

The IEEE Signal Processing Society of Northern Virginia invites you to a dynamic technical seminar on signal processing technology. You do not need to be an IEEE member to attend, and there is no cost to participate. Here are some details about the meeting, the seminar topic, and our speaker.

TITLE: Automated and Adaptive Modeling, Detection, Prediction, and Control

SPEAKER: Dr. Wallace E. Larimore, President Adaptics, Inc.

DATE: May 29th, 2008

TIME: 6:30 PM Pizza, Soft Drinks, & Networking -- 7:00 PM Seminar

LOCATION: The MITRE Corporation Building #2, Conference room 1N100, 7515 Colshire Drive, McLean, VA

CONTACT:

RSVP's by May 26th are appreciated, but walk-ins are welcome.

Email [t.settle@ieee.org](mailto:t.settle@ieee.org).

WEBSITE: [http://ewh.ieee.org/r2/no\\_virginia/sps/](http://ewh.ieee.org/r2/no_virginia/sps/)

For directions see [http://www.mitre.org/about/locations/mitre2\\_map.html](http://www.mitre.org/about/locations/mitre2_map.html)

ABSTRACT:

Over the past several decades, there has been a revolution in the modeling of linear Gaussian dynamic processes leading to more accurate and reliable detection, prediction, filtering and control. This presentation is focused on concepts at the foundation of this revolution - the use of reduced-rank statistical methods including:

- The fundamental statistical advantage of limiting a model to the "statistically significant" parameters or parametric subspace of the model
- How this is implemented computationally using a singular value decomposition (SVD) of process measurements with weighting determined by the correlation structure of the observations
- These computations are numerically stable and accurate to machine precision, and void iterative nonlinear parameter optimization typically required to solve such a problem that is frequently inaccurate and/or unreliable
- How this can be expressed as a maximum likelihood (ML) procedure with optimal properties satisfying the Cramer-Rao lower bound
- The use of optimal generalized likelihood ratio (GLR) tests of hypotheses to resolve unknown structure of the process such as the dynamic state order, presence of possible bias or trends, detection of process changes or faults,
- For a collection of interconnected sub-processes, to model the input/output dynamic behavior of a particular sub-process among measured inputs and outputs, the inputs and outputs from other subsystems provides no additional information

- so knowledge or ignorance of feedback has no effect on the accuracy of modeling the subsystem model that is optimal
- A brief discussion of recent progress in extending these results to the general nonlinear and non-Gaussian case is given.

Examples are given in such diverse applications such as monitoring and fault detection in closed-loop chemical processes, identification of vibrating structures under feedback, online adaptive control of aircraft wing flutter, and identification of the chaotic Lorenz attractor, detection and classification of seismic waves in the earth, modeling and fault detection in highly nonlinear combustion engines with delays. The presentation will emphasize concepts rather than mathematical detail and discuss the major implications for the automation of adaptation.

#### SPEAKER BIOGRAPHY:

Dr. Larimore received his Ph.D. and M.S. degrees in Statistics from George Washington University, and did his dissertation in the area of time series analysis. He has thirty years experience in the development of statistical methods with applications to dynamical processes and time series data. He is founder and president of Adaptics Inc, and has developed the ADAPT<sub>x</sub> software for the automatic time series analysis and modeling of dynamical processes. Dr. Larimore has done fundamental work in extending the canonical variate analysis method to the analysis of time series data including the publication of the first paper on subspace system identification.

Dr. Larimore has applied these methods to financial and econometric data, modeling and control of vibrating structures, detection and modeling of brain waves, and modeling and control of chemical and industrial processes. He has more than 70 published papers, and has organized numerous sessions at professional meetings. He has given workshops on Automated Multivariable Time Series Analysis and System Identification at several dozen conferences of various professional societies as well as at a number of corporations. He is a member of the American Statistical Association, Institute of Electrical and Electronic Engineers, and the Society for Industrial and Applied Mathematics.

The 1994 Statistics in Chemistry Award given by the Chemometrics Committee of the American Statistical Association was awarded to Dr. Larimore of Adaptics, Inc, in collaboration with Professors Duncan A. Mellichamp and Dale E. Seborg and their former graduate students Dr. Charles Schaper and Dr. Andreas H. Kemna of the Department of Chemical and Nuclear Engineering, at the University of California at Santa Barbara. The award is for the outstanding collaboration between statisticians and chemists in an industrial setting as judged by innovation and impact on the field.