

Department of Mathematics  
University of Houston

**Seminar on Computational Mathematics  
in Oil & Gas Exploration and Imaging**

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**A Fast Layered Finite Element Scheme Developed in  
Hamiltonian System, and Its Applications in Well Logging**

Tuesday, February 9, 2016  
1:30 PM – 2:30 PM  
Room 646 PGH

**Abstract:** A fast layered finite element method is proposed to solve electromagnetic problems in layered media. To develop this novel finite element scheme the governing equation of electromagnetic wave propagation is cast from the Lagrangian system based on one variable to the Hamiltonian system based on dual variables. Conventional finite elements are employed to discretize the cross section of a layered structure, which has arbitrary geometry and material distribution; A Riccati equation based high precision integration method is used to handle the longitudinal direction along which the structure is homogeneous. The flexibility of this layered finite element scheme can be greatly increased by hybridization with conventional finite elements, and this strategy works well for layered problems with local inhomogeneities. Examples will be given to show the applications of this method in resistivity well logging and electromagnetic telemetry.