Mathematical Biology

15:20-15:35 **T. Adeniran, R.O Ayeni**
Dept. of Pure and Applied Math., Ladoke Akintola Univ. of Technology, Ogbomoso, Nigeria

Title: **The Effect of Immunisation Rate on a Mathematical Model of Yellow Fever Epidemic**

Abstract: We revisit the mathematical model of yellow fever which involves the interactions of two principal communities of hosts (humans) and vectors (aedes aegypti mosquitoes)[6]. We extend the model to a situation where immunisation is non – permanent.
Using numerical technique, we evaluate S(t), R(t), I(t), N(t) and M(t) and show the immunisation and rate at which vaccine wanes have significant effects on the epidemic.

15:35–15:50 **Asrul Sani, Dirk P. Kroese**
Mathematics Department, University of Queensland, Brisbane, Australia, 4072

Title: **Stochastic Models For The Spread Of HIV In A Mobile Heterosexual Population**

Abstract: One of the most urgent world-wide public health problems is the AIDS (Acquired Immune Deficiency Syndrome) epidemic, caused by the Human Immunodeficiency Virus (HIV). The number of people infected with HIV/AIDS continues to rise at an alarming rate, especially in developing countries. The epidemic remains extremely dynamic, growing and changing character as the virus exploits new opportunities for transmission. An important factor in the dynamic transmission of HIV is the mobility of the population. In this paper we formulate various new stochastic models for the spread of HIV in a heterosexual mobile population, under the assumptions of constant and varying population sizes. We derive deterministic and diffusion analogues for these models, using a convenient rescaling technique, and analyze their stability conditions and equilibrium behavior. We illustrate the dynamic behavior of the models and their approximations via a range of numerical experiments. We show that the stochastic models are well approximated by their deterministic counterparts, and that around the endemic equilibrium the population process behaves like a multi-dimensional Ornstein-Uhlenbeck process.
Keyword: HIV/AIDS, Stochastic Modelling, Markov process, Multiple Patch, Mobility, Density Dependence, Deterministic and Diffusion Approximation

15:50–16:05 **Lusia Krismiyati Budiasih**
Departement of Mathematics, Institut Teknologi Bandung, Indonesia

Title: **Epidemiological Model for the Spread of Anti-Malarial Resistance and Its Economics Aspect**

Abstract: The spread of anti-malarial resistance is making malaria control increasingly difficult. Mathematical models for the transmission dynamics of resistant and sensitive strains of the parasite can be used as a tool to help to understand the factors that influence the spread of anti-malarial resistance, and they can help in thinking the strategic steps to control the spread of resistance.
Now it can be found that malaria parasite resistant to chloroquine. With increasing the resistance, attention has begun to be pressed in treatment strategies by using some new drugs such as ***sulfadoxine-pyrimethamine*** (SP), and artemisinin-based combination treatments (ACT). Although there are strong theoretical arguments in favor of switching to ACT, the validity of these arguments in the economics aspects has not been previously analyzed.
This paper presents an epidemiological framework to investigate the spread of anti-malarial resistance. Several mathematical models, based on Macdonald-Ross model of malaria transmission, enable to examine the processes and parameters that influenced in the spread of resistance and also can be used to examine the optimal treatment strategies.
In the simplest model, the resistance does not spread if the fraction of infected individuals treated is less than a threshold value. The threshold value is determined by the rates of infection and level of anti-malarial effectiveness. Using the developing of this model, it can be showed that in the appropriate level of treatment, the treatment strategy by using ACT early needs less cost than by SP in a few time and then replaced with ACT.
Keywords: malaria epidemiological model, spread of resistance, ACT, SP, treatment strategy

16:05–16:20 **Hermayanti, Ponidi, Arie Wibowo, Rahmi Rusin**
Department of Mathematics, University of Indonesia, Indonesia

Title: **The Effect of a Diagnosis Mechanism for SARS Epidemic**

Abstract: In this paper, we discuss the effect of a diagnosis mechanism for SARS epidemic. First, we derive the mathematical model of SARS epidemic with and without diagnosis mechanism, then from that model, a Basic Reproduction Ratio Number R_0 is obtained using the next generation operator approach. By comparing the dynamics of the two models, we will see

that diagnosis mechanism has a large effects in SARS epidemic.
Key-words: Basic Reproduction Ratio Number, epidemic, equilibrium, SEIJR, SARS.

16:20–16:35 **Setiawan Hadi[1], Adang Suwandi A.[2], Iping Supriana S.[2],Farid Wazdi[2]**
1) Universitas Padjadjaran, Bandung, Indonesia
2) Institut Teknologi Bandung, Indonesia

Title: **Mathematical Model of Skin Color for Face Detection**

Abstract: Skin is an important feature in images, and skin detection is the .rst step in several recognition tasks. Skin colour can be used to detect faces [2, 4, 5] or hands [6, 8, 9] in video images as well as in still images. Skin colour has also been used to detect images of naked people for Internet content altering [1, 3]. Skin colour can also be used to analyse medical images. For example, the ability to segment an image using skin colour can aid in the diagnosis of skin cancer [7]. In this paper, mathematical model of skin color is developed based on the RGB, *rg* and HSB color space representations. The model is developed by calculating mean chromaticity for each color spaces. After that, the covariance matrix is computed with assumed additional parameter. Mahalanobis distance from population is measured using bivariate Gasussian distribution. To measure how well the observed frequency distribution, the X^2 statistic is utilized. A large value for X^2 indicates that the distributions are di.erent, whereas a small value indicates the the distributions are similar. This model will be utilized as the .rst step of face detection tasks, that is to .nd and locate faces in images. The experiment that has been conducted, utilized 114 objects which are selected from FERET Color Face Database (obtained directly in 2 DVD's from NIST), 44 objects from our departmental face database (UNPAD) and 63 objects from various multimedia resources. Images from FERET database consist of non-Indonesian people, meanwhile the other 107 images are Indonesian (9 images are pictures of east-Indonesia people). These images consist of unwanted information like background or non-facial part of the body, therefore, semi-manual segementation task is conducted to localize faces-only images. Moreover, images also are taken using variable condition in illumination and position, so some image processing techniques are applied to standardize the images.

Keywords: Skin color model, face detection

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16:35–16:50 **S. Munzir, L.S. Jennings, M.T. Koh**
School of Mathematics and Statistics-UWA, Crawley, WA, Australia.

Title: **A Simulation Study for Estimation of Torques and Body Segment Parameters from Biomechanic Displacement Data Using Optimal Control**

Abstract: This work is a preliminary simulation study of the use of dynamic optimization for biomechanical systems to simultaneously obtain joint torques and body segment parameters, while smoothing kinematic raw data of biomechanic subjects obtained from film or video. Angular displacement data is generated through forward integration, by intuitively assigning an appropriate set of torques to segments over a time horizon. The raw data smoothing approach is implemented in the form of an additional inequality constraint similar to the splines smoothing. The formulation is tested on a two segment rigid body, with the assumption that the mass is uniformly distributed as a rod. The simulation results show the formulation capabilities and weaknesses in computing torques and body segment parameters from noisy simulated data.

Keyword: optimal control, biomechanics, BSP estimation, dynamic optimization