

Tutorial Proposal

Title: Advanced Motion Control for Vibration Suppression: from Theory to Applications

1. Presenters:

Professor Seiichiro Katsura Keio University

katsura@sd.keio.ac.jp

Professor Kiyoshi Ohishi Nagaoka University of Technology

ohishi@vos.nagaokaut.ac.jp

Professor Krzysztof Szabat Wroclaw University of Science and Technology

krzysztof.szabat@pwr.edu.pl

2. Brief description

Recently, progress in performance of computer and control techniques has contributed to rapid and accurate control of industrial machines and robots. However, the rapid movements excite the mechanical resonances, which prevent the machines and robots from further improvement of rapidness and accuracy. In addition, time delay included in a communication system or D/A converter decreases phase margin of a controlled system, and it also induces vibrations. Therefore, in order to realize the further rapid and accurate motion of machines and robots, vibration suppression of mechanical resonance and time-delay compensation should be considered in the control design. In this Tutorial, 3 speakers will give lectures about vibration control of motion systems from theory to industry applications.

3. Outline

1. Introduction of the Tutorial and Modeling of Vibration Systems

Professor Seiichiro Katsura: 25min (inc. 5min Q&A)

2. Vibration Control Based on Disturbance Observer

Professor Kiyoshi Ohishi: 40min (inc. 10min Q&A)

3. Model Predictive Control of Vibration Systems

Professor Krzysztof Szabat: 40min (inc. 10min Q&A)

4. Summary (15min)

4. Publications

Seiichiro Katsura, Kouhei Ohnishi: "Absolute Stabilization of Multi-Mass Resonant System by Phase-Lead Compensator Based on Disturbance Observer," *IEEE Transactions on Industrial Electronics*, Vol. 54, No. 6, pp. 3389-3396, 2007.

Yuki Yokokura, **Kiyoshi Ohishi**: "Fine Load-Side Acceleration Control Based on Torsion Torque Sensing of Two-Inertia System," *IEEE Transactions on Industrial Electronics*, Vol. 67, No. 1, pp. 768-777, 2020.

Krzysztof Szabat, Than Tran-Van, Marcin Kamiński: "A Modified Fuzzy Luenberger Observer for a Two-Mass Drive System," *IEEE Transactions on Industrial Informatics*, Vol. 11, No. 2, pp. 531-539, 2015.

5. Presenter's biography (IEEE style):

Seiichiro Katsura (S'03-M'04) (katsura@sd.keio.ac.jp)



received the B.E. degree in system design engineering and the M.E. and Ph.D. degrees in integrated design engineering from Keio University, Yokohama, Japan, in 2001, 2002 and 2004, respectively.

From 2003 to 2005, he was a Research Fellow of the Japan Society for the Promotion of Science (JSPS). From 2005 to 2008, he worked at Nagaoka University of Technology, Nagaoka, Niigata, Japan. Since 2008, he has been at Department of System Design Engineering, Keio University, Yokohama, Japan. Currently he is working as a Professor.

His research interests include applied abstraction, human support, data robotics, wave system, systems energy conversion, and electromechanical integration systems. Prof. Katsura serves as an Associate Editor of the IEEE Transactions on Industrial Electronics and Technical Editor of IEEE/ASME Transactions on Mechatronics. He was the recipient of The Institute of Electrical Engineers of Japan (IEEJ) Distinguished Paper Awards in 2003 and 2017, IEEE Industrial Electronics Society Best Conference Paper Award in 2012, and JSPS Prize in 2016.

Kiyoshi Ohishi (M'86-SM'08-F'15) (ohishi@vos.nagaokaut.ac.jp)



received the B.E., M.E., and Ph.D. degrees in electrical engineering from Keio University, Yokohama, Japan, in 1981, 1983, and 1986, respectively. From 1986 to 1993, he was an Associate Professor with the Osaka Institute of Technology, Osaka, Japan. Since 1993, he has been with the Nagaoka University of Technology, Nagaoka, Japan, where he became a Professor in 2003. His research interests include motion control, mechatronics, robotics, and power electronics.

Prof. Ohishi is a General chair of the Annual Conference of the IEEE Industrial Electronics Society 2015. He is a General chair of IEEE International Workshop on Advanced Motion Control 2010 and 2016. He also contributes as an AdCom Member of the IEEE Industrial Electronics Society and an Associate Editor for the IEEE Transactions on Industrial Electronics. He is a member of the Institute of Electrical Engineering of Japan and the Robotics Society of Japan.

He received the Outstanding Paper Awards at 11th Annual Conference of the IEEE Industrial Electronics Society (IECON'85) and Best Paper Awards at the 28th Annual Conference of the IEEE Industrial Electronics Society (IECON'02) and the 30th Annual Conference of the IEEE Industrial Electronics Society (IECON'04) from the IEEE Industrial Electronics Society.

Krzysztof Szabat (krzysztof.szabat@pwr.edu.pl)



received the Ph.D. and D.Sc. degrees from the Electrical Engineering Faculty of Wroclaw University of Technology, Wroclaw, Poland, in 2003 and 2008, respectively. In 2016 he was awarded with the title Professor of Technical Sciences. Since 1999 he has been a Member of the academic staff with Faculty of Electrical Engineering, Wroclaw University of Technology. He is the author and coauthor of over 100 journal and conference papers. His main field of interest is the application of the control theory, artificial intelligence methods, and microprocessor techniques to motion control. Prof. Szabat had scientific/didactic stays in the universities in Germany, Ireland, UK, Croatia and Russia.