TEXAS STATE UNIVERSITY

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Discrete Mathematics Seminar

Time: Friday, October 21, 2016, 2:30-3:30 PM
Room: 237 Derrick Hall
Title: Weak Galerkin Finite Element Methods for Partial Differential Equations
Speaker: Dr. Chunmei Wang, Department of Mathematics

Abstract:

Weak Galerkin (WG) is a new finite element method for partial differential equations (PDEs) where the differential operators (e.g., gradient, divergence, curl, Laplacian, etc.) in the variational forms are approximated by weak forms as generalized distributions. The WG discretization procedure often involves the solution of inexpensive problems defined locally on each element. The solution from the local problems can be regarded as a reconstruction of the corresponding differential operators. The fundamental difference between the weak Galerkin finite element method and other existing finite element methods (FEM) is the use of weak functions and weak derivatives (i.e., locally reconstructed differential operators) in the design of numerical schemes based on conventional weak forms for the underlying PDE problems. Weak Galerkin is a natural extension of the classical Galerkin finite element method and has advantages over FEM in many aspects. Due to its great structural flexibility, the weak Galerkin finite element method is well suited to most partial differential equations by providing the needed stability and accuracy in approximations. In this talk, the speaker will introduce the basic ideas and a general framework for WG methods by using the second order elliptic equation as a motivating example. Furthermore, the speaker will introduce a recent development of WG finite element methods called primal-dual weak Galerkin methods by taking the second order elliptic problem in non-divergence form as an example. Finally, the speaker will present an application of weak Galerkin in a fourth order PDE problem arising from fluorescence tomography.