Math 504 **Fall 2009**

Numerical Methods for PDEs, 39705

Instructor:	Dr.W.Proskurowski
	http://almaak.usc.edu/∼proskuro/teaching/math504
Lecture:	MWF, 10-11, KAP 138
Office:	KAP 120 E, Hours: MWF 2:30-3:30

This is a course devoted to computationally efficient numerical schemes (and their analysis) for solving steady state and time dependent Partial Differential Equations (PDEs).

Course Outline

(a subset of the following, for discussion with students)

1. Introduction to finite difference and finite element methods.
2. Discretization of the Laplacian (a model problem).
3. Fast Poisson solvers based on FFT.
4. Solving sparse (and large) problems in Matlab.
5. Review of iterative methods.
6. Elements of the multigrid method.
7. Preconditioned conjugate gradient iterations.
8. Heat equation, a model problem for time dependent problems.
9. Selected 1-D problems: convection–diffusion and nonlinear.
10. Solving 2-D parabolic problems: ADI and operator splitting methods.
11. Introduction to hyperbolic problems.

Recommended reading: 'Numerical Solutions of PDEs' by G.D.Smith, Oxford, 3rd ed., 1985.

Additional reading: 'A Multigrid tutorial' by W.Briggs et al. (2nd ed.), SIAM, 2000.

There will be several computational term projects, homework (in MATLAB whenever possible), and no exam.