UNIVERSITY of HOUSTON

Department of Mathematics

Scientific Computing Seminar

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Continuous Data Assimilation by Non-Interpolant Observables

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1 PM- 2 PM
Room 646 PGH

Abstract:

Continuous data assimilation tackles time-dependent problems with unknown initial conditions by integrating observational data into a nudging term. In this work, we focus on the heat equation with spatially varying conductivity and Neumann boundary conditions, and propose assimilation schemes that utilize non-interpolant observables, diverging from traditional approaches. These generalized nudging techniques are particularly effective for problems that lack regularity beyond the minimal framework. We establish that the spatially discretized nudged solution converges exponentially in time to the true solution, with a convergence rate determined solely by the nudging strategy—independent of the discretization method. Moreover, the long-term discrete error achieves optimality, aligning with known estimates for problems with limited regularity and known initial conditions. We numerically investigate three nudging strategies:

- Nudging via a conforming finite element subspace;
- Nudging using piecewise constant functions on the boundary mesh;
- Nudging based on the mean value of the solution.

These strategies are tested on three benchmark problems, including one with Dirac delta forcing and the Kellogg problem characterized by discontinuous conductivity.