CRA Distinguished Lecture Series

Centre for Robotics and Automation
香港城市大學
City University of Hong Kong

A New Paradigm for Signals and Control

Professor Yutaka Yamamoto

Professor Emeritus
Kyoto University

Date: 4 December 2023 (Monday)
Time: 2:00 pm
Venue: P4302 (Pruple Zone), 4/F, Yeung Kin Man Acad Building

Abstract

Modern technology has induced the strong trend of replacing conventional analog processing techniques by digital counterparts. The versatility of digital processing gives us the impression of almighty power of handling real-world problems. However, the real story is not all that simple, and we are confronted with various practical limitations. Of particular importance is that of bandwidth. Namely, digital processing places an upper bound for the maximum frequency band that we can deal with. Examples abound: the limitation of 20kHz in compact disc recordings; the lack of resolution in image processing due to limited sampling rates; rejection of high-frequency disturbance that is beyond the so-called Nyquist frequency, and also many others. All these problems reduce to one generic problem, namely, how one can obtain suitable signal actions in spite of the limited resolution due to a finite sampling period. The celebrated Shannon sampling theory seems to negate this hope: it claims that there is an absolute upper bound for processing digital signals, namely the Nyquist frequency.

In this talk, we will clarify that this conclusion hinges upon an presumptuous hypothesis on the nature of signals, and can be replaced by another hypothesis on a physical model of the class of signals we are dealing with. Based on such a signal model, we can develop a new technique of obtaining high frequency components beyond the Nyquist frequency. We will base this new theory on the H-infinity sampled-data control theory, and exhibit various striking applications in signal processing, and also the control of signals beyond the Nyquist frequency.

Biography

Yutaka Yamamoto received his B.S. and M.S. degrees in engineering from Kyoto University, Kyoto, Japan in 1972 and 1974, respectively, and the M.S. and Ph.D. degree in mathematics from the University of Florida, in 1976 and 1978, respectively. From 1978 to 1987 he was with Department of Applied Mathematics and Physics, Kyoto University. In 1987 he joined the Department of Applied Systems Science as an Associate Professor, and became a professor in 1997. He had been a professor at the Department of Applied Analysis and Complex Dynamical Systems, Graduate School of Informatics of Kyoto University until 2015. He is now Professor Emeritus of Kyoto University.

His research and teaching interests are in realization and robust control of distributed parameter systems, learning control systems, and sampled-data systems, its application to digital signal processing, with emphasis on sound and image processing.

All are welcome

Enquiry: craoffice@cityu.edu.hk
3442-4699