Computational Mathematics Seminar Series

Discontinuous Galerkin Methods for Diffusion-Dominated Radiative Transfer Problems

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Johnston Hall 338
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Abstract:

While discontinuous Galerkin (DG) methods had been developed and analyzed in the 1970s and 80s with applications in radiative transfer and neutron transport in mind, it was pointed out later in the nuclear engineering community, that the upwind DG discretization by Reed and Hill may fail to produce physically relevant approximations, if the scattering mean free path length is smaller than the mesh size. Mathematical analysis reveals, that in this case, convergence is only achieved in a continuous subspace of the finite element space. Furthermore, if boundary conditions are not chosen isotropically, convergence can only be expected in relatively weak topology. While the latter result is a property of the transport model, asymptotic analysis reveals, that the forcing into a continuous subspace can be avoided. By choosing a weighted upwinding, the conditions on the diffusion limit can be weakened. It has been known for long time, that the diffusion limit of radiative transfer is a diffusion equation; it turns out, that by choosing the stabilization carefully, the DG method can yield either the LDG method or the method by Ern and Guermond in its diffusion limit. We will close discussing solution techniques for the resulting discrete problems.

Speaker's Bio:

A native of Krefeld, Germany, Dr. Kanschat received his undergraduate education at the University of Bonn and his PhD from the University of Heidelberg in 1996, where he also habilitated himself in 2004. He held appointments at the University of Heidelberg, the University of Minnesota and Texas A&M University. In his research, Dr. Kanschat works on the aspects of discretization, efficient solvers and implementation of finite element methods for partial differential equations. He is one of the authors and maintainers of the deal.II software library for finite element computations. His research focuses on discontinuous Galerkin methods and multilevel solvers for coupled flow problems and radiative transfer.

This lecture has refreshments @ 03:00 pm
This lecture has a reception @ 03:00 pm

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