



EE Seminar Series

Dallas Chapter of IEEE Signal Processing Society Presents

Optimal FIR Estimation of Discrete-Time State-Space Models

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ECSS 2.102 (TI Auditorium)**

Optimal estimation of signal parameters and system models is often required to formalize *a posteriori* knowledge about undergoing processes in the presence of noise. Therefore, filtering, smoothing, and prediction have become key tools of statistical signal, image, and speech processing and found applications in algorithms of various electronic systems. Estimation can be provided using methods of finite impulse response (FIR) linear optimal filtering having strong features, such as the inherent bounded input/bounded output stability and robustness against temporary model uncertainties and round-off errors. In this talk, I will show that the general p -shift optimal linear FIR estimator follows straightforwardly from the real discrete-time state space model (from n and $n-1$ to n) used in signal processing, rather than from the prediction model (from n to $n+1$) used in control. This general estimator allows solving universally the problems of filtering ($p = 0$), prediction ($p > 0$), and smoothing ($p < 0$) on a horizon of N points. I will then present different batch and recursive algorithms and the unique low-degree polynomial gains for unbiased FIR estimators. Applications will be given for polynomial state space modeling, clock state estimation and synchronization, and image processing.

Dr. Yuriy S. Shmaliy is a Professor at Guanajuato University, Mexico. He received the PhD degree in 1982 from the Kharkiv Aviation Institute, Ukraine. In 1992, he received the Doctor of Technical Science degree from the Kharkiv Railroad Institute. From 1993 to 1999, he was a director-collaborator of the Scientific Center "Sichron", Kharkiv, Ukraine. In 1999, he joined the Kharkiv National University of Radio Electronics, and, since November 1999, he has been with the Guanajuato University of Mexico. Dr. Shmaliy has authored several books, handbooks, and manuals. He has published 245 journal and conference papers and 80 patents. His textbooks "*Continuous-Time Signals*" (2006) and "*Continuous-Time Systems*" (2007) were published by Springer. His book "*GPS-based Optimal FIR Filtering of Clock Models*" and the invited chapter to the book "*Global Positioning System*" are to be published by Nova Science Publishers in 2009. He also co-authored an invited chapter to the book "*Image Processing*" published by In-Tech. He is a founder and organizer of the International Conference on Precision Oscillators in Electronics and Optics and an editorial board member of several journals. He is a Senior Member of the IEEE.

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