Department of Mathematics

University of Houston

Scientific Computing Seminar

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Sparse Grid Discontinuous Galerkin Methods for High-Dimensional Partial Differential Equations

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Abstract: In this talk, we will discuss sparse grid DG methods for computing high-dimensional PDEs. Over the past few decades, DG methods have gained popularity in many applications due to their distinctive features. However, they are often deemed too costly because of the large number of degrees of freedom of the approximation space, which are the main bottleneck for simulations in high dimensions. Using a hierarchical basis representation, we construct a sparse finite element approximation space for DG schemes, reducing the degree of freedom from the standard $O(h^{-d})$ to $O(h^{-1}|\log_2 h|^{d-1})$ for d-dimensional problems,where h is the uniform mesh size in each dimension. The accuracy of the numerical approximation of this method is only slightly deteriorated, which is verified by error estimates and numerical tests in multi-dimensions.

This is joint work with Dr. Yingda Cheng.