UNIVERSITY of HOUSTON

Department of Mathematics

Scientific Computing Seminar

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Multiscale solver for problems in heterogeneous and high-contrast domains and structures

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1 PM- 2 PM
Room 646 PGH

Abstract: Many real-world applications occur in heterogeneous media, such as subsurface flow and processes in composite materials. For an accurate numerical solution, we should use a fine grid that resolves all small-scale features and provides accurate approximation within standard techniques such as the finite element or finite volume method. Such fine-scale approximation leads to a large discrete system that is computationally expensive. The upscaling technique or multiscale method reduces the size of the system and constructs computationally efficient solvers.

In this work, we present the construction of the macroscale model by carefully designing local spectral problems and Galerkin coupling. The method involves two basic steps: (1) the construction of multiscale basis functions that take into account small-scale features in the local domains and (2) the construction of the coarse-scale approximation on a multiscale space. The applicability of the constructed macroscale model in a two-grid approach as a preconditioner is discussed. Numerical results are presented for various applied problems with different types of heterogeneities, high-contrast properties and network structures.

This seminar is easily accessible to persons with disabilities. For more information or for assistance, please contact the Mathematics Department at 743-3500.