Abstract Submitted
for the DFD07 Meeting of
The American Physical Society

Efficient Analysis of Stochastic Systems in the Presence of Discontinuity TONKID CHANTRASMI, ALIREZA DOOSTAN, GIANLUCA IACCARINO, Stanford — This talk presents the predictive accuracy of some existing uncertainty propagation schemes for solution of stochastic partial differential equations that exhibit certain irregularities in the probability space. In particular, it will be shown that traditional global stochastic Galerkin schemes, such as polynomial chaos expansions, are inefficient in capturing quantities of interest that are discontinuous in the random space due to Gibbs phenomenon. As one possibility, the formalism of Pade approximation of discontinuous functions coupled with a stochastic collocation scheme is proposed to resolve the above issue for the steady state solution of a dual throat nozzle. The initial velocity prescribed on the domain of the system is modeled as a high- dimensional random field. The goal of the analysis is then to efficiently estimate the probability distribution function of the shock location in the steady state regime given such uncertainty in the initial velocity. The advantages of the proposed algorithm over the existing techniques for capturing discontinuities in both physical space and also a high- dimensional probability space will be discussed in details.

Tonkid Chantrasmi
Stanford

Date submitted: 03 Aug 2007 Electronic form version 1.4