

A computational statistics and stochastic modeling approach to multiscale modeling and design of materials*

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We will discuss a number of diverse problems that highlight the important role that stochastic modeling, Bayesian computation and statistical learning techniques can play in the analysis, design and control of materials systems. Topics to be introduced include:

- Development of a variational multiscale approach with subgrid scale modeling for stochastic continuum transport systems.
- Bayesian statistical inference and advanced simulation techniques for multiscale and multiphysics transport phenomena in porous media.
- An information theoretic approach to uncertainty propagation across length scales in the deformation of polycrystal materials.
- Hierarchical statistical (machine) learning techniques for representation, modeling, design and control of materials across length scales.

* Invited lecture at the Multiscale Model Development and Control Design Closing Workshop (organizers: Profs. R. Smith & A. Gelfand), National Institute of Statistical Sciences (NISS) in Research Triangle Park, NC. September 27-28, 2004,