

KIOS Distinguished Lecture Series



Prof. Petros Ioannou

Electrical Engineering Systems
University of Southern California

Friday, **11 March 2022**, 11:00 – 12:00 | Amphitheatre **LRC012**

Or via zoom: https://ucy.zoom.us/meeting/register/tJlrf--rrDMjG9HQ_6OxL10FLoAD1VpCm5Bi

Rejection of Vibrations with Unknown Frequencies using Robust and Adaptive Feedback

LECTURE ABSTRACT

The suppression of unknown narrow band disturbances with time-varying characteristics has many industrial applications. The narrow band disturbances get mixed up with broadband noise of lower amplitude and usually appear at the output of the system. The objective is to use feedback to attenuate or reject the narrow band disturbances without amplifying the broadband noise. In this talk we present the design and analysis of an effective robust adaptive scheme that rejects the narrow band disturbances whose characteristics can change with time without amplifying the output noise and in the presence of plant unmodeled dynamics.

The techniques used include an overparametrized robust adaptive filter that provides enough freedom to adaptively search for parameters that achieve both objectives namely disturbance rejection and guarantees no noise amplification. In addition, it includes a feed forward filter to increase the gain of the system over the frequency range of the narrow band disturbances and therefore allow the zeros of the plant to be closer to those of the internal model of the disturbance without sacrificing performance. The problem of rejecting the unknown narrow band disturbance when the plant model parameters are unknown or change with time is solved in the case of minimum phase plant models by using a different feedback control structure that is based on adaptive pole placement control. The results are developed for SISO and MIMO LTI systems both in discrete and continuous time domain. Simulation results based on a model of a laser beam device are used to demonstrate the results.

BRIEF BIO

Petros Ioannou is a Professor in the Department of Electrical and Computer Engineering at the University of Southern California and holds the A.V 'Bal' Balakrishnan Endowed Chair. He also holds courtesy appointments with the Department of Aerospace and Mechanical Engineering and Department of Industrial Systems Engineering. He is the founder and Director of the Center for Advanced Transportation Technologies and co founder and Associate Director for Research of the University Transportation Center METRANS at the University of Southern California. Dr. Ioannou was the recipient of the Axelby Outstanding Paper Award by the IEEE Control System Society in 1984 and the recipient of a 1985 Presidential Young Investigator Award for his research in Adaptive Control. In 2009 he received the IEEE Intelligent Transportation Systems Society (ITSS) Outstanding Application Award and the 2009 IET Heaviside Medal for Achievement in Control. In 2012 he received the IEEE ITSS Research Award and in 2016 the IEEE Transportation Technologies Field Award. In 2022 he was inducted to the National Academy of Engineering.

Dr. Ioannou is a Fellow of IEEE, IFAC and AAAS and the author/co-author of 9 books and over 400 research papers in the area of controls and applications and intelligent transportation systems.

