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Application of SENLAN SB60 in Flow Variable Frequency Speed Control System

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Abstract. The frequency speed control system in flow control based on SENLAN SB60 frequency converter is made up of input set value and actual value which is the feedback voltage signal given by flow sensor, then adjusted by process PID automatic control, changes output frequency to regulate the speed of three-phase asynchronous motor to achieve the purpose of speed regulation, thus the tank's flow control can be obtained .

Introduction

With rapid development of modern technology, frequency converter to realize ac motor speed control has been widely used in the production practice. With SB60 frequency converter's basic functions and flow sensor's automatic detection function, the following flow frequency speed control system can adjust motor's speed according to practical needs. Voltage signal can be got through turbine flow sensor's signal transformation whose conversion of voltage signal is 0 ~ 5 v and feedback to VR1 end of frequency converter. According to given value input and the actual value of feedback, the frequency converter uses PID adjustment to change frequency output value and adjust the control of three-phase asynchronous motor's speed, thus the purpose of speed regulation is achieved, so as to realize the control of water tank's flow. The diagram of flow frequency speed control system is shown as in Figure.1

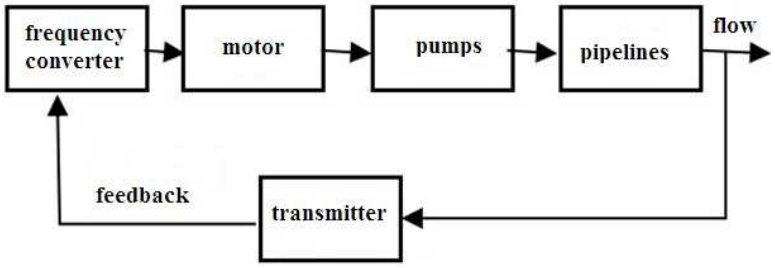

Figure.1 Diagram of flow frequency speed control system

The design and analysis of flow frequency speed control system

Flow frequency speed control system is shown in Figure.2. A major advantage of negative feedback control system is that the output signal after detecting element is fed back to the system's input and compared with given value, then after regulator's treatment the deviation signal is changed into another one controlling the process, so as to keep the controller basically constant regardless of system's internal and external disturbance influence.

The control quality totally depends on the inverter controller's structure and parameters . Proportional controller is adjusting proportion δ to achieve the system's control. As δ is smaller, the system's residual is smaller, but dynamic performance indexes such as overshoot volume is worse.On the contrary, as δ is bigger, the system's residual is bigger too while system's dynamic process slower and the overshoot volume is smaller. The proportional controller's effect has two parts: proportional part to the deviation and deviation's integral part. Integral function can make the system no residual

error, but integral time constant cannot be too small, or it will make the system's dynamic performance worser and even instability.

PID controller can not only realize the system's no residual error but also improve its stability and rapidity of response.Proportional control(P) is first introduced in PID adjustment process, in case of stability, it can reduce static error and improve accuracy, but increasing P can not completely eliminate the steady-state error.Then the integral control(I) is introduced to eliminate the steady-state error and improve the control precision. Finally differential control(D) is introduced to reduce the overshoot and improve the quality of system. Frequency converter adjusts PID parameters according to the deviation, when running parameters are far away from the required parameters, adjusting amplitude is accelerated, with gradually close to the deviation, the adjustable amplitude decreases gradually, when they gradually approach, the system achieves a dynamic balance maintaining a constant speed of the closed-loop system.

The above system's parameter values are adopted as following: proportional gain (P) is 1; sampling period is 0.2 ; integration time T_i is 3 min; differential time T_d is 1 min; differential gain (D) is 10, the above can debugged according to practical situation.

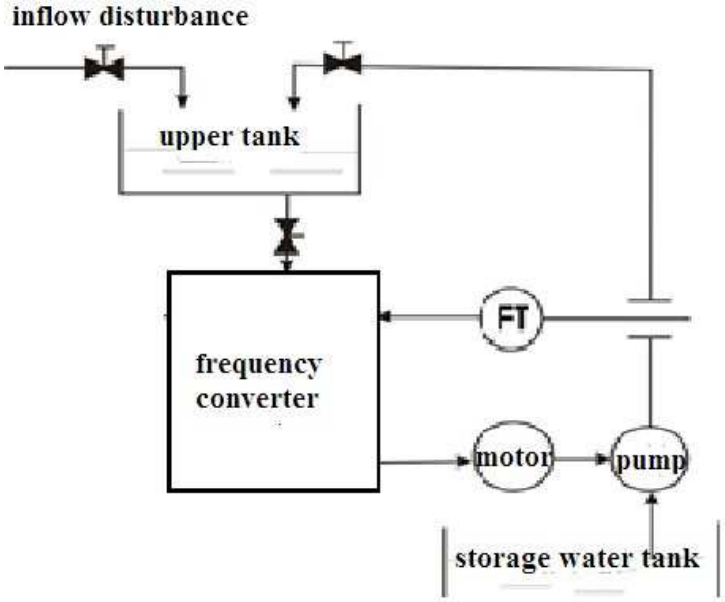

Figure.2 Structure chart of flow frequency speed control system

Choice of turbine flowmeter

Turbine flow sensor's structure is shown in Figure.3, it is mainly composed of shell, former guide frame, clamping ring on impeller, guide frame, and band amplifier magnetoelectric induction converters, etc. When detecting current flows through the sensor, its impeller creates a rotating by the fluid kinetic energy, the impeller changes the magnetic resistance of magnetoelectric induction coefficient periodically, so that the electrical pulse signal is produced through the coil magnetic flux cyclical changes, sent to the corresponding flow integrating instrument after the amplifier's amplification, and measured in quantity or amount.

The turbine flow sensor's parameters are: 0 ~ 5 v voltage corresponding to the flow of 0 ~ 75 ml/S (1 v voltage corresponding to 15 ml/S flow).

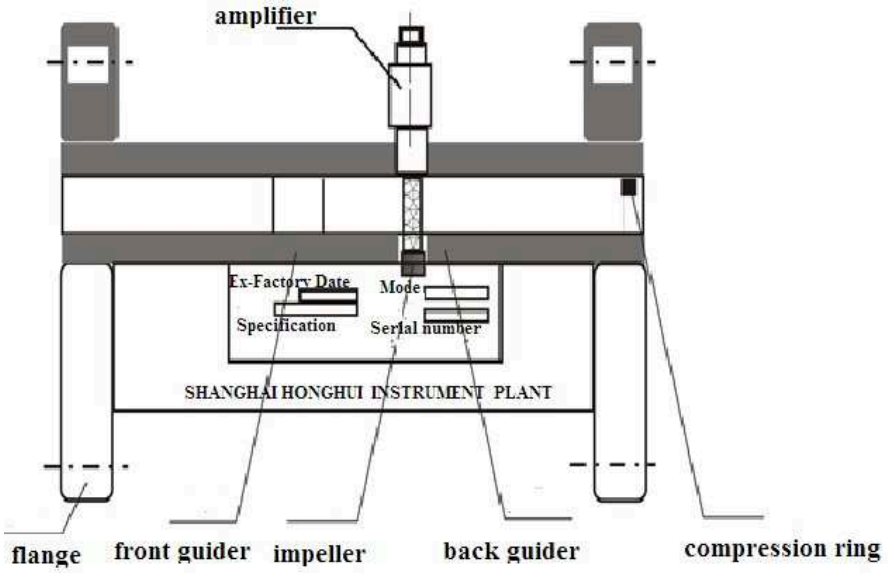

Figure.3 LWGY turbine flow sensor structure

Converter's related parameters' setting

Main parameters are set as following Table.1:

Table.1 Main parameters of the converter

Code	Function	Value	Code	Function	Value
F103	Torque increase	4	F012	Electronic thermal protection value	100
F000	Given frequency	50	F801	Value 1	50
F002	Lord given	1	F805	Feedback signal selection	0
F004	Given way	1	F806	Feedback channel 1	0
F006	Two line control mode	0	F807	Feedback channel 2	0
F009	Speed up time	15	F808	Feedback channel 1	0
F010	Deceleration time	5	F809	Feedback channel 1	1
F013	U/F closed loop	0	F810	Feedback channel 1	1
F811	Feedback channel 2	0	F812	Feedback channel 2	1
F813	Feedback channel 2 gain	0.4	F115	Automatic energy-saving	1
F100	Line voltage/frequency	0	F814	Proportional gain	1
F816	Differential time	1	F815	Integration time	3
F118	Prevent stall over voltage	2	F817	Differential gain	10
F119	Prevent stall over current	1	F120	Speed loss value	80
F833	Sensor range	5	F818	Sampling period	0.2

Summary

Compared with traditional flow control system, for the adoption of Senlan converter, constant frequency flow control system has advantages as: high clean, energy saving, convenient operation, high automation and high load capacity of water supply, long service life, etc. The system has no cistern, pressure tank, saves raw materials, reduces the investment, it can be used for production and agriculture, also for water supply devices, constant pressure spray system,and so on, so it has a broad application prospect.

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