

# Math 440H - Advanced Applied Numerical Methods

Spring 2004

Lou Kondic, Cullimore 622; phone: (973) 596-2996; email: kondic@oak.njit.edu

Office Hours: Tues, Thur, 4:00pm-6:00pm and by appointment

**Basic Text:** K. W. Morton and D. F. Mayers, "Numerical Solution for Partial Differential Equations", Cambridge (1994)

**Additional Texts:** Selected research articles

- Week 1: Overview of computing software and general methods of scientific computing;  
Methods for solving large systems of linear equations;
- Week 2: Overview of linear ODE's; Finite Difference Methods;
- Week 3: Spectral methods for Linear ODE's;  
Elliptic problems; Dirichlet and Neumann problems boundary conditions;
- Week 4: Boundary Integral Methods for Elliptic problems;
- Week 5: Nonlinear elliptic problems;  
Applications to problems in electrostatic and ideal fluid flow;
- Week 6: Diffusion equation in one space dimension;
- Week 7: Efficiency, stability, convergence, and consistency of different schemes  
used for diffusion problems; Error analysis;
- Week 8: Spectral methods for diffusion equation;  
Diffusion equation in higher dimensions: explicit and ADI type of schemes;
- Week 9: Introduction to linear hyperbolic equations; Method of characteristics;
- Week 10: Lax-Wendroff and leap-frog schemes;  
Inviscid Burgers equation;
- Week 11: Shock solutions to Burgers equation; Systems of hyperbolic equations;
- Week 12: Conservation Laws;
- Week 13: Applications of hyperbolic equations to gas dynamics;
- Week 14: Student presentations; Review