I-FA04 Intelligent Control 1

09:00-11:00 **Chair : Tae Yong Kuc (Sung Kyun Kwan Univ.)**
Room : C203 **Co-Chair : Muraoka Tefsuya (Gunma Polytechnic College)**

09:00 – 09:20 **I-FA04-1**

Fuzzy PI-PLL Control for DC Motors

Phuwanat Damrongporn and Pitikhate Sooraksa
(King Mongkut's Institute of Technology Ladkrabang)

A phase lock loop (PLL) circuit is a well-known electronic circuit in communication engineering and other areas. In this paper, we present application of the PLL and fuzzy logic for DC motor control which are mixed well to be more effective for motor control. With this scheme, the control system can reach the set point rapidly, especially, it can eliminate noises. In addition, the PLL makes the system to have more stability; whereas, fuzzy logic controls helping PLL to be able to lock rapidly for a good response. The experiment result shows that the proposed control system works more efficacious. By performance comparison between the pure PLL control and the hybrid architecture of PLL with the fuzzy control, the result reveals the hybrid control...

09:20 – 09:40 **I-FA04-2**

Modified Ziegler-Nichols PID Controller Design using the Fuzzy Logic System

Kyung-kwon Jung, Ki-hwan Eom (Dongguk Univ.), Sung-boo Chung(Seoil College), Hyun-kwan Lee(Honam Univ.), Dong-seol Son(Yuhan College),

In this paper, we propose a modified Ziegler-Nichols PID controller using the fuzzy logic system. The proposed method is to parameterize a Ziegler-Nichols formula with a single parameter, and use the fuzzy logic system for automatic tuning of a single parameter of the modified Ziegler-Nichols formula. The fuzzy logic system has simple nine control rules. In order to verify the effectiveness of the proposed method, we simulated with the servo system. Simulation results demonstrate that better control performance can be achieved when compared with that of the Ziegler-Nichols PID controller.

09:40 – 10:00 **I-FA04-3**

Fuzzy Forecast of Nonlinear Time-series Data

Komei Hirohashi, Hayao Miyagi (Univ. of the Ryukyus)
& Katsumi Yamashita (Osaka Prefecture Univ.)

The field of forecasting is considered as an application of time-series analysis even if the data is linear or nonlinear. To obtain the forecasted values from observed data exerts a big influence on the decision-making support system or the control of machine etc. The nonlinear data appear as the random enumerated data. However we sometimes find that the pattern of past appearance repeats itself when we try to observe these data locally. From this point of view, we propose a way of forecasting nonlinear data from the pattern of past appearance using fuzzy theory. The advantages of the method are that we can forecast the next data by small numbers of previous data, and react to some differences, considering the ambiguous mature of the given data.

10:00 – 10:20 **I-FA04-4**

A Learning Controller for Gate Control of Biped Walking Robot using Fourier Series Approximation

Dong-cheol Lim and Tae-yong Kuc
(SungKyunKwan Univ.)

A learning controller is presented for repetitive walking motion of biped robot. The learning control scheme learns the approximate inverse dynamics input of biped walking robot and uses the learned input pattern to generate an input profile of different walking motion from that learnt. In the learning controller, the PID feedback controller takes part in stabilizing the transient response of robot dynamics while the feedforwar –d learning controller plays a role in computing the desired actuator torques for feedforward nonlinear dynamics compensation in steady state. It is shown that all the error signals in the learning control system are bounded and the robot motion trajectory converges to the desired one asymptotically. The proposed learning control scheme is...

10:20 – 10:40 **I-FA04-5**

Safe and Comfortable Electromotive Cart for People of Advanced Age

Noboru Nakashima, Tetsuya Muraoka (Gunma Polytechnic College),
Kiyoshi Kojima (Kiyonari-Seiko Co.)

When the people of advanced age drive the public electromotive cart of tricycle type on the slant and bumpy roads, the viewing angle of driver changes at the different directions. So the risk of traffic accident is increased. For the improvement of the above problem, we had produced the first experimental cart installed to the new driver's seat based on the 2π control theory. Based on the results of the driving test for the first experimental cart, we have produced the safe and comfortable electromotive cart.

10:20 – 11:00 **I-FA04-6**

3-DOF Attitude Control of a Model Helicopter based on Explicit Decoupling and Adaptive Control Scheme

M. S. Park and S.K. Hong

(Ajou Univ.)

This paper describes a 3-DOF attitude control of a small model helicopter in hover through explicit decoupling and adaptive control scheme. A model helicopter mounted on gimbal-stand is considered as a system that has 3 independent SISO systems representing motions about roll, pitch and yaw axis and these subsystems are identified from the test flight data. In this consideration, the contribution of others to yaw channel is neglected since it is relatively small. Two PID controllers based on Ziegler-Nichols method are designed for roll pitch channels independently. Also, adaptive fuzzy tuner is designed and applied to those PID controllers to cope with coupling effects between each channel and system uncertainties due to variation of engine RPM. The experimental results show that the attitude control...