

Keynote speech info for WAIE2021



Short bio

Professor Makoto Iwasaki, Dr. Eng., IEEE 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. Since 1991, he has been with the Department of Computer Science and Engineering, Nagoya Institute of Technology, where he is currently a Professor at the Department of Electrical and Mechanical Engineering.

As professional contributions of the IEEE, he has been an AdCom member of IES in term of 2010 to 2019, a Technical Editor for IEEE/ASME TMech from 2010 to 2014, an Associate Editor for IEEE TIE since 2014, a Management Committee member of IEEE/ASME TMech (Secretary in 2016 and Treasurer in 2017), a Co-Editors-in-Chief for IEEE TIE since 2016, a Vice President for Planning and Development in term of 2018 to 2021, respectively. He is IEEE fellow class 2015 for "contributions to fast and precise positioning in motion controller design".

He has received the Best Paper Award of Trans of IEE Japan in 2013, the Best Paper Award of Fanuc FA Robot Foundation in 2011, the Technical Development Award of IEE Japan in 2017, the Nagamori Awards in 2017, the Ichimura Prize in Industry for Excellent Achievement of Ichimura Foundation for New Technology in 2018, the Technology Award of the Japan Society for Precision Engineering in 2018, and the Commendation for Science and Technology by the Japanese Minister of Education in 2019, respectively. 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 Multi-Axis 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, reduce performance deviation among products, and 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.