# I-TE05

# Identification and Estimation 3

15:20-17:20          **Chair : Han Seong Ho (Korea Railroad Research Institute)**
Room : C204          **Co-Chair : Takita Yoshihiro(National Defense Academy)**

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**15:20 – 15:40**                          I-TE05-1

### Thrust Force Estimation using Flexible Neural Networks

Myeong Hee Kim, Shigeyasu Kawaji (Kumamoto Univ.),
Masaki Arao(Social System Business Company)

The drilling process has a great importance for the production technology due to its widerspread use in the manufacturing industry. In order to enhance a maximum production rate and prevent the drill from the damage, it is important to monitor and control the drilling system. Thrust force and cutting torque are the main output variables in the design of drilling control systems. In this paper, an alternative estimation method of thrust force by using flexible neural networks is proposed. Flexible neural network uses the sigmoid activation function with adjustable parameter in order to enhance the approximation accuracy...

**15:40 – 16:00**                          I-TE05-2

### On the zeros of a multivariable discrete-time control system with approximate fractional order hold

Shan Liang, Mitsuaki Ishitobi, Qin Zhu
(Kumamoto Univ.)

This paper is concerned with the limiting zeros, as the sampling period tends to zero, of a multivariable discrete-time system composed of an approximate fractional-order hold (AFROH), a continuous-time plant and a sampler in cascade. An approximate fractional-order hold is proposed to implement fractional-order hold (FROH) and is applied to instead of the zero-order hold (ZOH). The implementing problem of the fractional-order hold is overcome. The properties of the limiting zeros are studied and the location problem of them is solved. In addition, a stability condition of the zeros for suffciently small sampling period is derived...

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**16:00 – 16:20**                          I-TE05-3

### Control of a welfare liferobot guided by voice commands

Masanori Sugisaka, Xinjian Fan(Oita Univ.)

This paper describes the control of a health care robot (called Welfare Liferobot) with voice commands. The welfare liferobot is an intelligent autonomous mobile robot with its own control system on-board and the set of sensors to perceive an environment. It is a natural way to control the welfare liferobot by use of voice command for the usage of keyboard and mouse may present a difficult problem to the elderly and the handicapped. Voice input as the main control modality can offer many advantages. A set of oral commands is included, and each command has its associated function. These control words (commands) have to be chosen by user. Each time a voice command is recognized by the robot, it executes the pre-assigned action...

**16:20 – 16:40**                          I-TE05-4

### Design of Optimal control for Automatic Train Operation system in EMU

Seong-Ho Han, Su-Gil Lee, Soo-Gon Kim, Woo-Dong Lee
(KRRI)

The automatic-driverless operation, a very important technique for metro railways, is necessary for achieving higher safety, greater reliability, and bigger transport capacity. To achieve these things, we have to build up the system design and testing techniques for the railway system operation. These techniques are related to the onboard train control and communication systems which include TCMS(Train Control and Monitoring System), ATO(automatic train Operation), ATC (Automatic train Control), and TWC(Train to wayside communication). These sub-systems should interface not only with each other but also between the sub-systems and the signal system on the ground. For the saving of energy, we designed coasting strategy of ATO system. In this paper, we developed ATO system and tested on the test line and ...

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**16:40 – 17:00**                          I-TE05-5

### Adaptive LQG Control for Semi-Active Suspension Systems: Disturbance Rejection Capability

Hyun-Chul Sohn, Kyung-Tae Hong, Keum-Shik Hong
(Pusan National Univ.)

In this paper, a road-adaptive LQG control for the semi-active Macpherson strut suspension system of hydraulic type is investigated. A new control-oriented model, which incorporates the rotational motion of the unsprung mass, is introduced. A semi-active suspension controller adapting to road variations is proposed. First, based on the extended least squares estimation algorithm, a LQG controller adapting to the estimated road characteristics is designed. Through the computer simulations, the performance of the proposed semi-active suspension is compared with that of a non-adaptive one. The results show better control performance of the proposed system over the compared one.

**17:00 – 17:20**                          I-TE05-6

### Indirect self-tuning regulator with loopshaping

Wei Xie, Yuji Kamiya
(Kitami Institute of Technology)

In this paper a new indirect robust self-tuning regulator is proposed including an inverse system of a plant and a robust compensator such that it achieves the desired frequency shape specified by solving the mixed $H^\infty$ sensitivity problem within a prescribed tolerance in the $H^\infty$ norm. Consequently, in the proposed self-tuning regulator, robust stability is guaranteed in spite of the identification error.