Colloquium

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Thursday, September 4, 2014

12:00 p.m -1:00 p.m, **HH-3017**

Preconditioning for PDE-constrained Optimization

Abstract:

Many control problems for PDEs can be expressed as Optimization problems with the relevant PDEs acting as constraints. As is being discovered in other areas such as multi-physics, there seem to be distinct advantages to tackling such constrained Optimization problems 'all-at- once' or with a 'one-shot' method. That is, decoupling of the overall problem in some loosely coupled iterative fashion appears to be a rather poorer approach than to compute on the fully coupled problem.

The use of iterative methods for the relavant linear algebra is crucial here since the overall dimensions (including the Optimization and PDE) are usually very large, but matrix vector products as required in Krylov subspace methods such as MINRES are still readily computed. The work to ensure rapid convergence is in preconditioning and it is this topic that we will mostly focus on in this lecture.