

Department of Applied Mathematics and Statistics
The Johns Hopkins University

STUDENT SEMINAR

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304 Whitehead Hall
4:00 p.m.

NON-STATISTICAL ESTIMATION OF STOCHASTIC
DYNAMICAL SYSTEMS

ABSTRACT

A general methodology is proposed for representing and propagating the effects of uncertainties in nonlinear dynamical systems. In particular, the random parameters of the identified model, as well as the excitation and the response, are treated as processes belonging to a finite-energy Hilbert space of random variables, and are approximated using a truncated spectral expansion in orthogonal functionals (Polynomial Chaos). This expansion transforms the original stochastic differential problem into a deterministic system of differential equations. The procedure is applied to single- and multi-degree-of-freedom systems (linear and nonlinear) with uncertainties in the form of stochastic parameters, and the results are compared with standard Monte Carlo simulations. In particular, a pseudo-spectral construction is used in the calculation of the bi-dimensional expansion of the Stochastic Restoring Force, where each term in the expansion is re-projected onto a basis of lower degree to allow a simplified model and a faster computation.