



Announcing

**A Mathematics Seminar
March 12, 2009 at 2:00 pm
SH 303**

at The University of Southern Mississippi

Speaker: James Lambers

Institute for Computational and Mathematical Engineering
Stanford University

**Title: Three Effective Compromises in Numerical
Analysis**

Abstract:

This talk presents three problems in which effective numerical methods are obtained by novel compromises between competing criteria.

First, I will discuss Krylov subspace spectral (KSS) methods for time-dependent variable-coefficient PDE, which apply techniques for computing elements of functions of matrices in order to obtain high-order accuracy in time. However, because KSS methods employ different approximations of the solution operator for each Fourier coefficient of the solution, they exhibit stability characteristic of implicit time-stepping schemes even though they are explicit. KSS methods have been applied to a variety of problems, but in this talk we focus on Maxwell's equations.

Second, I will present new models for de-noising images and signals by nonlinear diffusion. Some existing de-noising methods regularize the ill-posed Perona-Malik equation to achieve well-posedness, but at a cost, for they do not admit piecewise smooth solutions as (meta)stable equilibria. The new models presented slightly weaken the nonlinearity of Perona-Malik in such a way as to admit such equilibria, while still achieving well-posedness.

Third, I will present a new approach to coarse-scale modeling of flow in porous media in which MPFA discretization, upscaling, and adaptive mesh refinement are tightly integrated in order to ensure that computational effort is expended where it is needed most. In the resulting finite-volume scheme, stencils are constructed in such a way as to balance the competing goals of accurately resolving fine-scale effects and ensuring that solutions are free of non-physical oscillations.

Further Information

Further details and information about this and other departmental activities is available online at http://www.math.usm.edu/bulletin_board/.