


Department of Finance and Risk Engineering
Department of Electrical Engineering
Morton L. Topfer Chair Lecture Series

Professor Tyrone E. Duncan
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Date: Tuesday, October 21, 2008
Time: 1:00pm – 2:00pm
Location: LC102, Brooklyn

Mutual Information and Estimation

Abstract: Mutual information provides a quantitative relation between two stochastic processes. It is a basic notion in information theory and is used empirically to determine a quantitative measure of the relation between two time series. In this talk the mutual information between a signal and an observation process of the signal is given explicitly as an estimation (filtering) error. Another description of the observation process has the signal multiplied by a positive parameter. For this model the rate of change of the mutual information with respect to the parameter is given explicitly as an estimation (smoothing) error. Two noise models are considered in the observation process. The first model is fractional Brownian motion. Fractional Brownian motion is a family of Gaussian processes that includes Brownian motion as well as other processes that can often be justified empirically as models of random phenomena. The observation process is the sum of a fractional Brownian motion and a signal. The second model is a pure jump Levy process which is a stationary, independent increment process with purely discontinuous sample paths, for example, a Poisson process. An observation process is a pure jump process where the rate function for the Levy process depends on the signal.

About the speaker

Dr. Duncan has worked on a wide variety of aspects of stochastic analysis. He has a long history of research in stochastic filtering and control. He initiated some of the work on stochastic systems in manifolds. He has applied stochastic methods to geometry and Lie theory. In recent years, he has worked extensively on stochastic adaptive control for systems in both finite and infinite dimensions. He has made contributions to the mathematics of finance. Most recently, he has made initial contributions to stochastic systems with fractional Brownian motion. He is the author or co-author of more than 150 publications. He is a Corresponding Editor of SIAM Journal on Control and Optimization and is an IEEE Fellow.

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