Matrix Computations & Scientific Computing Seminar

Organizer(s): James Demmel & Ming Gu

Wednesday, 11:00AM–Noon, 380 Soda

March 10 **Paul Constantine**, Sandia National Lab

Computational Methods for Parameterized Matrix Equations

Models for complex engineering systems often depend on a set of parameters representing various input quantities including boundary/initial conditions, domain specification, material properties and/or a slew of potential uncertainties. Given a set of inputs, the model output is typically very expensive to compute, which makes exhaustive parameter studies infeasible – particularly for high dimensional parameter spaces. To properly explore the effects of the inputs on the outputs, one needs robust and accurate surrogate models that are cheaper to evaluate than the true model solution.

In this talk, we pose the model problem of a *parameterized matrix equation* – a matrix equation where the elements of the matrix and right hand side depend on a set of parameters. We then explore and compare techniques for approximating the vector-valued function (or some derived statistics) that satisfies the parameterized matrix equation. In particular, we review (1) a class of polynomial approximation methods known in numerical PDEs as spectral methods, (2) a least squares reduced basis method, and (3) a Stieltjes-Lanczos procedure, if time permits.

This will primarily be an overview of the methods with a few relevant motivating applications and particular emphasis on the optimization and matrix computation problems that arise.