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The Materials Process Design and Control (MPDC) Laboratory performs applied and basic research in the interface of computational mathematics, scientific computing and materials. It attracts gifted individuals from all over the world and provides an environment that prepares them for successful careers in academia or industry. MPDC is committed to providing industry and government with innovative computational solutions to materials problems for world-class competitiveness.

Emphasis of our work is on the development of unified mathematical approaches to uncertainty quantification and propagation in complex multiscale, multicompontent and multiphysics systems. We are interested in all aspects of stochastic and statistical (Bayesian) modeling of continuum and discrete systems including solution of stochastic multiscale PDEs in high-dimensions, stochastic coarse graining, Bayesian inference, data-driven predictive science, non-linear model reduction algorithms, optimization and design in the presence of uncertainty, machine learning and probabilistic graphical networks.

Current funded applications include multiscale modeling, design and control of complex coupled physics in random heterogeneous media (e.g. superalloys in aircraft engine disks, energetic materials, geological media/CO2 sequestration), component and system probabilistic analysis of aircraft engine design, multiscale inverse problems for non-destructive evaluation, ab initio design of materials for extremal properties, and inference in probabilistic graphical models of complex engineering systems. MPDC emphasizes interdisciplinary cooperation between its workgroups.