MTH 453: Section 001/MTH 553: Section 001
Numerical Solution of Partial Differential
Equations (PDEs)
Spring 2007

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Office Hours: MW: 11:00-11:50 am and by appt.

Class Time: MWF: 10:00-10:50 am
Classroom: GILK 100
Website: http://www.math.oregonstate.edu/~bokilv/MTH453-553.html

Textbook: There is no required textbook. We will follow the lecture notes
by R. J. LeVeque which will be posted on my website for you to download.
My website will also contain a list of suggested references.

Course Description: This course will explore numerical methods based on
finite difference discretizations for solving time dependent partial differential
equations (PDEs). Partial differential equations are used to describe a large
variety of physical phenomenon, from fluid flow to electromagnetic fields.
They also arise in many diverse applications as computer vision, animation,
mechanical systems, earth sciences and mathematical finance. Here is a brief
outline of the topics that will be covered in this course:

1. Examples of physical phenomenon modeled by PDEs.

2. Classification of PDEs into linear nonlinear, steady-state, transient,
eLLiptic, parabolic and hyperbolic, along with boundary and initial
conditions. Basic information on well-posedness.

3. Study of finite difference methods for first and second order linear
PDEs of elliptic, hyperbolic and parabolic type. We will consider ex-
plicit and implicit methods. We will start by discussing finite difference
methods for two-point boundary value problems.

4. Study of the properties of numerical methods such as consistency, sta-
bility, convergence, rate of convergence and cost.
5. Discussion of techniques for solving linear systems arising from discretizations of PDEs.

6. Additional topics may include nonlinear PDEs as well as introductory material on finite element methods for elliptic boundary value problems.

Prerequisites: Students should have a good background in differential equations. Familiarity with PDEs, some numerical methods, algorithms, some programming language and in particular with MATLAB is a plus; however I will develop the basics as necessary. Most students will have taken MTH 451/551 and/or 452/552 (or some other numerical methods course) prior to this class, but this is not mandatory. Please contact me to discuss your background if you do not have the necessary prerequisites.

MATLAB: The programming language for this course is MATLAB. If you have not used MATLAB before try working through tutorials available on the web. Introductory material on MATLAB will be available on my website.

Course Grading:

1. Homework Assignments: (40%) There will be four to five homework assignments this term. If your homework is late you will receive up to half credit for the first two days after the due date. Homework submitted three days or later after the due date will not receive any credit.

2. Midterm: Wednesday May 9, 2007, in class (25%)

3. Final: Monday, June 11, 2007 at 2:00pm, in class (35%)

If you do not perform well on your midterm, you may make up for it in the final: If your final is better than your midterm, the midterm will be discarded and the final score will count 60%. If the final is not better than the midterm, it will count 35% and the midterm 25%.

Check the class website (given above) for general information and other policies regarding the class.