

Massachusetts Institute of Technology
Department of Mathematics

Fall 2004

18.335: Numerical Methods of Applied Mathematics – I

<http://math.mit.edu/~plamen/18.335>

1-390, MW 3:00-4:30

• **Introduction**

This course will consist of two parts.

During the first two thirds of the course we will concentrate on Numerical Linear Algebra. We will study the solutions of linear systems of equations, least square problems, eigenvalue problems and singular value problems. Techniques for dense, sparse and structured problems will be covered. Students should still come to appreciate many state-of-the-art techniques and recognize when to consider applying them. We will also learn basic principles applicable to a variety of numerical problems and learn how to apply them. These principles include (1) matrix factorizations, (2) perturbation theory and condition numbers, (3) effect of roundoff on algorithms, including properties of floating point arithmetic, (4) analyzing the speed of an algorithm, (5) choosing the best algorithm for the mathematical structure of your problem, and (6) engineering numerical software.

In addition to discussing established solution techniques, open problems will also be presented.

The course assumes familiarity with linear algebra and will involve a reasonable amount of programming in MATLAB.

During the second part of the course we will concentrate on numerical methods for solving ordinary differential equations. These methods are usually introduced in undergraduate numerical analysis courses such as 18.330. Such courses, however, are not prerequisites for 18.335. This graduate-level exposition will be self contained and lecture notes will be provided.

• **Textbooks**

Numerical Linear Algebra, Trefethen and Bau, SIAM 1997

Optional: Applied Numerical Linear Algebra, Demmel, SIAM 1997.

Numerical ODEs: Lecture notes will be made available.

• **Instructor:** Plamen Koev

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– Office hours: Monday 4:30-6:30

• **Grading**

About eight homework assignments (80%) and one in class midterm on November 3rd (20%). No final exam.