

EECS Seminar Series

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AGH University of Science & Technology

“The Optimal Integral Observers for the Exact State Reconstruction”

Tuesday, Sept. 29, 2009 • 12:00 p.m. • Harris Center (HEC) 102

The general theory of the optimal state observers for the exact state reconstruction in linear systems will be presented. Its application to state observation and the LQR stabilization control will be presented.

The power of modern computers makes application of the other than Luenberger and Kalman Filter type state observation algorithms possible. They originate directly from the definition of the exact observability, reconstruct the state exactly (non-asymptotically) and in finite time interval. The structure of the observer is given by two inner products in function spaces of the output $y \in Y = L_2[0, T]$ and input $u \in U = L_2[0, T]$ measurements and special observation functions $G_1(\tau)$, $G_2(\tau)$, respectively. The inner products are defined as the integrals on finite time interval $[0, T]$. By the optimal choice of the functions $G_{1,2}(\tau)$ the norm of the observer is minimized. It guarantees the exact state observation if the measurements are perfect and the minimal error of the state reconstruction in the case of the worst disturbances with bounded norm in y and u measurements. In on-line application the version of the observer with Moving Observation Window will be presented.

WITOLD BYRSKI

Witold Byrski received the M.Sc. degree in Electrical Engineering in 1971 and in 1976 the PhD in engineering from AGH University of Science and Technology in Krakow. Since 1995, he has been employed in the Institute of Automatics, AGH-UST, International internships in Institute of Mathematics University of Groningen (1992 Holland), many times visiting in Birmingham University (UK), Technical University in Lyngby (Denmark), Ecole Centrale Lille (2001 France). He received the doctor habilitatus (DrSc) degree in Automatics and Robotics in 1994 from AGH-UST and in 2009 he obtained the scientific title of Professor. Presently, he is employed in the position of a professor at the Department of Automatics, Faculty of Electrical Engineering, Automatics, Computer Science and Electronics, AGH-UST in Krakow. Since 1998, he is Deputy Head of the Department of Automatics. The field of researches is covered by new integral algorithms for exact state observation (voluminous monograph) and convolution methods for identification of continuous dynamic models of high order as well as computer control systems. Results of his research were published in monograph and sections in other books, in papers and international conferences and congresses (over 90 reviewed publications and over 100 other research reports). He is a member of the Commission of Technical Sciences of the Polish Academy of Arts and Sciences PAU, member of Chapter of Automatics in Polish Academy of Science PAN, a member of Polish Chapter of Control System IEEE and Polish Chapter of Robotics and Automation IEEE. He was honored with The Gold Cross of Merit, Medal of National Education Commission and Medal of AGH UST.