Mathematical and Computational Methods for Predictive Simulation of Evolution Systems

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When complex evolution multi-physics systems are treated as a monolithic object, the time step selection is governed by the most rapidly varying component. However, the appropriate analysis can often reveal a splitting that allows rapid, efficient, and accurate simulation of the full system by carefully coordinating the uncoupled computation of each subsystem.

We have developed numerical methods that address these important practical problems: modular use of existing sub-physics legacy codes and integration of uncertainty quantification techniques in legacy codes. We have examined the novel decoupling techniques using both rigorous analytic mathematical theory and relevant numerical experiments.

I will illustrate these ideas with specific examples: the implicit-explicit approach for uncoupling evolution equations with exact skew-symmetric coupling, the equations for magneto-hydrodynamic fluid flow, and the modeling of turbulent flow at high Reynolds number.

The lecture will take place in Thackeray 704 at 4:00pm.
Refreshments will start at 3:30pm.