continuing Education
Informal Continuing Education
Future Trends

CONTINUING EDUCATION FOR DECISION-MAKERS INCLUDING POLITICIANS, SENIOR GOVERNMENT OFFICIALS AND CHIEF EXECUTIVES IN INDUSTRY

Human Knowledge and Some of its Salient Characteristics
Continuing Education
Suggestions for the Curricular Content for the Continuing Education of Leaders of Society
Some Other Issues that Leaders of Society ought to be aware of with a view to addressing them
Need and an Innovative Mechanism for Certification

CONTINUING EDUCATION FOR UPDATING TEACHERS OF ENVIRONMENTAL SCIENCE

Starting the education process
Reasons for staff education
The strategy of staff education
After the starting process
Example exercise

MECHANISMS FOR THE CONTINUING EDUCATION OF THE PUBLIC

Mechanism for continuing public education
Continuing education of the public and for informing them on specific issues
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INFORMAL MECHANISMS FOR RAISING PUBLIC AWARENESS AT NATIONAL AND GLOBAL LEVELS AND IMPORTANT RELATED ISSUES

Why public awareness of environmental issues and problems is important, and the difficulties
Primary objectives of raising public awareness
Strategies for raising public awareness
Informal mechanisms for raising public awareness
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THE VOLUNTARY SECTOR AND INITIATIVES IN ENVIRONMENTAL EDUCATION

Expansion of Voluntary Sector
Individuals
NGOs
Current and Future Trends

IUCN COMMISSION ON EDUCATION AND COMMUNICATION (CEC)

The CEC — Its Vision, Mission and Objectives
Organization of The CEC
CEC Involvement in IUCN Work Programmes
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INTERNATIONAL CENTRE FOR CONSERVATION EDUCATION

International Centre for Conservation Education and Its Major Activities
Current Projects of ICCE
ICCE's Educational Resource Base
Other Services Provided by ICCE

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ENVIRONMENTAL LIAISON CENTRE INTERNATIONAL

The Environmental Liaison Centre International — Its Vision, Mission and Objectives

ELCI's Links to and Relationship with International Organizations

Major Activities of ELCI

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OTHER INTERNATIONAL NGOS

Greenpeace

WaterAid

Worldwatch

THE INTERNATIONAL EARTH DAY

The "International Earth Day"

Observance of the "International Earth Day"

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Conclusion

NATIONAL AND LOCAL NGOS

Sustainable Development Higher Education Program

Support for Schools

Demonstration Project

Local Action

INITIATIVES FOR ENVIRONMENTAL EDUCATION IN UNDERDEVELOPED COUNTRIES

International NGOs

Local NGO-International NGO Collaboration

Community Initiatives

Performance education

Individuals

NGOS FOR THE CONSERVATION OF AFRICA'S WILDLIFE AND THEIR HABITATS

Some of the Major NGOs for the Conservation of Africa's Wildlife and their Habitats.

Observations

ENVIRONMENTAL EDUCATION (EE)

Historical Perspective and Definition

Scientific, Technical, and Socioeconomic Foundations of EE

Conceptual Foundations of EE

Pedagogical Foundations of EE Programs

Some Examples of Successful EE Methods and Programs

Future Trends

ENVIRONMENTAL SYSTEMS

Introduction: Systems Approach to Environmental Objects

Measurements: Data Capture, Validation, Interpretation

Modeling: Model Types, System Identification and Parameter Estimation

Decision Support: Optimization, Multicriteria Approach, Hierarchical Optimization

Applied Systems Analysis: Urban and Regional Studies and Information Systems

MEASUREMENT TOOLS FOR POLLUTION SOURCES AND AMBIENT CONCENTRATIONS

The Air Pollution System

Spectroscopic Monitoring Techniques
Monitoring of Criteria Gaseous Pollutants in Ambient Air
Monitoring of Non-Criteria Gaseous Pollutants in Ambient Air
Particulate Matter

MEASUREMENT TOOLS: SOIL SYSTEMS

The Soil Solid Phase (Soil Matrix)
Soil Solution

MEASUREMENT TOOLS FOR ATMOSPHERIC SYSTEMS

Techniques
Measurement Tools for Meteorological Parameters
Measurement Tools for Chemical Parameters

MEASUREMENT TOOLS: WATER SYSTEMS (INLAND WATERS)

Field Techniques
Measurement Tools

MEASUREMENT TOOLS: WATER SYSTEMS (OCEANS)

Current Measurements for Oceans
Thermodynamic State Properties
Optical Measurements

FIELD TECHNIQUES: SOIL SYSTEMS

Field techniques to study soil formation and soil classification
Evaluating the impact of human activities on soil quantity, soil quality and soil functions
Field techniques related to study soil loss, soil functionality and soil pollution

FIELD TECHNIQUES FOR ATMOSPHERIC SYSTEMS

Conceptual Aspects of Field Campaigns and Techniques
Platforms
Chemical Sampling Techniques
Flux Measurements
Intensive Field Studies and Long-term Monitoring Programs
Epilogue

FIELD TECHNIQUES: INLAND WATERS

Objectives: Lakes, Rivers, and Groundwaters
Human Use, Anthropogenic Changes, and Threats to Inland Waters
Sampling, Data Assessment, and Field Techniques
Monitoring the State and Change of Water Quality
Monitoring Surface Waters by Remote Sensing

FIELD TECHNIQUES: WATER SYSTEMS (OCEANS)

Measuring Platforms
Vertical Profiling
Towed Systems and Drifters
Remote in situ Methods
Satellite Remote Sensing

BIOINDICATORS

Levels of Bioindication
Application of Bioindicators

BIOINDICATION OF ECOSYSTEMS REGENERATION ABILITY THRESHOLDS

Background
Model Concept
Applications
Results, Current State of the Work and Future Outlook

ENVIRONMENTAL DATA AND STATISTICS

Environmental Data
Multivariate Data
Time Series Analysis
Geostatistics

SPATIAL ENVIRONMENTAL DATA

Use of Spatial Environmental Information
Spatial Data Geometry
Classification of Spatial Environmental Databases
Metadata for Spatial Environmental Information
Spatial Information Systems
Aerial and Satellite Images
An Example Study: The European THETIS Project

NON-SPATIAL ENVIRONMENTAL DATA

Proliferation of Environmental Information
Classification of Environmental Databases
Metadatabases for Environmental Information
Environmental Information Systems and Meta-information Systems on the Free Internet
Need for Analysis and Evaluation of Environmental Databases

STATISTICAL ANALYSES' DESIGN

Classification of Environmental Problems
A Sample of Environmental Problems
Environmental Data
Characteristics of Environmental Processes
Domains of Analyses
Statistical Approaches
Design of Statistical Analysis
Statistical Modeling
Model Selection

BIOSTATISTICS

Analyzing Environmentalecological Structures
Analyzing Spatio-temporal Structures

DATA ACCURACY AND VALIDATION

Data Requirements for Environmental Management
Environmental Data Management
Errors (Noise) in Data
User's Interpretation of Data Accuracy

ENVIRONMENTAL MODELS AND SIMULATIONS

Modeling Elements
Models as a Management Tool
Briefly about the History of Modeling
Classification of Models

How Good Are Our Models?
Generality of Environmental Model
State-of-the-Art of Modeling on the Edge of the Third Millennium
Modeling in the Future

TYPES OF ENVIRONMENTAL MODELS

Common Features of Environmental Systems
Types of Environmental Systems
Uses and Objectives of Environmental Models
Types of Models
Modeling Environmental Systems
Future Directions in Environmental Modeling

CASE STUDIES OF LOCAL, REGIONAL AND GLOBAL APPLICATIONS OF ENVIRONMENTAL MODELS

Modeling the Environment
Local, Regional and Global: The IMAGE Model
Policy use of the IMAGE Model

DATA INTEGRATION INTO ENVIRONMENTAL MODELS AND SENSITIVITY TO INPUT DATA

Introduction: Mathematical Modeling
Examples of Data's Importance in Environmental Modeling

IDENTIFICATIONS AND APPLICATIONS OF COUPLED CLIMATE MODELS

Elements of Coupled Climate Models
Component Models
Coupling Interfaces
Computational Aspects of Coupled Climate Models
Important Issues in Climate Model Coupling
Hierarchy of Coupled Climate Models
Applications of Coupled Climate Models

MODEL APPLICATION FOR DECISION MAKERS AND POLICY EVALUATORS

The Spatial Dimension
The Temporal Dimension
The Hydrological Cycle - Stocks and Flows
Implications for Life Support on Earth

ASSESSING THE ROLE OF CLIMATE IN ENVIRONMENTAL SYSTEMS ANALYSIS AND MODELING

Brief Description of the Climate System and How it is Modeled
The Role of Climate in Environmental Modeling
Case Study I: Smoke From Biomass Burning
Case Study II: Rainfall/Runoff in Climate Models

DECISION SUPPORT FOR ENVIRONMENTAL MANAGEMENT

DSS- Basic Concepts
AI Based Decision- Making
Advanced DSS for Environmental Management

MULTI-OBJECTIVE DECISION SUPPORT INCLUDING SENSITIVITY ANALYSIS

Basic Concepts
Multi-objective Model Analysis

Structure and Use of Model-Based DSSs
Advantages and Limitations of Model-Based DSS

DECISION SUPPORT SYSTEMS FOR ENVIRONMENTAL PROBLEMS AT DIFFERENT SCALES

Regional water quality management
Land use planning
Air quality management
Lessons from the presented DSSs

VALIDATION AND UNCERTAINTY IN ANALYSIS DECISION SUPPORT

Validation of Decision Support Systems
Uncertainty in Decision Support Systems
Validity and Uncertainty Analysis

SYSTEM TO SUPPORT DECISIONS ON SUSTAINABLE DEVELOPMENT: INTEGRATED ASSESSMENT

Definition of Sustainable Development
Operationalization of the Concept of Sustainable Development
Sustainability Indicators as a Further Step in Operationalizing Sustainable Development
Sustainable Global Development - The Integrative Concept
Decision Support System - General Aspects
Information Technology and Environmental Systems

KNOWLEDGE BASED SYSTEMS AND NEURAL NETS

Knowledge-based Systems
Neural Nets

SYSTEM TO SUPPORT DECISIONS ON CLEAN-UP OF POLLUTED LANDS

Questions on Clean-up Strategy
Hydrogeological Foundation
The Rule-based Map-orientated Analysis
Problems of Measurement Values

SYSTEMS TO SUPPORT DECISIONS ON ELECTRIC POWER GENERATION

Electricity Production Systems
Contribution of Energy Resources to World Electricity Production
Energy Storage, Efficiency of Production and Waste Heat
Appraisal of Investments in Electricity Production Systems
Expansion of Production vs. Demand Side Management
External Cost Factors
Optimization of Energy Mixture in Power Generation Systems

DECISION SUPPORT SYSTEMS FOR URBAN AND REGIONAL PLANNING

Population Growth
Urbanization
Decision Support Systems (DSS) for Regional and Urban Planning

SYSTEMS TO SUPPORT DECISIONS FOR URBAN AREAS

Environmental Impact Assessment and Multi-attribute Impact Theory
Consensus Formation and Multi-Agent Decision-making
Risk Management and Value Function under Risk

POLLUTION CONTROL TECHNOLOGIES

Control of Particulate Matter in Gaseous Emissions
Control of Gaseous Pollutants
Pollution Control through Efficient Combustion Technology
Pollution Control in Industrial Processes
Pollution Control in Transportation

CONTROL OF PARTICULATE MATTER IN GASEOUS EMISSIONS

Important Properties of Gases
Air and Emission Sampling and Analysis
Origins, Nature and Characteristics of Particles
Particulate
Dust Prevention
Dust collection
Health Factors: Respirable Dust
Safety Factors: Dust Explosions
Emission Codes

BASIC CONCEPTS OF THE GAS PHASE

Survey
Elementary Particles in Chemistry and Physics
The states of aggregation
Physical Properties of a Compound
Forms of Energy
Equation of state
The Kinetic Theory of Gases

EMISSION SAMPLING AND ANALYSIS

Survey
Flue Gas Sampling
Gas Analyzers

EFFLUENT GAS MONITORING

Survey
Occupational Hazard Monitoring Methods
Light Absorption Methods
Atomic Absorption Spectrometry
Spectrochemical Emission Analysis
Electrochemical Cells
Paramagnetic Instruments

DUST-PARTICLE FORMATION AND CHARACTERISTICS

Survey
Sources
Physical characteristics
Chemical characteristics
Source apportionment
Dust Sample Analysis
Particle Evaluation
Effluent Dust Analyzers
Dust Sampling Procedure

DUST COLLECTION

- Scope
- Aims and some applications
- Respirable Dust
- Emission Codes
- Collection efficiency
- Principles of Dust Separation
- Selecting a Filter
- Safety Factors: Dust Explosions

MECHANICAL AND CYCLONIC COLLECTORS

- Survey
- Settling Chambers
- Cyclone Separators
- Mechanical centrifugal separators
- Brownian Movement
- Dry Atmospheric Deposition

GAS FILTRATION

- Survey
- Absolute Filters
- Filter Characteristics

ELECTROSTATIC PRECIPITATORS

- Survey
- Characteristics
- Operation
- Operating Problems
- Wet Electrostatic Precipitators
- Unusual Forces acting on Aerosol Particles

WET SCRUBBERS

- Survey
- Liquid Atomizers
- Scrubber Types
- Venturi Scrubber Practice
- Particulate Scrubber Design
- Estimating Collection Efficiency and Pressure Drop
- Wet Scrubbing of Gaseous Compounds
- Mist Elimination
- Wet deposition

CONTROL OF GASEOUS EMISSIONS

- Atmospheric Pollution
- Equilibrium Partition of Pollutants
- Mass Transfer
- Condensation as a Treatment Method
- Gas Absorption and Desorption
- Semi-wet scrubbing
- Dry-scrubbing
- Adsorption and Gas Cleaning
- Thermal and Catalytic Oxidation

Applications

CONTROL OF CARBON MONOXIDE AND VOLATILE ORGANIC COMPOUNDS, INCLUDING CONDENSATION

- Condensation
- Control of Carbon Monoxide
- Volatile Organic Compounds

ADSORPTION OF GASEOUS POLLUTANTS

- Scope
- Scientific Principles of Adsorption
- Adsorption kinetics

ADSORBENTS AND ADSORPTION PROCESSES FOR POLLUTION CONTROL

- Survey
- Properties of adsorbents
- Fixed bed adsorbers
- Continuous counter-current flow systems
- Application of adsorbents for desiccation
- Desorption and adsorbent regeneration
- Design of adsorbers

CONTROL OF SULFUR OXIDES

- SO₂ Control Strategies
- Fuel Cleaning
- Flue Gas Desulfurization Technologies

CONTROL OF NITROGEN OXIDES

- Nitrogen Oxides
- Sources of NO_x-emissions
- Formation of NO_x
- Pollution Prevention and Combustion Control Techniques
- Flue Gas Treatment Technologies

ODOR EMISSION CONTROL

- Human Senses and Smell
- The Human Senses
- Generation and Monitoring of Odors
- Technical Solutions to the Smell Problem

INDOOR AIR QUALITY MONITORING AND CONTROL

- Indoor Air Quality
- Origins
- Methods of Study
- Symptoms
- Remediation Methods
- Combustion
- Biological contaminants
- VOCs

POLLUTION CONTROL THROUGH EFFICIENT COMBUSTION TECHNOLOGY

- Combustion concepts
- Pollution related to the fuel

Pollution from combustion processes
Incomplete combustion
Fuel impurities
Incineration

COMBUSTION FUNDAMENTALS

Basics
Combustion Kinetics and Mechanisms
Basic Types of Flames
Combustion of Gases
Combustion of Liquids and Solids

FUNDAMENTALS OF TRANSPORT PHENOMENA IN COMBUSTION

Dimensional Analysis and Mathematical Modeling
Transport Phenomena
Fluid Flow
Heat Transfer
Mass Transfer
Prediction methods for Physical Properties

COMBUSTION RESEARCH AND COMPUTER FLUID DYNAMICS

Combustion Research
Combustion Research
Basic Types of Flames
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Risk Assessment
Analysis of Public Health and Ecological Risks from Hazardous Waste Facilities
Participatory Risk Management for Hazardous Wastes

HAZARDOUS WASTE TREATMENT TECHNOLOGIES

Biological Treatment
Physical and Physicochemical Processes
Thermal Treatment
Technological Advances

THE MANAGEMENT OF HEALTHCARE WASTE

- Introduction and background
- What is Healthcare waste?
- Principles of Legislation and Management
- Segregation, Handling, and Transport
- Treatment and Disposal Methods
- Waste Prevention, Recycling, and Reuse
- Future Trends

INDUSTRIAL SITE REMEDIATION

- Contamination and Pollution
- Overall Approach
- Plant Closure
- Dealing with the Closed Site

INDUSTRIAL METABOLISM

- Industrial Ecology and Sustainability
- Basic Concepts of Industrial Ecology
- Industrial Ecology and the relation to tools and methods
- Examples for Applications
- How to Achieve Industrial Ecosystems—Potential Benefits

WASTE MANAGEMENT AND MINIMIZATION

- History
- Resource Economics
- Public Health
- Composition
- Collection
- Treatment
- Disposal
- Reduction and Recycling

ELEMENTAL KEYS TO SUSTAINABLE WASTE PREVENTION

- Evolution of Waste
- Sources
- Key Roles
- Industrial Keys
- Government Keys
- Advocates Keys

ANTHROPOGENIC CAUSES OF GLOBAL ENVIRONMENTAL CHANGE

- Atmospheric Constituents and Global Environment
- Changes in Atmospheric Composition
- Global Environmental Changes

GLOBAL WARMING AND GREENHOUSE GASES

- Contemporary Temperature Trends
- Paleoclimatic Temperature and Trace Gases
- Greenhouse Gases: Sources, Distribution and Trends
- Aerosols: Sources, Distribution and Trends

UV RADIATION AND EFFECTS OF OZONE DEPLETION ON UV

- UV Measurements and Estimates

Ozone and UV Radiation
Trace gases, Cloud, Snow, and Aerosol Effects
Changes in UV Irradiance due to Ozone Depletion

GLOBAL ENVIRONMENTAL CHANGES FROM AGRICULTURE AND FOOD PRODUCTION

Global Mass Balances of Atmospheric Gases
The Effect of Agricultural Activities on Atmospheric Composition
Agricultural Activities and Global Environmental Change
Issues and Perspectives

SOCIAL AND ECONOMIC FACTORS

THE ENVIRONMENTAL IMPACT OF TRANSPORTATION: AIR, RAIL, ROAD, AND WATER

Road Transport
Rail Transport
Air Transport
Water Transport
Measures of Minimizing Transport Threats

URBANIZATION

General Process of Urbanization
Main Problems Caused by Urbanization
Urbanization and Poverty
Urbanization versus Habitat Loss
Environmental Impact of Urbanization
Benefits of Urbanization
Sustainable Urban Development
A case: Chinas urbanization

RURAL DEVELOPMENT

Rural Poverty
Time to Revitalize Rural Development
Challenges for Rural Development
Reducing Poverty and Hunger
Information Techniques
Food Security

SOME ISSUES IN THE SUSTAINABLE DEVELOPMENT OF THE GLOBAL ENVIRONMENT

Issues in Sustainability

INTERACTIONS: ENERGY/ENVIRONMENT

The Major Environmental Problems
The Major Causes of Environmental Problems

ENVIRONMENTAL EFFECTS OF FOSSIL FUEL EXTRACTIONS AND TRANSPORT

LAND DISTURBANCE AND THE ENVIRONMENTAL POLLUTION FROM OIL - AND GAS - WELL DRILLING AND EXTRACTION, WITH SPECIAL REFERENCE TO NATURALLY OCCURRING RADIOACTIVE MATERIALS

Introduction: The Issues
NORM in the oil and gas industry
Mechanisms of Enhancement of NORM
The hazards of alpha active materials

Prevailing levels of NORM and control of risk
Naturally existing levels
Disposal options
Radiation protection philosophy and legislation
Authorised disposal
Identification of the potential environmental pathways to man
The clean-up of contaminated sites
Laboratory evaluations

LAND DISTURBANCE AND RECLAMATION OF PEAT EXTRACTION

What is Peat?
Factors Contributing to Peat Formation
World Peatland Distribution
The Uses of Peat
Peat Extraction and Harvesting
Reclamation of Peatland
International Policies Relating to Peatland Conservation

ENVIRONMENTAL EFFECTS OF FOSSIL FUEL COMBUSTION

Fossil Fuel Sources
Energy Demand and Air Pollution
Combustion and Pollutants Formation
Gross Emission of Pollutants
Pollutants in the Atmosphere
Pollutant Transformation in the Atmosphere
Flue Gas Treatment

ENVIRONMENTAL EFFECTS OF SUSPENDED AND TOXIC MATERIALS FROM COAL AND PEAT COMBUSTION

The Atmosphere and its Role
The Effect of Pollutants on Human Health and the Environment
Fly Ash
Carbon Monoxide (CO)
Sulfur Dioxide (SO₂)
Nitrogen Oxides (NO_x)
Halogens
Soil Degradation induced by Atmospheric Precipitation of Pollutants

ENVIRONMENTAL EFFECTS OF TOXIC MATERIALS FROM OIL AND GAS COMBUSTION

Acid Deposition
Effects on Vegetation
Effects on Visibility and Turbidity of the Atmosphere
Effects on Materials
Other Effects on Animals and Aquatic Life

ENVIRONMENTAL SIGNIFICANCE OF TOXIC TRACE ELEMENTS FROM FOSSIL FUEL COMBUSTION

Basic Concepts
The Epidemiological Model
Toxic Trace Elements from Fossil Fuel Combustion
Environmental Behavior of Metal Pollutants

Toxic Effects of Heavy Metals
Environmental Impact of Coal Combustion
The Environmental Significance of Toxic Trace Elements

ENVIRONMENTAL SIGNIFICANCE OF FUEL-DERIVED ORGANIC COMPOUNDS

Emission of Organic Compounds in the Combustion Process of Fossil Fuels
Participation of Hydrocarbons in Oxidation of Nitrogen Oxide
PAH Influence on Human Health

GREENHOUSE GASES FROM FOSSIL FUELS AND THEIR IMPACT ON GLOBAL CHANGE

Global Warming
Fossil Fuels' Contribution to Greenhouse Warming
The Contribution of Deforestation

ENVIRONMENTAL EFFECTS OF NUCLEAR POWER PRODUCTION

Mining and Milling Nuclear Fuel
Nuclear Fuel Processing
Power Generation
Nuclear Wastes
Nuclear Fuel Reprocessing

ENVIRONMENTAL EFFECTS OF NUCLEAR FUEL PROCESSING. REFINING: FROM THE YELLOW CAKE TO THE FUEL ELEMENT.

Refining: From the Yellowcake to the Fuel Element
Nuclear Power
The Problem of Energy Supply
Chemistry and Technology of the Fuel Cycle: Uranium Raw Materials
The Refining Processes and Uranium Products
Radiation and Safety
Uranium Enrichment
Depleted Uranium
Economical Recovery of Non-Radioactive Products
Wastes and Disposal
Health and Environmental Considerations
Treatment of Liquid Effluents
Solid Effluents
Gaseous Effluents
Principles of Radiation Protection and Safety
Recovery of Uranium
Public Acceptance

ENVIRONMENTAL EFFECTS OF NUCLEAR POWER GENERATION

Nuclear Energy
Nuclear Reactors and Power Generation
Environmental Effects

ENVIRONMENTAL EFFECTS OF NUCLEAR FUEL REPROCESSING

Reprocessing
The Chemistry of Fuel Reprocessing
Reprocessing plants and the environment
Plutonium in the environment

ENVIRONMENTAL EFFECTS OF USE OF RENEWABLE ENERGY RESOURCES

ENVIRONMENTAL EFFECTS OF HYDROPOWER PLANTS INCLUDING THOSE USING THERMAL, TIDAL, AND WAVE POWER

ENVIRONMENTAL IMPACTS OF WIND POWER

- Emissions
- Water Use
- Landscape and Visual Impact
- Noise
- Non-avian Wildlife Impact
- Avian Impact
- Land Use
- Electromagnetic Interference
- Lifecycle Energy Balance of Wind Turbines
- Disposal and Recycling of Wind Turbines
- Future Trends and Perspectives

ENVIRONMENTAL EFFECTS OF GEOTHERMAL POWER

- Geothermal Systems
- Air Quality
- Water Quality
- Geologic Hazards
- Wastes
- Noise
- Biological Resources
- Land Use
- Future Research and Development Directions

ENVIRONMENTAL EFFECTS OF ENERGY FROM BIOMASS AND MUNICIPAL WASTES

- Environmental Impacts of Current Uses of Biomass and Municipal Wastes
- Environmental Effects of Technological Options

EFFECTS OF ENERGY PRODUCTION ON HUMAN HEALTH

FOSSIL FUEL ENERGY IMPACTS ON HEALTH

- Air Pollution and Respiratory Diseases
- Main Health Effects

NUCLEAR ENERGY IMPACTS ON HEALTH

- Nuclear Energy and Health: Categories of Risk
- Why Does This Issue Matter: Important Trends and Issues
- Sources of Health Impacts: Normal Operations and Accidents
- Controlling Health Effects: National and International Regimes

POINT SOURCES OF POLLUTION: LOCAL EFFECTS AND CONTROL

- Characteristics of Point Sources: Wastewater
- Characteristics of Point Sources: Air Pollution
- Characteristics of Point Sources: Waste Solids
- Characteristics of Point Sources: Noise
- Legislation for Controlling Point Sources of Pollution
- Management Improvement for the Control of Point Sources of Pollution
- Technologies for Controlling Point Sources of Pollution

VEHICULAR EMISSIONS

Vehicle Population
Vehicle Emissions
Environmental Problems Associated with Vehicle Emissions
Control Strategies

TYPES AND AMOUNTS OF VEHICULAR EMISSIONS

Pollutants From Vehicles
Mechanisms of Pollutant Formation and Emission Factors

ENVIRONMENTAL IMPACT OF MOTOR VEHICLES

Impacts of Secondary Pollutants
Impacts of Greenhouse Gases
Impacts on Building Materials and Structures
Impacts of Vehicle Runoff on Water Bodies
Impacts on Ecosystems

HEALTH EFFECTS

Carbon Monoxide
Nitrogen Oxides
Sulfur Dioxide
Volatile Organic Compounds
Particulate Emissions
Photochemical Smog

REGIONAL DISTRIBUTION OF VEHICULAR EMISSIONS

Global Distribution of Vehicle Emissions
Twenty Megacity Vehicle Emission Summaries
Urban Distribution of Vehicular Emissions
Remarks

CONTROL STRATEGIES TO REDUCE EMISSIONS

Emission Standards and Regulations
Vehicle Technology for Controlling Emissions
I/M Programs for In-Use Vehicles
Fuel Modifications
Economic Incentives and Traffic Strategy
Remarks

INDUSTRIAL POLLUTION

Industrial Pollution Facing Different Countries
Industrial Air Pollution
Wastewater Pollution
Solid Waste
Toxic Chemicals
Noise Control
Environmental Standard and Voluntary Environmental Programs
Industrial Ecology
Future Perspectives

AIR POLLUTION CAUSED BY INDUSTRIES

Main air Pollutants and Industrial Emissions Inventory
Petroleum industry

Paper and pulp manufacture
Combustion Sources and their Emission Characterization
The Chemical Industry
Metallurgical Industry
Construction Material Industry

INDUSTRIAL WASTEWATER-TYPES, AMOUNTS AND EFFECTS

The types of industrial waste water
The amount of industrial wastewater
The effects of industrial wastewater
Other factors related to the effect of industrial wastewater

TYPES, AMOUNTS AND EFFECTS OF INDUSTRIAL SOLID WASTES

Types of Industrial Solid Wastes
Amounts of Industrial Solid Wastes
Effects of Industrial Solid wastes

INDUSTRIAL POLLUTION PREVENTION STRATEGY-CLEANER PRODUCTION

Concept and basic principles of CP
Ways of Implementing CP
Cleaner Production in the 21st Century
Review of Status

ENVIRONMENTAL STANDARDS CONCERNING INDUSTRIAL POLLUTION DISCHARGE

Wastewater Emission Standards
Emission Standards for Air
Noise and Odors
ISO (International Standards Organization)
Development Trend of Emission Standards
Solid and Hazardous Waste Management
Enforcement

DOMESTIC POLLUTION

Characteristics of domestic wastewater
Characteristics of domestic solid wastes
Disposal control of domestic wastewater
Reuse of domestic wastewater
Management of domestic wastes

CONCENTRATIONS AND COMPOSITIONS OF DOMESTIC WASTEWATER

Flow characteristics
Composition

AMOUNTS AND COMPOSITION OF MUNICIPAL SOLID WASTES

Sources of MSW
Amounts of Municipal Wastes
Estimation and Calculation of Quantity of MSW
Methodology of Estimation of Waste Quantities
The Concept of Composition of Solid Wastes
The Method of Wastes Composition Studies
Waste Composition Studies
Waste Composition of MSW in the World

DISPOSAL OF SOLID WASTES

- Conception of Waste Disposal
- Criteria for Evaluating of Wastes Disposal Orientation
- Background Conditions that Affect Disposal Orientation
- Judgment for Maneuverability of Project
- Waste Reduction
- Waste Collection and Transfer
- Landfill
- Incineration
- Composting

MUNICIPAL EFFLUENT DISPOSAL STANDARDS

- The regulation of conventional pollutants
- The standards for toxic and dangerous substances
- Technology-Based Standards
- Water Quality-Based Limits
- Effects of Effluent Disposal Standards

MUNICIPAL WASTEWATER REUSE

- Agricultural irrigation
- Industrial reuse
- Groundwater recharge
- Urban Reuse
- Augmentation of potable supplies
- Recreational and habitat restoration/enhancement
- Treatment Technologies for Wastewater Reuse

ENVIRONMENTAL POLLUTANTS AND THEIR CONTROL

- Effects of toxic chemicals
- Waste management
- Clean production
- Environmental regulations
- A sustainable energy strategy
- Environmental education and the civil ecological movement
- Sustainable Development

INDUSTRIAL CHEMICALS

- Inorganic Chemicals
- Metals
- Organometallic Compounds
- Organic Chemicals
- Metalloids
- Radionuclides

AGRICULTURAL CHEMICALS

- Insecticides
- Fungicides
- Herbicides
- Other Pesticide Type
- By-products

SAMPLING, MEASUREMENT AND ASSESSMENT

Sampling and samples pretreatment
Measurement and determination
Quality Assurance

CONTAMINANT FATE AND TRANSPORT PROCESS

Surface Waters
The Subsurface Environment
The Atmosphere

ECONOMICS, SOCIAL, LEGAL AND HEALTH IMPLICATIONS

Economic implications
Social implications
Legal implications
Human health implications

CONTROL STRATEGY FOR TOXIC POLLUTANTS

Pollution prevention for toxic pollutants
End-of-pipe treatment of toxic pollutants
Remediation of soils and groundwater contaminated by toxic pollutants

TECHNOLOGIES FOR AIR POLLUTION CONTROL

Setting up an emission limit
Identifying emission sources
Process modification
Defining the control problem
Selecting a control system

AIR POLLUTION DYNAMICS AND MODELING

Source characteristics
Air Pollution Meteorology
Atmospheric Removal Processes
Atmospheric Diffusion
Air Pollution Modeling
Pollution Accidents and Meteorological Control

CLEAN COAL TECHNOLOGIES

Precombustion Technologies
Combustion Processes
Post-Combustion Treatment
Coal Conversion
Research and Development of CCT

CONTROL TECHNIQUES FOR PARTICLES

Cyclones
Fabric Filters
Electrostatic Precipitators
Wet Scrubbers
Researches and Development of Particulate Collectors

TECHNOLOGIES OF GASEOUS POLLUTANT EMISSION CONTROL

Absorption
Adsorption
Catalytic conversion

Other technologies

TECHNOLOGIES FOR WATER POLLUTION CONTROL

Physical, chemical and Biological Characteristics of Water
Wastewater Treatment Processes
Physical Treatment Processes
Chemical Unit Processes
Biological Treatment Processes
Bioremediation
Soil Vapor Extraction (SVE)
Perspective Trend

TECHNOLOGIES THAT MOVE POLLUTANTS FROM ONE ENVIRONMENTAL COMPONENT TO ANOTHER: PHYSICAL METHODS

Screening
Sedimentation
Grit removal
Flotation
Filtration
Other Physical Technologies Commonly Used in Water and Wastewater Treatment

TECHNOLOGIES THAT TRANSFORM POLLUTANTS TO INNOCUOUS COMPONENTS: CHEMICAL AND PHYSICOCHEMICAL METHODS

Coagulation
Chemical Precipitation
Chemical Oxidation
Disinfection
Adsorption Process
Ion Exchange
Membrane Separation
Prospective Trends

TECHNOLOGIES THAT TRANSFORM POLLUTANTS INTO INNOCUOUS COMPONENTS: BIOLOGICAL METHODS

Activated sludge process
Other Activated Sludge Configurations
Biological Nutrient Removal
Advanced Biological Treatment Techniques
Trickling Filter Processes
Rotating Biological Contactor Processes
Oxidation Pond Processes
Land Treatment Processes
On-site Treatment Systems
Anaerobic Biological Treatment Processes

TECHNOLOGIES THAT TRANSFORM POLLUTANTS INTO INNOCUOUS COMPONENTS: COMBINED BIOLOGICAL/CHEMICAL METHODS

The Application Areas of Combined Chemical/Biological Processes
Chemical Treatment Processes
Biological Treatment Processes
Perspective

REMEDIATION TECHNIQUES FOR SOIL AND GROUNDWATER

- Soil Washing
- Bioremediation
- Containment
- Future Development
- Pump-and-Treat
- Soil Vapor Extraction
- Solidification/Stabilization
- Air Stripping
- Precipitation
- Vitrification
- Thermal Desorption
- Strategy for Technique Selections

CHERNOBYL NUCLEAR POWER PLANT ACCIDENT- CASE STUDY

- Chernobyl Nuclear Power Plant Accident (Versions of Possible Causes of the Accident)
- Formation and Description of Close-in and Remote Zone of the Environment contamination after the Accident. Radionuclide Composition of the Contamination
- Analysis of Radioactive Contamination Transport with Consideration of Real Meteorological Situation after the Accident
- Calculation and Reconstruction of Doses after Chernobyl
- Penetration of Radioactive Substances into other Medium. Contamination of Agricultural and Natural Vegetation
- Medical (for Human Health) Consequences
- Biological and Ecological (for Nature) Consequences

ENGINEERING GEOLOGY, ENVIRONMENTAL GEOLOGY, AND MINERAL ECONOMICS

- Engineering Geology
- Environmental Geology
- Medical Geology
- Geoindicators
- Use of Underground Space for Human Occupancy

DEFINITIONS AND HISTORICAL DEVELOPMENT

MODERN TRENDS IN ENGINEERING GEOLOGY

- Introduction
- Importance of Population Growth
- Selected 20th Century Events
- Project Phases Involving Geology
- Regulatory and Business Influences
- Material Characteristics and Natural Processes
- Trends and the Future of Engineering Geology

GEOSYSTEMS ENGINEERING

UTILIZATION OF GEOLOGICAL MATERIALS

- Introduction
- Origin of Geologic Materials
- Rock Properties Relevant to Engineering Use
- Utilization of Rocks
- Utilization of Unconsolidated Materials

MISCELLANEOUS

FORENSIC GEOLOGY

- Geologic Science
- Geologic Methodology
- Site Specific Geologic Context
- Evidence Collection/Preservation
- Buried Evidence and Clandestine Gravesites
- Materials Identification
- Documentation/Reporting
- Expert Witness/Testimony
- Future Trends

MINERAL ECONOMICS

INTERNATIONAL TREATIES GOVERNING MINERAL EXPLORATION

- Introduction
- International Conventions - social impact
- The Role of Non Government Organizations
- International Treaties
- Treaties with Minerals Industry Implications
- Industry Roles, Reactions and Relationships
- The Role of Governments
- Discussion
- Conclusion
- Treaties and the Resources Industry

BIODIVERSITY: STRUCTURE AND FUNCTION

- The Biosphere at Risk
- Characterization of Biodiversity
- Biodiversity and Ecosystem Function
- Global Change: Magnitude, Distribution, and Characteristics of Biodiversity Dynamics
- The Spatial and Temporal Dynamics of Biodiversity and Ecosystem Structure
- The Biodiversity of Marine Ecosystems
- Perspectives for Biodiversity Utilization, Protection, and Research

CHARACTERIZATION OF BIODIVERSITY

- Foundations of classification: from early representations to modern taxonomy
- Species concepts
- Systematics and Taxonomy: Classification and description
- Nomenclature and Codes
- Indices of Biodiversity
- Characterization of genetic diversity
- Ecological and functional characterization of biodiversity

BIODIVERSITY AND ECOSYSTEM FUNCTIONING

BIODIVERSITY AND ECOSYSTEM FUNCTIONING: BASIC PRINCIPLES

- A historical perspective
- A new paradigm in ecology: the Biodiversity-Ecosystem Function Paradigm
- Combining old and new concepts
- Biodiversity and stability
- Implications for ecosystem management and conservation

BIODIVERSITY AND ECOSYSTEM FUNCTIONING: EXPERIMENTAL SYSTEMS

- Biodiversity experiments
- Experiment and observation
- Experimental design and analysis
- Interpretation and mechanism
- Advances in biodiversity experimentation

THE ROLE OF ABOVE- AND BELOWGROUND LINKAGES IN ECOSYSTEM FUNCTIONING

- Effects of plant diversity on higher trophic levels
- Effects of above- and belowground organisms on plant diversity and ecosystem processes
- Interactions between aboveground and belowground organisms
- Discussion

BIODIVERSITY AND ECOSYSTEM FUNCTIONING OF SELECTED TERRESTRIAL ECOSYSTEMS: GRASSLANDS

- Evidence from observational studies in natural and semi-natural grasslands
- Functional redundancy and removal experiments in natural grasslands
- Diversity and stability

BIODIVERSITY AND FUNCTIONING OF SELECTED TERRESTRIAL ECOSYSTEMS: ALPINE AND ARCTIC ECOSYSTEMS

- Alpine and arctic biodiversity
- Effects of biodiversity on arctic and alpine ecosystems
- Biodiversity and Global change in arctic and alpine ecosystems
- Future research needs

BIODIVERSITY AND FUNCTIONALITY OF AQUATIC ECOSYSTEMS

- Why research on aquatic systems has lagged behind
- The nature of aquatic habitats
- Species-specific functional roles
- Species-combined functionality: Functional groups
- The problem of functional plasticity
- Direct and indirect measures of functionality
- Threats to Biodiversity and ecosystem function
- Future challenges and directions

BIODIVERSITY AND THE FUNCTIONING OF SELECTED TERRESTRIAL ECOSYSTEMS: AGRICULTURAL SYSTEMS

- Introduction—biodiversity in agricultural ecosystems
- Planned diversity and the functioning of agricultural systems
- Unplanned diversity and the functioning of agricultural systems

SPATIAL AND TEMPORAL DIMENSIONS OF BIODIVERSITY DYNAMICS

- Temporal dimensions of biodiversity dynamics
- Spatial dimensions of biodiversity dynamics
- Dynamics across geological and ecological scales

EVOLUTIONARY AND GENETIC ASPECTS OF BIODIVERSITY

- Genetic Aspects of Biodiversity
- Evolutionary Aspects of Biodiversity
- Concluding statements on biodiversity, evolution, genetics, and conservation

BIODIVERSITY MONITORING, ASSESSMENT, DATA MANAGEMENT, AND INDICATORS

MONITORING OF BIODIVERSITY

- Introduction
- Multiple Goals of Biodiversity Monitoring
- Monitoring of Biodiversity in a Global Change Context
- Scales and Levels of Biodiversity Monitoring
- Approaches towards an Integrated Observation System

SEARCH FOR INDICATORS FOR BIODIVERSITY ASSESSMENTS

- Measuring biodiversity
- The attributes of good indicators
- Types of indicators
- Some pragmatic solutions

DATA AND INFORMATION MANAGEMENT AND COMMUNICATION

- Scope of the information domain in biodiversity informatics
- State of the art
- Some perspectives

THE VALUE OF BIODIVERSITY

- Need, benefit and value of biodiversity
- Biodiversity and ethics of nature

ECONOMIC RELEVANCE OF BIODIVERSITY

- Biodiversity as an economic good
- Value and access
- Economic measures and limits of use

ETHICAL RELEVANCE OF BIODIVERSITY

- Human beings and nature: a complex relationship and its normative implications for the conservation of biodiversity
- Rules of preferences and criteria of decision making

HALTING BIODIVERSITY LOSS: FUNDAMENTALS AND TRENDS OF CONSERVATION SCIENCE AND ACTION

- Culture vs. nature? Biodiversity loss and conservation as facets of human culture and evolution
- Dimensions, causes and consequences of biodiversity loss
- Halting biodiversity loss - conservation planning and implementation

APPLICATION OF ECOLOGICAL KNOWLEDGE TO HABITAT RESTORATION

- Historical perspective
- The theoretical framework
- Biodiversity
- Degradation and habitat destruction
- Restoration
- Applications

DISTURBANCE MANAGEMENT - APPLICATION OF ECOLOGICAL KNOWLEDGE TO HABITAT RESTORATION

- Part A: Concepts and Theory - Relating Disturbance Ecology to Restoration
- Part B: For Practitioners - Application of Ecological Knowledge to Habitat Restoration
- Part C: Case Study - Conservation Action For Substitution of Missing Dynamics

LANDSCAPE DYNAMICS

- Landscape changes in the wilderness

- Human driven changes
- Analysis of local landscape changes: the importance of mapping for a spatial analysis
- Driving factors in temperate agricultural landscapes
- Riparian landscapes
- How do landscape dynamics have to be considered in ecological restoration?
- Discussion and perspectives

ALTERNATIVE RESTORATION STRATEGIES IN FORMER LIGNITE MINING AREAS OF EASTERN GERMANY

- General site characteristics
- Investigation methods
- Colonization processes
- Site dependent and chronological woodland differentiation
- General Sucessional development—an overview
- Near-natural restoration methods
- Opportunities and perspectives for integration of natural potential in reclamation of post-mining landscapes

AFFORESTATION AND REFORESTATION

- The particular features of forests among terrestrial ecosystems
- Ecosystem level effects of afforestation and reforestation
- Effects on biodiversity
- Arguments for plantations
- Political goals of afforestation and reforestation
- Reforestation problems
- Afforestation on a global scale
- Planting techniques
- Case studies of selected regions and countries

TROPICAL FOREST RESTORATION EXPERIENCES

- Knowledge about Key Processes
- Using differing approaches under different circumstances
- Case Studies
- Assessing success
- Restoration at a landscape level

COMBATING DEGRADATION IN ARID SYSTEMS

- Degradation of natural resources
- Frame conditions: The importance of scale
- Defining compartments for feasible approaches
- Assessment and Monitoring of the problem
- Approaches to Combating degradation in arid systems
- Policy challenges

THE ROLE OF FOOD, AGRICULTURE, FORESTRY, AND FISHERIES IN HUMAN NUTRITION

- Humans Have Modified the Global Environment
- Population Growth and Food Production
- Food Security: A Major Goal
- Food, Nutrition, and Health
- Global Stability: Problems and Prospects
- The Search for Sustainability

FOOD AND AGRICULTURE AND THE USE OF NATURAL RESOURCES

- A Brief History of Food—Gathering, Production, and Storage
- The Impact of Technology on Agriculture and Food Production
- Protecting the Resource Base: Economic and Ecological Imperatives
- Constraining Factors in Food Production
- Challenges for the Twenty-first Century

HISTORICAL ORIGINS OF AGRICULTURE

- Introduction: Domestication and the Origins of Agriculture
- Historical Conditions for the Origins of Agriculture
- Why Take up Farming? Explanations for the Origins of Agriculture
- The Development and Spread of Early Farming
- The Consequences of Early Farming

FORESTS AND GRASSLANDS AS CRADLES FOR AGRICULTURE

- Humans as Parts of Forest and Grassland Ecosystems
- The Development of Agroecosystems—Agroforestry was the Origin
- Agroforestry Today
- Sustainable Agroecosystems for the Future

DOMESTICATION AND DEVELOPMENT OF PLANT CULTIVARS

- Early Plant Domestication
- Reasons for Plant Domestication
- Development of Landraces
- Advent of Plant Genetics as a Scientific Discipline in Cultivar Development
- New Developments of Molecular Genetics and Cellular Physiology
- Lessons, Challenges, and Opportunities

ANIMAL HUSBANDRY, NOMADIC BREEDING, AND DOMESTICATION OF ANIMALS

- Introduction to Animal Husbandry
- Trends Toward Domestication of Animals
- Distribution of Modern Pastoral People
- Traditional Animal Husbandry
- Social Parameters
- Changes in the Pastoral Way of Life in the Early Twenty-First Century
- Future of Nomadic Pastoralism

HISTORY OF FORESTRY

- Concepts of Modern Forestry
- Origins of Modern Forestry

Spread of Modern Forestry
Development Forestry
Social Forestry
Sustainable Forestry
Challenge and Change

ANCIENT FORESTRY PRACTICES

Properties of Trees
Timber, Wood, Leaves
Coppicing
Timber-growing
Pollarding
Wood-pasture and Savanna
Burning
Hedges and Fence-rows
Other Non-forest Trees
Woodmanship in the Twentieth Century

TREE DOMESTICATION AND THE HISTORY OF PLANTATIONS

Origins of Planting
Movement of Germplasm
Tree Domestication
Plantations
Forest Plantations 1400–1900
Plantations 1900–1950
Plantations 1950–2000
Protection Forests
Amenity Planting and Urban Forestry
Plantation Practices
Sustainability of Plantations

PROTECTING FORESTS AND TIMBER STOCKS

An Overview of Approaches to Timber and Forest Protection
Twentieth Century Forces of Change
The Scientific Approach to Timber Protection
Community Forestry Programs Aimed at Timber and Forest Protection
Domestic Policies and Forest Management
Timber Protection and International Trade
Environmental Labeling, Certification, and Timber Protection
The Evolving International Dimensions to Timber Protection

A HISTORY OF FISHING

Introduction to Fish
Fishing Methods, Trawling, and Influential Fish
Fish Surplus, Over-exploitation, and Extinction
Fisheries Science, Models, and Management
Global Fish Issues
The Future of Fisheries

TRADITIONAL METHODS OF FISHING (SOUTHWEST PACIFIC)

Subsistence Fishing Practices and Resource Development

Traditional Fishing Techniques: An Overview
Traditional Fishing: Constraints and Opportunities

DEVELOPMENT OF FRESHWATER FISHERIES

History of Freshwater Fisheries
Development of Freshwater Fish Culture
Recreational Freshwater Fisheries
Evolution of Freshwater Fisheries

DEVELOPMENT OF MARINE FISHERIES

History
Fishermen Character and Policy
Fisheries Resources
Fish Processing and Trade
Financing
International Conditions
Science
Management

THE DEVELOPMENT OF SPECIALIZED SHIPS, NETS, AND EQUIPMENT

How Fishing Tools Appeared
Differentiation of Catching Methods
Fishing Gear and Fishing Vessels
The Major Categories of Fishing Vessels
Scientific Foundation for Fishing Gear Technology
Mid-water and Deep-water Fishing
Electronics and Information Services
Fishing Ports
Education

IMPACT OF GLOBAL CHANGE ON AGRICULTURE

Agriculture and Environment
Agriculture and Global Change: A Reciprocal Relationship

PROJECTIONS OF GLOBAL CARRYING CAPACITY

The Reality of Projected Population Growth
Responses to Population Pressure on Resources
Optimum Populations
Food Production Outlook
Projections of Global Carrying Capacity

RURAL RESOURCES AND FEEDING FOLK FULLY: PROBLEMS, POSSIBILITIES, AND PROSPECTS

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Inefficiency and its Consequences
Overextraction of Water and its Consequences
Climate Change and Water Availability
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SALINATION, DESERTIFICATION, AND SOIL EROSION

Land Use Practices that Lead to Salinization of Croplands
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Desertification: Its Extent and Severity
Main Causes of Land Degradation in Drylands
Soil Erosion: A Threat to Sustainability
Erosion Processes

CONSERVATION OF PLANT GENETIC DIVERSITY

Diversity in Biodiversity
Threats to Biodiversity
The Conservation Process
Sustainable and Integrated Botanical Diversity Conservation

PLANT AND ANIMAL GENE BANKS

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State of the Art: Ex Situ Conservation Approaches and Methods
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ECONOMICS AND POLICY OF FOOD PRODUCTION

State of Hunger and Food Insecurity
Causes of Hunger and Food Insecurity
Policies for Food Supply and Food Security
Toward a Long-Term Strategy for Improving Food Production and Access to Food
Policies to Achieve Broad-Based Agricultural and Rural Development and to Improve Food Availability and Access to Food
Public-Private Partnerships
Prospects for Change

WORLD DEMOGRAPHY AND FOOD SUPPLY

A Decline in the Momentum of Population Growth
Likely Future Population Change
The Global Food Situation
Future Food Production

SOCIOECONOMIC POLICIES AND FOOD SECURITY

Food Security and Policy in a Changing World

Macroeconomic Reforms, Structural Adjustment, and Food Security
Economic Growth and Food Security: Tradeoffs and Complementarities
Agriculture and Food Security: Implications for Short-term Policies and Long-term Strategies
Technological Change, Commercialization of Agriculture, and Food Security
Specific Interventions to Alleviate Food Insecurity
Food Income Transfers: Targeted Distribution and Food Subsidies
Targeting Using Nonincome Criteria
Food Security Policies for the Household or the Individual?
Food Security Interventions: The Role of Food Aid
Policies for Stabilization of Food Supplies and Prices

FOOD CONTROL AND INTERNATIONAL FOOD TRADE

Concerns for Food Quality and Safety
Elements of a Food Control System
Common Food Control Deficiencies
Permanent Expert Groups/Committees
Codex Alimentarius Commission (CAC)
Future Directions for Food Control

INTERRELATIONSHIPS BETWEEN THE ENVIRONMENT AND FOOD PRODUCTION

Urbanization, Population Growth, and Technological Changes
Interrelationships between the Environment, Human Societies, and Food Production

ECONOMIC DEVELOPMENT, FOOD, AND NUTRITION

Background
Food and Nutrition Security: A Conceptual Framework
Promotion of Food and Nutrition Security: To A Virtuous Circle
A Technical Cooperation Model for the Implementation of the Food and Nutrition Initiative in Central America
Strategies to Reach Food and Nutrition Security
Food and Nutrition Security at the Local Level: Experiences in Frontier Regions of Central America

WOMEN AND FOOD SECURITY: ROLES, CONSTRAINTS, AND MISSED OPPORTUNITIES

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Women and Food Production
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Women and Access to Food
Women and Food Utilization
Time Allocation and Women

FUNDAMENTALS OF HUMAN HEALTH AND NUTRITION

Functions of Food
Macronutrients
Micronutrients
Water as a Nutrient

ADEQUATE DIET OF ESSENTIAL NUTRIENTS FOR HEALTHY PEOPLE

Definitions of Terms
Achieving Adequate Nutrition

- Food Groups
- Essential Nutrients
- Nonessential Nutrients
- Perspectives

ETHNOGRAPHIC ASPECTS OF HUMAN NUTRITION

- A Cultural-Ecological Framework for Understanding the Social Aspects of Nutrition
- Cultural Aspects of Food Acquisition—Types of Food Systems
- Cultural Aspects of Food Preparation and Storage
- Cultural Aspects of Food Distribution
- Cultural Aspects of Food Consumption
- Research and the Importance of Ethnographic Information for Nutrition Programming

REGIONAL AND CULTURAL DIFFERENCES IN NUTRITION

- Evolution of Dietary Culture
- Food and Religion
- Food Habits in Different Regions
- Nutritional Status in Different Regions

ANTINUTRITIONAL FACTORS IN FOOD LEGUMES AND EFFECTS OF PROCESSING

- Phytic Acid, Saponins, Polyphenols, Lathyrrogens, α -galactosides
- Protease Inhibitors, Lectins, and α -amylase Inhibitors

HUMAN NUTRITION: AN OVERVIEW

- Background
- Biochemistry of Nutrients in Foods
- Significance of Nutrition to Life-cycle Events
- Impact of Malnutrition on Society
- Food Supply, Diversity and Dietary Patterns
- Specific Intervention to Improve Nutrition
- Nutrition in Future Societies

NUTRITIONAL ASSESSMENT: METHODS FOR SELECTED MICRONUTRIENTS AND CALCIUM

- Stages in the Development of Nutritional a Deficiency
- Choosing the Most Appropriate Nutritional Assessment Indices
- Dietary Assessment
- Nutritional Assessment Indices

NUTRITION AND HUMAN LIFE STAGES

- Preconceptive and Periconceptive Nutrition
- Fetal Nutrition and Maternal Nutrition during Pregnancy and Lactation
- Infants and Children
- Adolescents
- Adults and Families
- Aging and the Aged

MALNUTRITION: HUNGER AND SATIETY, ANOREXIA AND OBESITY

- Critical Contrasts
- Food and Food Systems
- Human Energy Imbalance
- Diagnosis of Obesity, Underweight, and Intermediary Body Composition Disorders
- Hunger and Famine

Eating Disorders
The Obesity Epidemic

NUTRITIONAL DEFICIENCY AND IMBALANCES

Protein-Energy Malnutrition (PEM)
Conditioning Factors
Malnutrition Secondary to Chronic Disease
Spectrum of Micronutrient Deficit and Excess

FOOD ALLERGIES AND INTOLERANCE: ROLE OF DIETARY INTERVENTIONS IN EARLY CHILDHOOD

Food Intolerance
Pathogenesis and Immunologic Mechanisms
Clinical Manifestations
Diagnosis
Treatment
Prevention

FOOD MODIFICATIONS AND IMPACT ON NUTRITION

Home Preparation, Processing, and Conservation Techniques to Increase the Micronutrient Content of Foods
Home-Processing Techniques to Increase Micronutrient Bioavailability (Focus on Iron)
Enzymatic Methods to Reduce Phytic Acid Content
Nonenzymatic Methods to Reduce Phytic Acid Content
Experience with Home-Processing Techniques in Developing Countries
Food-to-Food Fortification to Increase Micronutrient Bioavailability (Especially Iron)
Increasing the Intake of Enhancers of Nonheme Iron Absorption
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Plant-Breeding Technologies
Increasing the Mineral or Vitamin Content of Staple Crops
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FOOD AND AGRICULTURAL SCIENCE AND TECHNOLOGY:NATURAL RESOURCES AND FOOD AND AGRICULTURE

Setting the Context
Agrosystems as Ecosystems
Climatic Resources
Land Resources and Soils
Water Resources
Energy Resources
Biological Diversity
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ENERGY RESOURCES FOR AGRICULTURE

General discussion of energy and agriculture
Some specific agricultural energy demands
Analysis of Alternate Energy Sources

THE MANAGEMENT OF NATURAL RESOURCES IN SATISFYING THE NEEDS OF HUMAN LIFE:THE ROLE OF AGRICULTURE, FORESTRY, AND FISHERIES

Introduction: A Brief History of Human Evolution and Agriculture, Forestry, and Fisheries

The Present Situation of Agriculture
The Present Situation of Fisheries
The Present Situation of Forestry
The Biological Basis of Production in Agriculture, Forestry, and Fisheries
The Impacts of Global and Local Climate Change on Agriculture, Forestry, and Fisheries
The Future: Optimistic or Pessimistic?

AGRICULTURE MANAGEMENT: HISTORIC, GEOGRAPHIC AND SOCIAL PERSPECTIVES

Introduction - Domestication of Wild Plants and Animals-
Agriculture in Medieval Era
Agricultural Revolution
Agriculture in the Nineteenth Century
Contribution of Genetic Science to Agriculture
Establishment of Educational and Research Systems in Agricultural Sciences
Agriculture in the Twentieth Century
The Present Situation of Food Production in the World
Biotechnology and Agriculture- Contribution of Biotechnology to Improvement of Agricultural Productivity
Agriculture in the Future

FOOD CROP PRODUCTION

Introduction - Importance and Production of Food Crops
Classification of Food Crops
Origin and Spread of Cultivated Forms of Food Crops
Botanical and Agronomic Characterization of Rice (*Oryza sativa* and *Oryza glaberrima*)
Botanical and Agronomic Characterization of Wheat (*Triticum* spp.)
Botanical and Agronomic Characterization of Maize (*Zea mays*)
Botanical and Agronomic Characterization of Potatoes (*Solanum tuberosum*)
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FORAGE CROP PRODUCTION

Early Recognition of the Importance of Forage
Early Use of Forage Crops
The Dark Ages
The Great Progress
The Modern Era

ANIMAL PRODUCTION

Introduction: General Aspects of Domestication of Wild Animals
Domestication Process and Present Situation of Goat
Domestication Process and Present Situation of Sheep
Domestication Process and Present Situation of Pig
Domestication Process and Present Situation of Cattle
Domestication Process and Present Situation of Horse
Domestication Process and Present Situation of Fowl

CULTIVATED PLANTS, PRIMARILY AS FOOD SOURCES

History of Crop Production
Land Used for Agriculture
Cropping Systems
Future Trends

GRAINS AND CEREALS

RICE

- Rice in the world - living with rice
- Short history
- Growth, morphology and chemistry of the rice plant
- Rice ecosystems
- Main constraints to production and environmental consequences
- Development of plant genotypes for stabilized high yields for each ecosystem.
- Eating rice

SORGHUM AND MILLETS

- Sorghum
- Millets

BUCKWHEAT, AMARANTH AND OTHER PSEUDOCEREAL PLANTS

- Buckwheat
- Amaranth
- Quinoa

NUTRITIONAL ASPECTS OF LEGUMES

- History, taxonomy and distribution
- Chemical composition
- Food, feed and non-food uses of legumes
- Agronomy, yield and production

PEAS AND LENTILS

- Pea
- Lentil

BEANS

- Faba bean
- Dry beans

LUPIN AND CHICKPEA

- Lupin
- Chickpea

VEGETABLES AND PLANTS FOR EDIBLE STARCH, OIL, SUGAR AND BEVERAGE PRODUCTION

- Concept of food security
- Our most important nutrients
- Food quality and safety
- Home-garden for household food security
- Growing cities – growing demand for safe food
- Water use for plant production

VEGETABLES: ROOT CROPS

- Vegetables – as a part of the diet
- Root vegetables
- Bulb alliums – main characteristics
- Leaf vegetables
- Cole crops, Brassicas

VEGETABLES II (OTHERS)

Tomato
Green pepper: *Capsicum annuum*
Eggplant (*Solanum melongena*)
The gourd family: Cucurbit crops
Vegetable legumes

STARCH BEARING CROPS AS FOOD SOURCES

Starch bearing plants as the source of dietary energy
Starch in cereals
Root and tuber crops
Other starchy plants

PROTEIN BEARING CROPS

Protein bearing plants and world's food supply
Protein sources

PLANTS AS SOURCES OF OIL

Soybean
Oil Palm Fruit and Kernel
Rape
Sunflower
Peanut
Olive
Corn
Flax
Castor plant
Pumpkin

SUGAR BEARING CROPS

The present status of carbohydrate consumption
Sugar crops
Sugar crops as source of ethyl alcohol and fuel

PLANTS USED FOR THE PRODUCTION OF BEVERAGES

The importance of spices and herbs in the production of beverages
Plants used for the production of beverages

PLANTS USED FOR THE PRODUCTION OF STIMULANTS

Species used for stimulation
Characterization of the species

SPICES

Spices of the temperate zone
Spices of the tropics

FRUIT AND NUTS

Classification of fruits according to the horticultural scientist
How botanists classify fruits
How botanists define nuts

FRUIT IN NORTHERN LATITUDES

Apples
Pear
Plum

Blackberry
Blueberry
Cranberry
Currants /Black and Red/
Gooseberry
Raspberry

SUBTROPICAL FRUIT

Citrus fruit and types
Date palm
Olives
Pomegranate
Grapes
Fig
Kiwi or Chinese gooseberry
Persimmon
Stone fruits: peach nectarine, apricot and plum

TEMPERATE FRUITS

Peach
Apricot
Cherry
Strawberry

TROPICAL FRUITS

Banana
Mango
Pineapple
Papaya
Avocado pear
Guava
Coconut
Passion fruit
Litchi and longan
Soursop and other annonas

NUT PLANTS

Cashew nut
Almond
Macadamia nut
Pistachio nut
Hickory nut
Pecan
Chestnut
Walnut

FIBER, FORAGE, AND INDUSTRIAL CROPS

ORNAMENTAL PLANTS

Ornamental plants
Introduction to selected flower crops

PHARMACEUTICAL PLANTS (PLANTS USED IN PHARMACEUTICAL PREPARATIONS)

Species processed by pharmaceutical industry
Characterisation of the species of main importance

MEDICINAL PLANTS

Medicinal plants used against respiratory tract problems
Medicinal plants against digestive system problems
Medicinal plants for problems of the cardiovascular system
Medicinal plants in nervous system disorders
Medicinal plants curing urinary tract diseases

AROMATIC PLANTS

Chemical structures and extraction of essential oils
Species of main importance used for production of essential oils
Essential oil producing species of main importance from the tropics
Essential oil producing species of main importance selected from the Mediterranean region
Essential oil producing species of main importance from temperate regions

COLOURING (DYE) PLANTS

Alkanet
Elder
Greater nettle
Hollyhock
Madder
Safflower
Saffron
Woad

FORESTS AND FOREST PLANTS

The Forest Resource Base
Important Tree Species
Forest Products
Forest Services
Forest Classification
The Understory
Forest Management
Agroforestry
Forest Regeneration and Forest Science

NATIONAL FOREST INVENTORIES AND GLOBAL RESOURCE ASSESSMENTS

Introduction: Global Importance of Forests
National Forest Inventories
Global Information Needs
Global Forest Resource Assessments (FRA)
Global Forest Cover Assessments (GFCA)
The Future

FOREST LAND RESOURCES

Forest Resources
Forest Products.
Social and Environmental Services of Forests.

CLASSIFICATION AND DISTRIBUTION OF FOREST BY GEOGRAPHY

Classic Methods of Classification

Classification by Remote Sensing
Classification and Distribution of Actual Forests
Perspectives and Guidelines

BOREAL AND TEMPERATE FORESTS

Definitions and Geographic Distribution of Boreal and Temperate Forests
Boreal and Temperate Forest Classification
Forest Disturbance and Stand Dynamics in Boreal and Temperate Forests
Paleological Perspectives and the Importance of Glaciation
Historical and Modern Patterns of Resource Use and Management
Responses of Boreal and Temperate Forests to Global Climate Change and Other Anthropogenic Impacts

TROPICAL AND SUBTROPICAL FORESTS

Introduction: Definition and Geographical Localization of the Tropics and Subtropics
Phytogeographical Units, Forest Ecology and Land Use
Important Tree Families
Socioeconomic Framework of Forest Management and Deforestation
Sustainable Natural Forest Management Approaches
Silvicultural Systems
Non-Timber Forest Products
Plantation Forestry
Agroforestry
Conservation Strategies
Certification of Forests and Forest Management and Timber Labeling
Forests as a Carbon Sink
Perspectives

FOREST PLANTATIONS

Definition
History
Future Developments
Types of Plantations
Plantation Silviculture
Plantation Yields and Productivity
Problems with Plantations
Outlook

FOREST ECOLOGY

Introduction: What is a Forest, What are Forest Ecosystems, and What is Forest Ecology?
Why are Forests Different from One Part of the World to Another, at Different Locations on a Continent and Even Locally?
Why do Forests Change Over Time? The Question of Temporal Diversity.
Forest Ecosystem Structure
Forest Ecosystem Function
Interactions Between the Components and Processes of Forest Ecosystems
Forest Ecosystem Complexity
An Ecological Foundation for Sustainable Forest Management: The Application of Knowledge of Forest Ecology
Non-timber Aspects of Forest Ecology
How can Forest Ecology Deal with Ecosystem Complexity and the Large Spatial and Temporal Scales of Forest Ecosystems? The Role of Remote Sensing and Modelling.

FORESTS IN ENVIRONMENTAL PROTECTION

- Protection Forests
- Forests Benefit from Environmental Protection
- The Role of Forests in Global Cycles
- Forests in Restoration, Reclamation and Rehabilitation Projects

UNDERSTORY PLANTS IN TEMPERATE FORESTS

- The Understory Environment
- Structure of Forest Understory Vegetation
- Diversity and Composition of Forest Understory Plants
- Physiology of Forest Understory Plants
- Reproduction and Clonal Growth
- Effects of Canopy Variation
- Responses to Disturbance
- Changes During Succession
- Dynamics of the Understory
- Effects of Understory Plants on Tree Seedling Establishment
- The Tree Seedling Bank
- Functional Aspects of the Understory
- Conservation and Management of Forest Understory Plants

URBAN FORESTRY

- Urban Forest Statistics
- Urban Forest Effects - Benefits and Costs
- Urban Forest Management
- Future Directions

MULTIPURPOSE SUSTAINABLE FOREST MANAGEMENT

- Role of Forests
- Sustainability
- Conservation of Biological Diversity
- Productive Capacity of Forest Ecosystems
- Forest Ecosystem Health and Vitality
- Conservation and Maintenance of Soil and Water Resources
- Maintenance of Forest Contribution to Global Carbon Cycles
- Socioeconomic Issues and Forest Management

AGROFORESTRY

- Agroforestry Systems and Practices
- Biological Basis of Agroforestry
- Social Basis
- Future Development of Agroforestry

FOREST RECREATION ON PRIVATE LANDS

- Overview of Recreational Forestry
- Examples from Costa Rica

IMPORTANT TREE SPECIES

- Importance of Trees
- Softwoods
- Hardwoods
- Trees of Desert / Arid Zone

Trees for the Reclamation of Land

CONIFEROUS TREES

General overview

Species

TROPICAL HARDWOODS

Types of Tropical Forests

Economic and Environmental Evaluation

Some Tropical Hardwoods

Conservation Strategies

TREE SPECIES IN RECLAMATION

Tree Species Options for Degraded Land

Opportunities for Land Reclamation Using Trees

ARID ZONE FORESTRY WITH SPECIAL REFERENCE TO INDIAN HOT ARID ZONE

Arid Zones of the World

The Indian Hot Arid Zone

Some Important Aspects of Vegetation and its Ecology

Tree Species Profiles

Artificial Establishment of Trees

Synthesis

FORESTS AND FOREST PRODUCTS

HISTORY, NATURE, AND PRODUCTS OF WOOD

History of Wood Use

The Nature of Wood

Basic Forms of Wood and Wood Based Materials

CELLULOSE AND PULP

What is Cellulose?

Fundamentals of Cellulose

Cellulose and Liquids

Cellulose Derivatives

Grafting of Cellulose

Thermal Decomposition of Cellulose

Synthesis of Cellulose

Outlook for Uses of Cellulosic Products

Introduction of Pulp

How Pulp is Made

Pulp Properties

The Utilization of Pulp

FOOD, FORAGE AND MEDICINAL RESOURCES OF FORESTS

Forest Food

Forage

Forest Medicines

Agroforestry, Swidden and Other Forms of Forest Management

Economic Use and Potential

PRODUCTS OF RESIN PROCESSING

Resins from Conifers

Resins from broadleaf trees
Hard Resins
Fossil Resin
Lac

WILDLIFE AND TOURISM IN FOREST ECOSYSTEMS

Wildlife
Tourism

FORESTS IN THE BIOSPHERE

Introduction: Brief Description of the Biosphere
Life in the Biosphere
Forests in the Biosphere
Forests, Carbon, Oxygen and Carbon Dioxide
Types of Forests and Forest Biodiversity
Major Environmental Influences of Forests
The Productive Role of Forests
Deforestation

THE ROLE OF FORESTS IN THE PRESERVATION OF BIODIVERSITY

Levels of Diversity
Forest Ecosystems and Biodiversity
Forest Age/Successional Stages and Biodiversity Preservation
Human Influences in Forest's Role in Preserving Biodiversity

THE ROLE OF FORESTS IN THE HYDROLOGICAL CYCLE

The Hydrological Cycle in Forests
Forests and Hydrological Processes
Effects of Afforestation/Deforestation on Streamflow
Influence of Forests on Water Quality

ROLE OF TREES IN CROPLANDS

Classification of trees in croplands
Contributions of trees in croplands to economic development and income generation
Contributions of trees in croplands to environment improvement
Negative Effects of Trees in Croplands
Management Options to Increase Benefits and Decrease Negative Impacts
Some Important Trees in Cropland

FLOW AND CONSERVATION OF ENERGY IN FORESTS

The Flow and Capture of Light Energy in Forests
Factors Influencing Flow and Conservation of Energy in Forests
Methodologies

CONSERVATION AND BREEDING OF FOREST TREES

Species in Different Ecosystems
Status with Respect to Use and Value
Status with Respect to Threat
Management Tactics
Management Strategies
Program Strategies
International Capabilities

TECHNIQUES IN FOREST TREE BREEDING

- Genetic Surveys of Natural Populations
- Improvements Through the Use of Superior-Tree Selection in the Wild
- Testing Procedures for Genetic Advancement
- Genotype by Environment Interactions
- Advanced Generation Breeding and Testing
- Breeding Population Structure
- Inbreeding Depression
- Genetic Diversity and Risk in Forestry
- Gene Conservation
- Changes in Deployment Zones through Climate Change
- Advanced Technologies and their Role in Tree Breeding

STRUCTURE, GROWTH, DEVELOPMENT AND REPRODUCTION OF FOREST TREES

- Crown Form
- The Stem
- Roots
- Leaves
- Reproduction

SILVICULTURAL SYSTEMS FOR BOREAL AND TEMPERATE FORESTS

- Silvicultural Systems and their Applications
- Benefits from Silviculture: Today and in Future
- Constraints to Implementing Silvicultural Systems

TROPICAL FOREST PLANTATIONS

- Reforestation in the tropics
- Main purpose of reforestation
- Forest Research
- Some problems

PRODUCING PLANTING STOCK IN FOREST NURSERIES

- The unique character of forestry planting stock
- The role of forest nurseries in forest management
- Does the nursery affect the planting stock?
- Types of nurseries
- Establishing a new nursery
- The origin of the planting stock
- The culture of forestry planting stock:
- The control of harmful organisms in the nursery.
- Beneficial soil organisms
- Storage of planting stock
- Stock quality

FOREST PEST AND FIRE MANAGEMENT

- Causes of Death in Natural Forests
- Problems Caused by Human Activity
- The Trend Toward Ecologically-Based Integrated Resource Management
- Strategies and Tactics in Integrated Pest and Fire Management
- Future Prospects

FOREST RESOURCE MANAGEMENT

Historical Review of Forest Resource Management
The Status of World Forests
Approaches of Forest Resource Management

TERRESTRIAL ANIMALS: MAMMALS, BIRDS AND INVERTEBRATES

FARM ANIMALS AND HUMAN SOCIETY

Products of Animal Origin and Human Society
Animal Husbandry in the World
Animals, Environment, and Sustainable Development
Animals as Sources of Medicines, Ferments, and Hormones
Animal Behavior and Animal Welfare
Major Diseases of Domesticated Animals
Animal Feeding

MINOR DOMESTICATED ANIMALS

Introduction: Minor Domesticated Animals

FISHERIES AND AQUACULTURE : TOWARDS SUSTAINABLE AQUATIC LIVING RESOURCES MANAGEMENT

The Role of Fisheries
An Outline of Fisheries
Fisheries Economic Outlook
Fisheries Issues
Perspectives

HARVESTING THE SEAS

Historical Development
Fishery Systems
State of World Fisheries
The Dynamics of Overfishing

WORLD YIELDS OF MARINE ORGANISMS

World Fishery Production over the last Half of Century with Recent Trends
Profile of Catches by Geographic Areas

RATIONAL EXPLOITATION AND CONSERVATION OF MARINE ECOSYSTEMS

The Exploitation and Conservation of Natural Resources
Rationalization of Uses
Effects on Wealth Distribution

FORECAST OF YIELDS

A perspective on Fisheries Trends Offered by Estimates of Production per Shelf Area
Development Trends and Potential
El Nio: the Consequences for Fisheries
A Framework for Sustainable Fisheries

POLLUTION OF THE HYDROSPHERE AND QUALITY CONTROL IN NATURAL WATERS

Pollution Occurring in the Hydrosphere
Monitoring and Assessment
Water Quality Control and Environmental Management

MARINE ORGANISMS AS FOOD, FORAGE, INDUSTRIAL, AND MEDICAL PRODUCTS

Historical Perspective
The Current Picture of Food and Non-food Uses

Future Prospects

ALLOCATION OF USE RIGHTS AND ADJUSTMENT OF INSTITUTIONS

Exclusivity Systems

Allocation Mechanisms

Regulatory Bodies

SUBSIDIES TO FISHING

Why do Governments Subsidize Fisheries?

Subsidies and Their Classification

Effects of Subsidies

Subsidy Reform

FISHING PORT MANAGEMENT, THE FORGOTTEN SUBJECT

Historical Development of Service Functions of Fishing Ports

Definitions Applied

Key Functions of a Modern Fishing Port

Differentiation of Port Functions and Services

Fishing Port Management Planning

Basic Concepts of Management Structures

Introduction to Fishing Port Operation Management

Management Planning

Inventory Management and Control

Port Operation and Fishing Fleet Management

MARINE FISH AND INVERTEBRATES: BIOLOGY AND HARVESTING TECHNOLOGY

New approaches

Biology and Harvesting of Major Species

Marine Plants: Production and Utilization

Commercial Sea-Cucumbers and Trepang Markets

Importance of Non-commercial Fish

The Problem of Discards in Fisheries

Fisheries Engineering and Technology: Fishing Operation and Economic Considerations

Subsistence Hunting of Marine Mammals

SCHOOLING FINFISH (CODS, HERRINGS, SARDINES, MACKERELS, AND OTHERS)

Peruvian Anchoveta (*Engraulis ringens*, Jenyns 1842)

Alaska Pollock (*Theragra chalcogramma*, Pallas 1811)

Chilean Jack Mackerel (*Trachurus murphyi*, Nichols 1920)

Atlantic Herring (*Clupea harengus*, Linné 1758)

Chub Mackerel (*Scomber japonicus*, Houttuyn 1782)

Capelin (*Mallotus villosus*, Müller 1776)

South America Pilchard (*Sardinops sagax*, Jenyns 1842)

Atlantic Cod (*Gadus morhua*, Linnaeus 1758)

Pacific Cod (*Gadus macrocephalus*, Tilesius 1810)

Japanese Anchovy (*Engraulis japonicus*, Temminck and Schlegel 1846)

Sardine (*Sardina pilchardus*, Walbaum 1792)

SCHOOLING FINFISH: AN OVERVIEW OF THE TUNAS, BILLFISHES AND SHARKS

An Overview of the Tunas, Billfishes and Sharks

Species by Species Overview and Discussion

Overview of Sharks

Billfishes
Recommendations

SHRIMPS AND KRILL

Shrimps
Krill

CRABS AND LOBSTERS

Species and Fisheries
Harvesting
Biology
Stock Assessment and Management Approaches
Issues for the Future

SHELLED MOLLUSCS

Species and Fisheries
Harvesting and Cultivation Techniques
Biology
Stock Assessment and Management Approaches
Issues for the Future

SQUID, OCTOPUS AND THE LIVING CEPHALOPODS

Taxonomy
Distribution
Life History
Ecology
Production and Biomass
Size Spectra
Fisheries Management
Aquaculture

ORANGE ROUGHY AND OTHER DEEPWATER BENTHIC FISHES

Foreword
The Deepwater Environment
Orange Roughy, *Hoplostethus atlanticus*, Collett, 1889
Round Nose Grenadier, *Coryphaenoides rupestris*, Gunnerus, 1765
Black Scabbard Fish, *Aphanopus carbo*, Lowe, 1839
Alfonsinos, *Beryx* spp
Oreos, *Alloctytus niger*, James, Inada and Nakamura 1988; *Pseudocyttus maculatus* Gilchrist 1906
Black Cardinal Fish, *Epigonus telescopus*, Risso, 1810
Tooth Fish, *Dissostichus eleginoides*, Smitt, 1898; *D. mawsoni*, Norman, 1937

FLATFISHES AND SKATES

Plaice, *Pleuronectes platessa*, Linnaeus, 1758
Greenland Halibut, *Reinhardtius hippoglossoides*, Walbaum, 1792
The Yellow Fin Sole, *Limanda aspera*, Pallas, 1811
Common Sole, *Solea solea*, Linnaeus, 1758
Atlantic Halibut, *Hippoglossus hippoglossus*, Linnaeus, 1758
The Other Flatfish

MARINE PLANTS: PRODUCTION AND UTILIZATION

Foreword

Alginophyts and Alginic Acid
Agarophyts and Agars
Carrageenophyts and Carrageenans

COMMERCIAL SEA CUCUMBERS AND TREPANG MARKETS

The Commercial Sea Cucumbers
Collecting and Processing Methods for Trepang
The Main World Fisheries
The Main World Markets
Over-exploitation and Sustainable Management

THE IMPORTANCE OF NON-COMMERCIAL FISH

Importance of Non-commercial Fish in Terms of Global Harvests
Importance of Non-commercial Fish for Humans
Importance of an Ecosystem Approach for the Sustainability of the Resource

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- Economic and Social Consequences of Foodborne Diseases and Food Contamination
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- Responsibilities for Prevention of Foodborne Illness: The Concept of Shared Responsibility

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MICRO-ORGANISMS IMPORTANT IN FOOD MICROBIOLOGY

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- Metabolism of Lactic Acid Bacteria
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- Chemistry of Food Constituents

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Amelioration: Premises and Practices

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Soil Salinization Control: Chemical Amelioration

Erosion Control: Agricultural Afforestation

Clearance of Vegetation: Phyto-Melioration

Amelioration of Sands: Abrasion Control

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THE NECESSITY FOR DEVELOPMENT OF LAND RECLAMATION

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Principles of mathematical models for optimizing environmental conditions of plants and edaphic biota.

Mathematical models of processes of creation of environmental conditions.

Quantitative methods of substantiation of natural necessity of complex regulation of factors affecting the life of plants

Necessity of applying different kinds of reclamation for different natural zones.

HINDRANCES AND RESTRICTIONS TO FARMING

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Factors influencing efficiency of land use.

Limitations of opportunity of application of agro-technical methods.

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Land Amelioration in the Ancient World (Egypt, Mesopotamia, China, India, etc.)

Land Amelioration in Medieval Times

The Modern Period of Land Amelioration

Contribution of Land Amelioration to the Development of Agriculture and Food Supply

Scientific and Technical Progress in Land Amelioration

Land Amelioration and Economic Security

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Direction of land improvement and an agriculture in various native-climatic zones of the Earth.

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Rice Irrigation Systems
Irrigation Systems that Use Communal Wastewater and Livestock Sewage
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Reasons of secondary irrigated land salinity
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Salt - resistance of crops
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Washing of salinized lands
Water loss reduction in irrigated system
Biological drainage

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TECHNIQUES AND TECHNOLOGIES OF LAND DRAINAGE SYSTEMS

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FLOODS AND HIGH WATERS, USING POLDERS FOR PROTECTING AGRICULTURAL LANDS FROM THE FLOODS

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Methods and ways of protecting land from floods.
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Non-flooding polders.
Flooded (summer) polders.
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Formation of Debris Flows and Factors Causing Them
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SOIL IMPROVEMENT

Kinds and Technologies of Agrotechnical Work
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Removal of Stones
Removal of Tussocks, Thick Sod, and Moss Cover
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Soil Amendment
Initial Soil Tillage
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Crop Growing
Radical Improvement of Meadows and Pastures
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Introduction. Definition of Concepts. Goals and Tasks of Chemical Amelioration
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Acid Soils and Their Chemical Amelioration
Salt-Affected Soils and Their Amelioration
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Acidity and Alkalinity as Properties Limiting Soil Fertility
Kinds of Chemical Amelioration: Chemical Amendments
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RECLAMATION OF ACID SOILS

Soil acidity and its indices
Natural reasons for increasing soil acidification
The reasons for anthropogenic acidification of soils. The phenomenon of environmental "Acidification"
Reasons for plants sensitivity to soil acidity
Liming as a major means of soil reaction optimization
Sorts of lime fertilizers.
Methods of application of liming material
The efficiency of liming.
Perspectives of soil reaction control in agroecosystems.

AMELIORATION OF ALKALI(SODIC/SOLONETZ) SOILS

Diagnosis of Alkali Soils: Concept, Indices and Criteria for Evaluation
Properties Limiting the Productivity of Alkali Soils
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PARTICULAR FORMS OF LAND AMELIORATION DEVELOPMENT OF COASTAL MARSHLANDS AND OTHER SALINE SOILS

Object of research. Geographical position, particular development and amelioration of soils in coastal areas
Polder meliorative systems. General position
Specific land use in coastal areas of different natural zones
Natural peculiarities and examples of land amelioration within coastal areas of South-Eastern Asia.

BIOLOGICAL AND AGROTECHNICAL AMELIORATION

Climatic factors unfavorable for agricultural production
Erosion and deflation of soils
Influence of PFS on climatic factors, erosion and deflation
Kinds and destination of protective forest stands, their structure, form and placing

GOALS AND DEMAND

Greening of agriculture
Realization of biological and agro-technical land improvement
Use of the grounds without radical land improvement
Phytomelioration and forest reclamation
Combating erosion, use of eroded land, and recultivation
Soil protective systems and improvement of soils subject to erosion and deflation
Fertilizers

PHYTOMELIORATION

Phytomelioration: the concept and sphere of application
Phytoclimatic zones
Phytomelioration for protection of soil from water and wind erosion
Phytomelioration for reinforcing of ravines and gullies
Phytomelioration for fastening and uses of sand
Phytomelioration on irrigated and drained land
Phytomelioration for lowering of water table and reduction of infiltration
Use of afforestation for protection of agricultural crops from unfavorable climatic conditions
Phytomelioration with recultivation of the ground
Afforestation for aesthetic improvement
Halophytes - introduction and selection work

AGROTECHNICAL MELIORATION AND FERTILIZER

Agroeconomic estimation of landscapes and soils.
Organisation of agricultural crops cultivation.

Optimisation of crop rotation systems in agricultural landscape.
Optimum ratio between elements in landscape (meadow, plough-land, forest, water).
Agroecological principles and methods of soil processing.
Management of organic substance content in soil, regulation of microbiological processes.
Maintenance of soil with nutritious elements; systems of macro- and microfertilizers.
Peculiarities of processing of soil polluted with heavy metals and radionuclides.
Agrotechnical protection of plants from harmful organisms (weed plants, harmful insects and diseases).
Forecast of agrotechnical melioration development and fertilizers applications in the XXI century.

CONSERVATIONAL SOIL TREATMENT

Anti-Erosion Organization of Territory
Rational Placing of Agricultural Crops
Soil-Protecting Water-Absorbing Processing of Soil
Making Meadows
Forest Meliorative Measures
Strip Agriculture
Retention of Surface Flow
Full Processing of Soil with Stubbles
Regulation of Small River Flow and Surface Flow
Artificial Structure-Formers
Artificial Irrigation of Soil

EROSION AND DEFLATION CONTROL

Soil Erosion
Soil Deflation
Field-Protecting Anti-Erosion Forest Belts
Melioration of Gully-Ruined Lands
Anti-Erosion Hydrotechnic Constructions
Bed and Bottom Constructions

FOOD ENGINEERING

The History and Future Trends of Food Engineering
Food Engineering: The Profession
Engineering Properties of Foods
Thermodynamics in Food Engineering
Food Process Engineering
Design and Technology Implementation in Food Engineering

ENGINEERING PROPERTIES OF FOODS

Thermal Properties
Optical Properties
Electrical Properties
Mechanical Properties
Properties of Food Powders
Role of Food Microstructure in Engineering Properties

THERMAL PROPERTIES OF FOODS

Experimental Data and Prediction Models
Density

Specific Heat
Thermal Conductivity
Thermal Diffusivity
Boiling Point Rise and Freezing Depression
Viscosity

ELECTRICAL PROPERTIES OF FOODS

Electrical Conductivity
Electric Permittivity

OPTICAL PROPERTIES OF FOODS

Nature of Light
Physical Phenomena
Optical Properties of Materials
The Vision Process
Visual Appearance

MECHANICAL PROPERTIES OF FOODS

Classification of Mechanical Properties
Density
Shrinkage and Expansion
Porosity
Volume and Surface Area
Morphological Properties
Applications of Density, Shrinkage, Porosity, and Surface Area

PHYSICAL PROPERTIES OF FOOD POWDERS

Bulk Density and Compressibility
Angle of Repose
Flowability
Caking
Mixtures and Segregation
Disintegration and Attrition

PARTICLE SIZE DISTRIBUTION IN FOOD POWDERS

Methods for Particle Size Measurement
Particle Size Distribution
Applications in Food Powder Field

FOOD MICROSTRUCTURE

Structure-Property Relationships in Foods
Examining Food Microstructure
Food Preservation and Microstructure
Perspectives

THERMODYNAMICS IN FOOD ENGINEERING

Thermophysics
Chemical Thermodynamics

COLLIGATIVE PROPERTIES OF FOODS

Ideal Solutions
Colligative Properties

PHASE TRANSITIONS

Phase and State Transitions
Phase and State Transitions in Foods
Phase Transitions and Food Structure
Transitions and Food Processing
Reaction Kinetics and Food Stability

SURFACE PHENOMENA

Colloidal Forces Between Particles
Flocculation
Food Emulsifiers
Competitive Adsorption in Mixed Emulsifier Systems
Interfacial Rheological Properties of Adsorbed Layer

KINETICS OF CHEMICAL REACTIONS IN FOODS

Fundamental Concepts
Simple Reactions
Complex Chemical Reactions
Chemical Kinetics in Food Processing and Preservation
Enzyme Kinetics

CYCLES AND REFRIGERATION

Vapor Compression Cycles
Multistage Compression Cycle
Absorption Refrigeration Cycle
Components of Mechanical Refrigeration System
Other Refrigeration Systems
Refrigerants
Applications in the Food Industry

FOOD RHEOLOGY AND TEXTURE

Measurement

NEWTONIAN AND NON-NEWTONIAN FLOW

Stress and Deformation
Elastic Solids and Newtonian Fluids
Viscometric Functions
Rheological Classification of Fluids
Newtonian Flow
Non-Newtonian Flow
Viscoelasticity
Temperature Dependency
Effect of Concentration on the Viscosity
Rheological Measurements in Semi-Liquids Food Products
Determination of Yield Stress
Typical Applications
Final Remarks

VISCOELASTICITY

The Foundations of Viscoelasticity
Liquids, Solids, and Viscoelastic Materials
Linear Viscoelasticity
Experimental Methods of Measurement of Linear Viscoelastic Functions

Viscoelastic Properties of Food Biopolymers

SQUEEZING AND ELONGATIONAL FLOW

Squeezing and Elongational Flow in Fluid Foods
Foundations of Squeezing Flow Viscometry
Parallel Plate Viscometer

FOOD SUSPENSIONS

Rheological Behavior
Forces Acting on Particles
Measurement Techniques
Factors Affecting Viscous Behavior
Predictions of Rheological Properties Based on Structure
Flow Behavior of Solid-liquid Mixtures
Future Trends

FOOD EMULSIONS

Structure of Food Emulsions
Emulsion Stability. Destabilization Mechanisms
Interaction Forces Between Droplets
Emulsion Formation
Food Emulsion Rheology

CONSTITUTIVE MODELS FOR FOOD SYSTEMS

Linear Viscoelasticity
Dilute Solution Theories
Concentrated Dispersion Theories
Concentrated Solution/Melt Theories
K-BKZ Type Models
Differential Constitutive Models
Solid-Like Constitutive Models

SOLID FOODS

Rheological Properties of Solid Foods
The Deformability Modulus
Viscoelastic Properties of Solid Food
Final Remarks

TEXTURE IN SOLID AND SEMISOLID FOODS

Food Processing Affects Texture
Desirable and Undesirable Textures
Time of Day Affects Texture Preferences
Non-Destructive Test
How the Body Processes Food
Correlating Instruments with Sensory Evaluation of Texture
History of Development of Texture Measuring Instruments

FOOD TEXTURE: SENSORY EVALUATION

Physiological Perception
Elaboration and Interpretation of Sensation
Communication of the Sensation: Sensory Analysis

FOOD PROCESS ENGINEERING

- Food Process Engineering Overview
- Scope of Food Process Engineering
- Raw Material Preparation
- Prevention of Food Spoilage
- Food Preservation by Canning
- Aseptic Packaging
- Non-Thermal Processes for Food Preservation
- Low-Temperature Food Preservation
- Frying of Foods
- Physical Separation of Food Components
- Shaping and Textural Modification of Foods
- Optimization of Processes for Food Preservation

CONVENTIONAL THERMAL PROCESSING (CANNING)

- Historical Perspective
- Current Technology
- Scientific Principles
- Future Trends and Perspectives

OHMIC HEATING

- Microbial Death Kinetics
- Electrolytic Effects
- Applications

FOOD FREEZING

- History and Origin
- Food Quality and the Freezing Process
- The Freezing Process
- Freezing Systems

CONCENTRATION OF LIQUID FOODS

- Physical Properties of Liquid Foods
- Concentration by Evaporation
- Concentration with Membranes
- Combined Technologies in the Concentration of Liquid Foods
- Freeze Concentration

FOOD DEHYDRATION

- Basic Concepts Associated with Drying
- Drying Rate
- Heat and Mass Transfer Controlling Resistances during Drying
- Dehydration Techniques
- Future Directions

FOOD FRYING

- Physicochemical Changes in Foods during frying
- Edible Oils Used in Frying Foods
- Heat Transfer during Frying
- Frying Systems
- Future Studies

SEPARATION

- Liquid-Liquid Extraction

- Solid Liquid Separation
- Mechanical Separation
- Membrane Processing
- Column Chromatography
- Distillation

SUPERCRITICAL EXTRACTION

- Concepts of Supercritical Fluids
- Solubility Measurement Techniques
- Solubility Measurements
- Applications of Supercritical Fluid Extraction
- Other Applications of Supercritical Fluids

FOOD EXTRUSION

- Extruded Products
- Extrusion Equipment
- Extrusion Variables and Process Parameters
- Process Modeling and Scaling
- Scale-Up
- Physico-Chemical Changes During Extrusion
- Flavor Formation and Loss During Extrusion
- Effect of Extrusion on Nutritional Quality
- Other Applications of Extrusion Processing

CRYSTALLIZATION

- Crystallization Principles
- Controlling Crystallization in Foods
- Factors Affecting Control of Crystallization

NONTHERMAL PROCESSING OF FOODS AND EMERGING TECHNOLOGIES

- High Hydrostatic Pressure
- Ultrasound
- Food Irradiation
- Light Pulses
- Pulsed Electric Fields
- Oscillating Magnetic Fields
- Nonthermal Methods as Hurdles
- Final Remarks

HURDLE TECHNOLOGY

- Principles of Hurdle Technology
- Basic Aspects of Hurdle Technology
- Applications of Hurdle Technology
- Food Design by Hurdle Technology

FOOD FERMENTATION

- Definitions
- Microbial Ecology
- Groups of Fermenting Organisms
- Fermented Products
- Fermentation as a Source of Chemical Compounds for Foods
- Industrial Fermentation

FOOD POWDER PROCESSING

Introduction: Applied Powder Technology to Food Materials
Comminution
Attrition
Mixing
Separation and Classification
Agglomeration and Growth
Drying and Reconstitution

FOOD MIXING

Special Features of Food Mixing
Assessment of Mixedness
Types of Food Mixers

FOOD PACKAGING

Metal Containers
Glass Containers
Paper and Paperboard Packages
Plastic Containers

FOOD PLANT DESIGN

Principles
Critical Issues
Project Execution

FOOD PROCESS DESIGN

A General Approach to Food Process Design
Categories of Food Processes
Future Directions in Food Process Design

FOOD PROCESS MODELING

Modeling and its Various Uses
Types of Process Modeling
Other Models Used in Food Plant Design and Operation
Computational or Numerical Models
Observational (Empirical) Models

PROCESS INSTRUMENTATION AND CONTROL

Background
The Control Problem
Instrumentation
Computer-Controlled Systems
Future Trends
Future Directions

SOFTWARE FOR FOOD ENGINEERING APPLICATIONS

Software Sources
Software Tools

AUTOMATION OF FOOD PROCESSING

Why Automate?
Uniqueness of the Food Industry
Tools of Automation

THE SANITARY DESIGN AND CONSTRUCTION OF FOOD PRODUCTION FACILITIES

- Programs
- The Product
- Site Selection and Plant Design
- Plant Layouts
- Equipment
- The "Enemy": Bio-Films
- Placement of Equipment
- Valves
- Pumps and Piping
- Thermal Processing Equipment
- Conveying Systems
- Containment Vessels
- A Perspective

FOOD WASTE

- Wastewater Parameters
- Characteristics of Food Processing Wastewater
- Regulatory Issues
- Management and Treatment Processes

AGRICULTURAL MECHANIZATION AND AUTOMATION

- Technology and Power
- Machines and Implements
- Mechanization and Livestock Production
- Monitoring the Agricultural Environment
- Agricultural Wastes and By-products
- Livestock Slaughtering and Primary Processing

TECHNOLOGY AND POWER IN AGRICULTURE

- Technology
- Power
- Steam Power
- Internal Combustion Engine
- Fuel Sources
- Tractors
- Agricultural Implements
- The Moldboard Plow
- Reaping, Threshing, and Combine Harvesters
- Electric Power
- The Computer Revolution
- Precision Farming
- Social Issues

EXPENDITURES AND RETURNS

- Direct Machine Expenditure
- The Effect of Labor and Cropping on Machinery Expenditure

AGRICULTURAL EQUIPMENT: CHOICE AND OPERATION

- Importance of Agricultural Equipment Choice and Operation
- Methods of Obtaining Access to Equipment

- Equipment Costs
- Equipment Selection
- Equipment Operation
- Automation of Agricultural Equipment Operation
- The Future of Agricultural Equipment Choice and Operation

MAINTAINING WORKING CONDITIONS AND OPERATION OF MACHINERY

- Maintaining Working Conditions
- Operation of Machinery
- Tillage
- Distribution of Nutrients
- Crop Protection
- Irrigation
- Forage Harvesting and Preservation
- Grain Harvesting and Preservation
- Harvesting, Handling, and Storage of Potatoes
- Harvest and Handling of Sugar Beet
- Risks of Accidents and Health Hazards

HUMAN AND ANIMAL POWERED MACHINERY

- Human Powered Operations and Equipment
- Animal Powered Operations and Machinery
- Future Perspectives in the Use of Human and Animal Power in Agricultural Production

ENERGY SOURCES: NON RENEWABLE AND RENEWABLE

- Definition of Energy
- Forms of Energy and Energy Retention
- Energy Transformation, Energy Definition, Energy Supplies
- Energy Transformation of Fossil Fuels
- Energy Transformation from Atom Splitting and Atomic Fusion
- Energy Transformation from Renewable Energy Sources
- Perspectives and Future Energy Policy

AGRICULTURE AND AUTONOMOUS POWER SUPPLY

- Power Production and Aspects Concerning the use of Renewable Sources
- Technologies for Electricity Production at Farm Level From Renewable Energy Sources
- Internal Combustion Engines Combined with Generators (IC Generator-sets)
- External Combustion Engines/Turbines Combined with Generators (EC Generator-sets)
- Hydraulic Engines Combined with Generators (Water Wheels and Turbines)
- Photovoltaic Solar Plants
- Wind Generators
- Combined Production of Electric and Thermal Energy (Co-generators; CHP)

FARM MACHINERY

- Trends in Farm Machinery Adoption
- Machinery for Tillage
- Seeding and Planting Machinery
- Fertilizer Application and Plant Protection Equipment
- Machinery for Crop Harvesting and Threshing
- Machinery for Transport
- Horticultural Machinery

Standardization and Testing of Farm Machinery

TRACTORS AND TRANSPORT VEHICLES

- Mechanization, Tractor Development and Tractor Performance
- Thermodynamics and Cycles for Internal Combustion Engines
- Fuels and Combustion
- Engine Components
- Electrical Systems for Tractors
- Carburetor Engines and Ignition Systems
- Diesel Engines
- Engine Cooling, Coolants, and Cooling Systems
- Lubricants and Lubrication Systems
- Mechanics of the Tractor Chassis and Tractor Safety
- Tractor Hydraulics, Hitches, and Steering Systems
- Power Trains
- Ergonomics and the Operator Environment
- Traction Modeling and Tractor Draft Performance
- The Transportation of Farm Produce

TILLAGE AND SEEDING MACHINES

- Tillage Machines
- Primary Tillage Implements
- Secondary Tillage Implements
- Seeding Machines

FERTILIZER APPLICATORS AND PLANT PROTECTION EQUIPMENT

- Dry Fertilizer Application Methods and Equipment
- Liquid Fertilizer Applicators
- Granular Pesticide Applicators
- Sprayers
- Dusters
- Future Trends

HARVESTERS

- Classification of Crops
- Seed Harvesting Machines
- Root Crop Harvesters
- Green Plant and Leaf Harvesters
- Fruit Harvesters
- Fiber Crop Harvesters
- Timber

EQUIPMENT FOR POST-HARVEST PRESERVATION AND TREATMENT OF PRODUCE

- Historical Perspective
- Science, Engineering, and Technology
- Field-based versus Shed-based Operations
- Receipt of Produce
- Conveying
- Cleaning
- Sorting and Grading
- Treatment

- Packaging and Labeling
- Unitization
- Storage
- Dispatch
- Transport
- Wholesaling
- Retailing
- Consumption
- Policy
- Post-harvest Systems Management
- Future Directions

FACILITIES AND EQUIPMENT FOR LIVESTOCK MANAGEMENT

- The Evolution of Livestock Production
- Fundamentals for Equipment Design
- Challenges, Needs, and Future Perspectives

PLANNING AND BUILDING OF STOCK-RAISING FARMS

- Site selection considerations
- Space and distance requirements
- Topography
- Climate
- Utilities
- Safety and security
- Biosecurity
- Malodors from livestock facilities
- Combining buildings into a production system
- Developing a site plan
- Building a production facility

EQUIPMENT FOR CATTLE PRODUCTION

- Types of cattle production
- Methods of feeding
- Cattle housing
- Cattle health and welfare
- Milking equipment
- Management tools
- New developments and discussion

EQUIPMENT FOR PIG PRODUCTION

- Environmental Impact of Pig Production
- Equipment to Minimize Environmental Impact

EQUIPMENT FOR SHEEP PRODUCTION

- Sheep production options
- Equipment for pasture systems
- Watering troughs
- Feeding equipment
- Lambing equipment
- Confinement production
- Handling facilities

Buildings for sheep production

EQUIPMENT FOR POULTRY PRODUCTION

Types of poultry
Types of chicken housing systems
Economic Impact of Poultry Production
Housing Systems
Feeding Equipment
Watering Equipment
Medication Equipment
Ventilation and Heating
Lighting
Harvesting
Waste from Poultry Systems

AUTOMATION AND ELECTRONIC EQUIPMENT

Automation
Automatic Identification of Animals
Automatic Feeding
Automatic Monitoring of Physiological Yield Parameters
Software
Robotics
Milking Robot

ENVIRONMENTAL MONITORING

Loss of Ecology due to Agricultural Development
Environmental Monitoring
Equipment for Environmental Monitoring

ECOLOGY AND TECHNOLOGY

Interconnection of Human Beings and the Natural Environment
Designing with Ecological Constraints
The Issue of Sustainability
What is an Ecosystem Service?
Ecological Engineering – the Merging of Ecology and Technology
Key Technologies for Sustainable Ecosystems
Implementing Ecology and Technology

EROSION CONTROL EQUIPMENT

No-Till Systems
Ridge Tilling
Cultivators for Heavy Residue
Fall Strip-Till Systems
Mulch-Till Systems
Controlled Traffic
Wind Erosion

HEALTH AND SAFETY OF PERSONNEL IN AGRICULTURE

Tractors
Other Farm Machinery
Animals
Confined Spaces and Storage Structures

- Slips and Falls
- Overhead Power Lines and Electricity
- Chain Saws and Woodcutting
- All-Terrain Vehicles
- Fires
- Chemicals
- Respiratory Hazards
- Noise
- Skin Cancer
- Repetitive Motion and Back Injuries
- Maintenance, Repair, and Construction
- Child Safety on the Farm
- Stress and Depression
- Regulations and Management

AGRICULTURAL-RELATED FIRES AND EXPLOSIONS

- Fundamentals of Fires and Explosions
- Fires in Stored Agricultural Crops
- Agricultural Machinery Fires
- Fuel Storage
- Agricultural Chemical Fires
- Grain Dust Explosions
- Fire Detection and Suppression Systems

RECOVERY AND USE OF WASTES AND BY-PRODUCTS

STORAGE, HANDLING AND DISPOSAL OF ANIMAL SLURRIES

- Composition
- Storage
- Transport
- Treatment
- Application and utilization
- Environmental and legal aspects

ANIMAL SOLID MANURE: STORAGE, HANDLING AND DISPOSAL

- Solid Manure Characteristics
- Solid Manure Handling Alternatives
- Collection and Transfer Systems
- Storage
- Treatment
- Land Application

BALING, TRANSPORTATION, AND STORAGE OF STRAW

- Baling
- High Pressure Compaction
- Transport and Handling
- Storage
- Logistic Chains

COMMERCIAL USES OF STRAW

- Animal Feeding
- Electrical Power and Fuel Generation

- Composting and Mushroom Cultivation
- Building Construction and Structural and Paper Product Manufacturing
- Environmental Mitigation and Farm Use
- Other Uses

SLAUGHTERING AND PROCESSING OF LIVESTOCK

- Background
- Pre-Harvest Aspects
- Post-Harvest Aspects
- Health Certification of Meat and Meat Products Entering Trade
- Education and Food Safety
- Future Needs

ANIMAL WELFARE AND HUMANE SLAUGHTER

- Comparisons of electrical stunning and CO2 stunning
- Electrical Stunning
- Captive Bolt Stunning
- Carbon Dioxide Stunning
- Assessing Insensibility
- Insensibility in Poultry and Gas Stunned Animals
- Ritual Slaughter
- Objective Scoring of Animal Welfare
- Stunning Methods and Blood Splash

THE ROLE OF SLAUGHTER HYGIENE IN FOOD SAFETY

- Animal cleaning and washing
- Chemical dehairing
- Knife-trimming and steam-vacuuming
- Carcass decontamination by spraying, rinsing or exposure to steam
- Carcass chilling
- Carcass cutting and meat storage
- Further processing and preparation for consumption
- Overview

PROCESSING AND MARKETING NON-MEAT PRODUCTS FROM LIVESTOCK

- Historical background
- Physicochemical, ecological and economic background of the utilization of non-meat products from livestock
- Mass balance of world meat production and non-meat products from livestock
- Non-meat products from fallen stock and emergency culling
- Ethical consideration in the utilization of non-meat products from livestock
- Animal raw materials versus plant and "synthetic" raw materials
- Total quality management in non-meat products from livestock
- Outlook

AGROECOLOGY: ENVIRONMENTALLY SOUND AND SOCIALLY JUST ALTERNATIVES TO THE INDUSTRIAL FARMING MODEL

- Introduction
- Agroecology and Sustainable Agriculture for Small Farmers in the Developing World
- Organic Agriculture in the Industrial World
- Moving Ahead

SYSTEMS ANALYSIS AND MODELING IN FOOD AND AGRICULTURE

AN OVERVIEW OF THE FOOD SYSTEM

Food System
Topics of Concern in World Agriculture

ENERGY USE IN PRODUCTION OF FOOD, FEED, AND FIBER

After the 1973 Oil Embargo
Overview of Energy Use and Food Production
Agriculture and Alternative Energy

ENVIRONMENTAL IMPACT OF FOOD PRODUCTION AND CONSUMPTION

Soil Bio- diversity in Agricultural Food Production
Water Use and Water Pollution
Energy
Climate Change
Food Safety and Biotechnology
Use of Chemicals
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ENVIRONMENTAL ACCOUNTING OF AGRICULTURAL SUSTAINABILITY USING EMERGY ANALYSIS

Environmental Decision-making with Emergy
Food Production
Biofuels
Aquaculture
Forestry

SOCIAL AND POLICY ISSUES OF AGRICULTURE AND FOOD

Stages Underlying Contemporary Social and Policy Issues of Agriculture
Food Supply and Demand
Market Structure in Food Industries
Coping with Excess: The Problem of Obesity
Coping with Scarcity: Underdevelopment and Food Insecurity

DECISION SUPPORT SYSTEMS FOR FOOD AND AGRICULTURE

Systems Definition and Systems Theory

SPATIAL FOOD AND AGRICULTURAL DATA

Precision Agriculture
Spatial Data and Geographical Information System (GIS)
Food and Agricultural Product Traceability Systems
Infrastructures for Building, Upkeep and Use of Spatial Data

DATA ASSIMILATION SYSTEMS

Physical Properties of Biomaterials
Sensors and Data Acquisition Systems
Database and Data Utilization

STATISTICAL ANALYSIS DESIGN INCLUDING BIOSTATISTICS

The Need for Statistical Data Analysis
Principles of Statistical Analysis
Strategies for Statistical Data Analysis
Biostatistics

DATA PRESENTATION SYSTEMS

- Data Flow
- Tools for Data Presentation
- Conclusion

CROP MODELS - IN OPEN FIELD

- Brief history
- Crop modeling components
- Case Studies

CROP MODELS - WITHIN CONTROLLED ENVIRONMENT

- Crop Modeling
- Model Applications

FOOD PROCESSING MODELS

- Modeling Basic Transport Process and Kinetics

WATER RESOURCE MODELS

- Watershed-Scale Models
- Flow-Governing Equations
- Mathematical Bases of Watershed Models

AGRICULTURAL METEOROLOGICAL MODELS

- Approaches in Developing Agricultural Meteorological Models
- Models of Weather Variables not commonly measured
- Derived Weather Variables
- Models Linking the Microclimate to Atmospheric Forcing
- Crop, Livestock, Insect, and Disease Weather Response Models

DATA COLLECTION AND ANALYSIS METHODS FOR DATA FROM FIELD EXPERIMENTS

- Data Collection
- Methods for Data Analysis

TELECOMMUNICATIONS FOR DATA COLLECTION AND DISSEMINATION IN AGRICULTURAL APPLICATION

- Data Collection in Agriculture Production
- Wired Data Communication in Agriculture
- Wireless Data Communication in Agriculture
- Data Telecommunication Technology in Agriculture
- The Future of On-farm Data Telecommunication

FOOD RESEARCH AND DEVELOPMENT

- Non-destructive Quality Assessment of Foods
- Prediction of Microbial Growth in Foods
- Issues of Food Development in the 21st Century

WATERSHED MODELING FOR WATER RESOURCE MANAGEMENT

- SWAT Applications
- HSPF Applications
- DWSM Applications

METEOROLOGICAL FORECASTING FOR AGRICULTURAL PRODUCTION

- Application of Agricultural Meteorological Forecasts
- Meteorological Forecasts

Forecast Users

CURRENT USE AND PROSPECTS OF INFORMATICS IN MODELING, ANALYSIS AND MANAGEMENT OF NATURAL RESOURCES

Web-based Environmental Modeling System: A Case Study

Future Works

MANAGEMENT OF AGRICULTURAL, FORESTRY, AND FISHERIES ENTERPRISES

Challenge of Food and Fiber Production

Natural Resource Sectors

Natural Resource Enterprises

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ORGANIZATION OF AGRICULTURAL, FORESTRY, FISHERY, AND RURAL ENTERPRISES

The Nature of Resources

Major Factors Determining Resource Use

Major Factors Affecting Natural Resource Use

Organization for Resource Use

Special Resources: Energy, Food, and Water

Rates of Change and Changing Resources

Future Developments in Resource Use

COMMUNITY-BASED NATURAL RESOURCE MANAGEMENT

Benefits of Community-Based Natural Resource Management

Characteristics of Sustainable Community-Based Natural Resource Management

TRADITIONAL AND SMALL FARMS

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Historical Background

The Present Situation

Strategies for Dealing with Small Farms

State of the Art Approaches

INTERNATIONAL AGRICULTURAL COOPERATIVES

Cooperatives in Japan

Agricultural Cooperatives in Israel

Agricultural Cooperation in the Former Soviet Union

Agricultural Cooperatives in Canada

Agricultural Cooperatives in India

Agricultural Cooperatives in China

MARKETING BOARDS: AN INTERNATIONAL OVERVIEW

Introduction and Overview

The Functions of Marketing Relative to the Roles of Marketing Boards

Marketing Boards and Other Institutions of Market Intervention for Farm Products

Development, Focus, and Evolution of Marketing Boards

Types of Marketing Boards

Supply Management Marketing Boards

Some Examples of Marketing Boards and Government Boards for Agriculture

A Summary and Overview: Marketing Boards in the Future

COLLECTIVE AND STATE ENTERPRISES IN AGRICULTURE

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Collective Enterprises in Agriculture: a Historical Overview
Examples of Common/Collective Enterprises
An Evaluation of Collective Enterprises in Agriculture
State Agricultural Enterprises

CORPORATE CONCENTRATION AND SUPPLY CHAIN MANAGEMENT IN A GLOBAL FOOD INDUSTRY

Globalisation of Grocery Retailing
Food Manufacturing - The Clash of the titans
Supply Chain Partnerships for a Global Food Industry

PLANT MANAGEMENT SYSTEMS

Natures Building Blocks
Agroecosystems
Sustainable Agriculture Environmental Health
Integrated Approaches to PMS
The Costs of Technology
Meeting the Challenge of Environmentally Sustainable PMS

PLANT GENETIC RESOURCES

Importance and Utilization of Plant Genetic Resources
International Approaches to World Plant Germplasm Conservation and Use
Patterns of Plant Germplasm Use and Adoption
Collecting, Preserving, and Cataloguing Plant Genetic Resources
The Application of Plant Genetic Variation to Achieve Genetic Gains in Plants
Ownership and Access Issues in Plant Germplasm Conservation and Use

WATER MANAGEMENT

Importance of Water and Its Global Distribution
Cropping Systems for Sustainable Water Use
Irrigation
Drainage
Degradation of Water Resources

PLANT NUTRIENT MANAGEMENT

Macronutrients for Crop Production
Removal of Nutrients by Crops
Replacement of Soil Nutrients
Precision Farming
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MULTIPLE CROPPING SYSTEMS

Cropping Systems Terminology
Conservation Tillage
History of Multiple Cropping
Multiple-Cropping Systems in Less-Developed Countries
Multiple Cropping in Developed Countries

GREENHOUSE AND HYDROPONICS SYSTEMS

History
Definitions
Greenhouse Tomatoes
United States Greenhouse Tomato Demographics

- Global Greenhouse Tomato Demographics
- Market Saturation
- Essential Equipment for Growers
- Pollination
- Variety Selection
- Cluster Harvest
- Greenhouse Cherry Tomatoes
- Tips for New or Prospective Growers
- Information for New Growers

LIVESTOCK PRODUCTION SYSTEMS

- Role of Livestock in Food Systems
- Types of Livestock Systems
- Livestock Products in Human Nutrition
- Livestock Systems and the Environment
- Current and Future Challenges in Livestock Systems

GENETIC RESOURCES FOR LIVESTOCK PRODUCTION

- Animal Variability and Diversity
- Threats to Animal Diversity
- Steps Towards Better Management and Conservation of Animal Genetic Resources
- Management of Animal Genetic Resources

EXTENSIVE LIVESTOCK PRODUCTION: GRAZING MANAGEMENT ON RANGELANDS

- Grazing Intensity
- Grazing Studies in the United States
- Range Vegetation and Grazing System
- Livestock Performance and Grazing System
- Financial Returns and Grazing System
- Grazing Systems Versus Grazing Intensity
- Season of Use Versus Grazing Intensity
- Grazing Studies by Vegetation Type
- Consideration of Grazing Systems

LIVESTOCK PRODUCTION IN FEEDLOTS/LANDLESS SYSTEMS

- Animals
- Health
- Nutrition
- Growth Manipulation
- Marketing
- Waste Disposal/Nutrient Management

LIVESTOCK DIVERSIFICATION: ISSUES AND TRENDS

- Emergence
- Status of Farmed Wildlife
- Products and Markets
- Issues
- Future

CONTROLLED ADAPTIVE NATURAL RESOURCES MANAGEMENT

- Controlled Adaptive Natural Resources Conservation
- Need for Controlled Adaptive Approach

Philosophical Approach
Definitions and Basic Concepts
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FINANCIAL ASPECTS OF HUMAN RESOURCE DEVELOPMENT

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Early HRD Financial Analysis Classics
From Financial Analysis of Methods (FAM) to Forecasting Financial Benefits (FFB)
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Human Capital and the Individual: Training and HRD
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Education and human capital formation
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CULTURAL RESEARCH IN HUMAN RESOURCES DEVELOPMENT

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ELEMENTS OF PLANNING STRATEGIES FOR HUMAN RESOURCE DEVELOPMENT

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Human Resource Development Activities
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The Purpose of Needs Assessment
Levels of Assessment
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HUMAN RESOURCE DEVELOPMENT OBJECTIVES

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The challenge of defining HRD objectives
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Training as HRD activity for organizational growth
Designing HRD activities
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The desired outcomes of HRD activities
Three dozen ways to polarize the conceptualization of HRD activities
Constructing HRD activities: an HRD activities development process

HUMAN RESOURCE DEVELOPMENT PLANS

Planning is an imperative
Planning as learning is the key skill for business success
Two planning strategies for HRD
Planning, a strategy of action plans
Fluency in implementing work plans
Essential elements of planning as a science
Learning, another important element of HRD planning
The planning-learning cycle
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RESOURCE REQUIREMENTS FOR HUMAN RESOURCE DEVELOPMENT

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First Resource: HRD Professionals
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GLOBAL INTERDEPENDENCE AND BIOSOCIAL SYSTEMS

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ECOLOGICAL DIVERSITY AND MODERN HUMAN ADAPTATIONS

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DIVERSITY AND MULTICULTURALISM

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Multiculturalism and Cultural Diversity
The History of Diversity Efforts in the United States
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Group Process and the Personal Growth Movement
Current Thinking on Diversity Management
The Language of Diversity
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HUMAN DEVELOPMENT AND EQUITY

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SPIRITUALITY IN THE WORKPLACE

Spirituality & Leadership
Spirituality in the Organization: Frameworks to Consider
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HUMAN DEVELOPMENT AND CAUSES OF GLOBAL CHANGE

- Population Growth
- Economic Growth and Changes
- Technological Growth and Change
- Ecological and Environmental Changes
- Peace and Security
- The Tasks for Human Resource Development

WORLD POPULATION GROWTH AND THE ENVIRONMENT

- Ethical and conceptual issues
- Our uncertain knowledge of the environment
- The Impact of population growth on the environment
- What are the implications for population policy?
- Political and administrative difficulties in developing a global environmental policy

HUMAN RESOURCES AND ECONOMIC GROWTH

- Institutions and Trust in Early Societies
- Institutional Development
- Democracy and Human Development
- Economic Growth and Human Development in Nineteenth-Century Europe
- The Twentieth Century
- Political Systems and Human Development
- The Twenty-First Century
- The Moral Economy

WEB-BASED TRAINING

- Web-Based Learning Environment
- Web-Based Training Components and Features

HUMAN RESOURCE DEVELOPMENT AND ENVIRONMENTAL CHANGES

- Introduction: Human Resource Development and Environmental Change
- Global Environmental Change: The Response of Human Systems
- The Intertwining of Human Resource Development and Environmental Management: Education for Environmental Sustainability and Business Profitability
- Future Trends: A Strategic Partnership between HRD and Environmental Management

PEACE AND SECURITY

- Peace
- Security
- International Development Assistance and Conflict
- Peacebuilding

FINANCE AND HUMAN DEVELOPMENT

- How Finance Works: Value, Risk and Confidence
- Finance and Economic Growth
- Structural Adjustment, Financial Reform and Human Development
- Vulnerability in Financial Systems

CONSEQUENCES OF GLOBAL CHANGE FOR HUMAN RESOURCE DEVELOPMENT

- What constitutes 'global change'?
- Different views of 'global change'
- Global change - opportunity or threat?
- Other global trends

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Globalization, Market Triumphs and Life Support System Perils
Consequences of Economic Globalization for Ecology and Human Development
Taming the Market? Sustainable Human Development Alternatives

THE CONSEQUENCES OF GLOBAL SOCIAL CHANGE FOR HUMAN DEVELOPMENT

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VIRTUAL WORK: IMPLICATIONS FOR HUMAN AND ORGANIZATION DEVELOPMENT

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HUMAN RESOURCE POLICY IN SUSTAINABLE DEVELOPMENT:GLOBAL TRENDS IN HUMAN HEALTH

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Prevention and Control of Non-communicable Chronic Diseases
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HUMAN SECURITY:PERSPECTIVES FOR HUMAN RESOURCES AND POLICY MANAGEMENT

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- Decision-making
- Attitudes and behavior
- Changing attitudes
- Evaluating interventions
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- Conceptualizing Social Development
- Current Trends of Social Development
- The Emergent World Community
- The Global Expansion of Economy
- The Creation of a World Culture
- The Internationalization of Governance
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- The Nation-state
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SOCIAL DEVELOPMENT AND THE FAMILY

- Differences between a Domestic Group and a Family
- The Developmental Cycle of the Domestic Group
- The Universality Function of the Family
- Family Organization
- Types of Families
- The Nature of the Family
- Social Development in Relation to the Family
- The Family and the Nature of Change
- Patriarchy and Women
- Family Law and Women
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SOCIAL ECOLOGY IN URBAN SETTING

- Introduction: Human Ecology
- Territorial Organization
- Internal Organization of the City
- Urban Symbolic Ecology
- Urban Greenery and Agriculture
- Mega-urbanization

THE CONTEXT OF URBAN DEVELOPMENT POLICY

- Technology, Globalization, and Postmodernism
- Towards an Urbanized World
- Restructuring and Reinventing the Economies of Cities
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- The Ecological Challenge
- New Policy Paradigms
- Two Urban Development Programs

THE CONTEXT FOR RURAL DEVELOPMENT POLICY

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The Classification of Rural Societies
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Political Struggles and Land Ownership
Poverty in Rural Societies
Variations in Rural Society: Time and Space
Distinctions between Policy and Development
Survival of the Rural Poor: Poverty, Hunger, and Sustainable Development
How Green is the Green Revolution?
Approaches to Rural Development
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URBAN-RURAL DIMENSIONS OF SOCIAL DEVELOPMENT

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RURAL ISSUES IN DEVELOPED NATIONS

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Agriculture in the forefront of European integration: The '60's and '70's and the tragedy of success
Policy changes in the '80's and '90's: Economy and ecology
Prospects and issues in rural life in developed nations- towards a sustainable development of the countryside?

THE ROLE OF ETHNIC GROUPS IN SOCIAL DEVELOPMENT

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RELIGIOUS BELIEF AND RESOURCE DEVELOPMENT

Introduction: Culture, Religious Belief, and Worldview
Examples of Religious Belief and Worldview: Three North American Indian Tribes
Religious Beliefs Translated into Action: North American Indian Resource Management

GENDER DIMENSIONS OF SUSTAINABLE DEVELOPMENT

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Gender Differences in Education and Labor Market Outcomes

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Resource Use in Domestically Organized Cultures
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Equity and Human Rights: Economic, Social, Cultural, Civil and Political Rights.
Equity, Inequity, and global ecological pressure.
Equity and Sustainable Development: Providing for Environmental Balance and Basic Human Needs.

HEALTH - SOCIAL AND CULTURAL DEVELOPMENT INDICATORS

- A Framework for Core Indicators
- Historical Perspective
- Impact of Poverty on Health
- North–South Perspective and the Debt Crisis
- Impact of Population Pressure on Health
- Major Causes of Mortality
- Recent Trends in Health Thinking
- Global Burden of Disease Study 1992–1994, published 1996/7
- Cost-effectiveness of Health Interventions

DEVELOPMENT OF HUMAN AND SOCIAL DEVELOPMENT INDICATORS: HUMAN ASPIRATION AND SUSTAINABILITY

- Human Aspiration and Sustainability
- Sustainability Indicators and Accounting
- Economic Basis for Human and Social Development
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- Knowledge for Sustainable Development
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- Education for Sustainability

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- Educational Systems
- Sectors of Education
- Education Systems and Social Inclusion
- Cultural and Financial Dimensions
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- Assessment in an Education System
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- The Trends in Education for Sustainable Development
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ESSENTIAL OBJECTIVES OF EDUCATION

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- Meeting Needs and Reducing Barriers to Learning
- Action—Reflection—Action
- Ways of Expressing the Objectives of Education
- The Significance of Structures
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EDUCATION AND HUMAN DEVELOPMENT

- The Twentieth Century in the Context of World History
- The Twentieth Century -- the Century of Education
- Problems of the Development of Modern Education
- Main Directions of the Reformation of Education

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- Origins of education
- Science and education
- Education as a political and economical goal of a modern state

Education in global politics
International cooperation in the field of education
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PLANNING, ORGANIZATION, AND ADMINISTRATION OF EDUCATION

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Concepts of "Surroundings" and "Alienation of Knowledge" in Education
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HISTORICAL KNOWLEDGE. NATURE AND MAN: ORIENTATIONS TO HISTORICAL TIME

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The Cuban Missile Crisis
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BIO-SOCIAL KNOWLEDGE: HUMAN ADAPTATION IN DIFFERENT ECOLOGICAL NICHES OF THE WORLD

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Relationships of Human Adaptive Types with Ecological Forms of Animals and Plants
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Goals and Objectives of Early Education
Children's Health
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The priorities of Early Childhood
Children in the Family
A Model of Education: "Authoritarian" or "Democratic"?
Children and Nature Today
Children in Urban Environments
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TERTIARY OR POST-SECONDARY EDUCATION

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GRADUATE LEVEL EDUCATION

Peculiarities of Graduate and Postgraduate Education Systems in Western Europe and the USA

Graduate and Postgraduate Education Systems in Eastern/Central Europe

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GOING THE DISTANCE IN EDUCATION : TWENTY-FIRST CENTURY IMPERATIVES

Preface: An International Survey of Distance Education and Teacher Training: From Smoke Signals to Satellite

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Implications for the Future

Implications for Taiwan and Other Nations

LIFETIME LEARNING

Principles of Higher Education and Lifetime Learning

"Academic Lifetime Learning"—Definitions and Positions

Educative Aspects

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Lifetime Learning and the Reform of Higher Education

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Information technologies and human capital in post-Industrial society

Transition to a Public higher education and development of a system of educational services

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Russian Engineering School: From the Technocratic Approach to Education for Sustainable Development

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Salters Advanced Chemistry Project

Education in Global Change Project

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Psychological foundations: from behaviourism to constructivism
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Approaches to curriculum and instructional design in environmental education
Alternative perspectives in education for sustainable development
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Recent Tools: Aerial Photography and Remote-Sensing

Neglected Sources: Administrative Informations

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The fertility decline : a universal-but often delayed-phenomenon
Population trends : numbers and age structure
From population profile to economic size
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Global perspectives on the "human development"

THE DEMOGRAPHIC TRANSITION THEORY

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A massive health improvement
The state of literacy by major region at the end of the 20th century: Breakthroughs and slumps

ECONOMIC CONSEQUENCES OF THE DEMOGRAPHIC CHANGES

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Economic progress and demographic transition in poor countries: fifty years of experience, 1950-1999
Secular growth in the industrial world
Demographic aspects of modern economic growth
Economic breakthrough in poor countries

POPULATION, URBANISATION AND MIGRATION

Two centuries of urbanization 1800-2000
About 2.8 billion city dwellers in 2000
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Cities and slums in the third world
A further proliferation of megapolises : recent past and future
The future of urbanization; a skrinking occupation of space
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INVESTING IN THE FUTURE: POPULATION EDUCATION FOR YOUTH

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Education, Population, and Development
Empowering Young People through Education and Participation
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Women as Human Resources for Life Support Systems: An Overview
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Women and Environment—from Rio 1992 to Beijing 1995
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Services Require Attention to the Entire Supply Chain, not only to the Kiosk
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Kiosks do Better in Towns; Kiosks do Better in Remote Villages
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