Keynote speech info for ITET2022

Short bio

Professor Makoto Iwasaki, Dr. Eng., IEEE Fellow, IEE Japan Fellow

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Makoto Iwasaki received the B.S., M.S., and Dr. Eng. degrees in electrical and computer engineering from Nagoya Institute of Technology, Nagoya, Japan, in 1986, 1988, and 1991, respectively. He is currently a Professor at the Department of Electrical and Mechanical Engineering, Nagoya Institute of Technology.

As professional contributions of the IEEE, he has participated in various organizing services, such as, a Co-Editors-in-Chief for IEEE Transactions on Industrial Electronics since 2016, a Vice President for Planning and Development in term of 2018 to 2021, etc. He is IEEE fellow class 2015 for "contributions to fast and precise positioning in motion controller design".

He has received many academic, foundation, and government awards, like the Best Paper and Technical Awards of IEE Japan, the Nagamori Award, the Ichimura Prize, and the Commendation for Science and Technology by the Japanese Minister of Education, respectively. He is also a fellow of IEE Japan, and a member of Science Council of Japan.

His current research interests are the applications of control theories to linear/nonlinear modeling and precision positioning, through various collaborative research activities with industries.

Title of the speech

“GA-Based Practical System Identification and Auto-Tuning for Industrial Robots”

Abstract of the speech

Fast-response and high-precision motion control is one of indispensable techniques in a wide variety of high performance mechatronic systems including micro and/or nano scale motion, such as data storage devices, machine tools, manufacturing tools for electronics components, and industrial robots, from the standpoints of high productivity, high quality of products, and total cost reduction. In those applications, the required specifications in the motion performance, e.g. response/settling time, trajectory/settling accuracy, etc., should be sufficiently achieved. In addition, the robustness against disturbances and/or uncertainties, the mechanical

vibration suppression, and the adaptation capability against variations in mechanisms should be essential properties to be provided in the performance.

The keynote speech presents a practical auto-tuning technique based on a genetic algorithm (GA) for servo controllers of multi-axis industrial robots. Compared to conventional manual tuning techniques, the auto-tuning technique can save the time and cost of controller tuning by skilled engineers, can reduce performance deviation among products, and can achieve higher control performance. The technique consists of two main processes: one is an autonomous system identification process, involving the use of actual motion profiles of a typical robot. The other is, on the other hand, an autonomous control gain tuning process in the frequency and time domains, involving the use of GA, which satisfies the required tuning control specifications, e.g., control performance, execution time, stability, and practical applicability in industries. The proposed technique has been practically evaluated through experiments performed with an actual six-axis industrial robot.