Fall 2011 School of Computer Seminar Series

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Seminar

Fall 2011

THE UNIVERSITY OF SOUTHERN MISSISSIPPI

SCHOOL OF COMPUTING

Title: **The Local Discontinuous Galerkin Method for 1-D and 2-D Singularly Perturbed Convection-Diffusion-Reaction Problems**

Time & Location:

2:00pm, Friday, October 7, 2011
Tec 205 (Vislab), Bobby Chain Technology Building

Presenter:

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Abstract: **Singularly perturbed differential equations are typically characterized by a small parameter ϵ multiplying some or all of the highest order terms in the differential equation. In General, the solutions of such equations exhibit multiscale phenomena. Within certain thin subregions of the domain, the scale of some partial derivatives is significantly larger than other derivatives. These thin regions of rapid change are called boundary or interior layers. When ϵ ! 0, classical computational methods, such as finite difference, finite element method, to singularly perturbed problems fail to catch the rapid change of the solution unless extremely fine meshes are used. Robust or parameter-uniform numerical methods that converge in an appropriate norm independently of ϵ have been investigated by using adaptive or layer-adapted meshes. As a typical layer-adapted mesh, Shishkin-type mesh, which attracted much attention and are now widely used, can be generated a priori for the singularly perturbed problems, once the location and width of all possible layers are identified.**

In this presentation, we give a summary of our recent work on the analysis of the local discontinuous Galerkin method (LDG) for one-dimensional and two-dimensional singularly perturbed problems with boundary layers. Shishkin-type meshes are employed. The summary includes (1) the uniform convergence of the LDG for one-dimensional singularly perturbed problems of convection-diffusion type and reaction-diffusion type; (2) the uniform nodal superconvergence of the streamline-diffusion FEM and the LDG method for one-dimensional singularly perturbed convection-diffusion problems; (3) the uniform convergence of the the LDG method for two-dimensional singularly perturbed convection-diffusion problems.