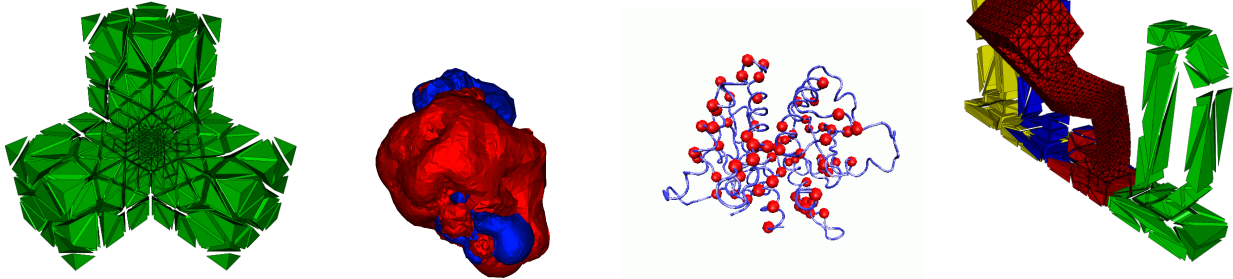


## MATH 7390-2—SCIENTIFIC COMPUTING, FALL 2006

BURAK AKSOYLU



Changes to course syllabus are possible and will be announced in class. Students are responsible for announcements made in class and on my website.

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Johnston 333, 578-8984; Lockett 142, 578-5308.

**COURSE WEBSITE:** [http://www.cct.lsu.edu/~burak/teaching/math7390-2\\_f2006.html](http://www.cct.lsu.edu/~burak/teaching/math7390-2_f2006.html).

**PREREQUISITES:** MATH 2057, 2065, 2070, 2085, 2090, 4027, 4065, 4066;  
basic programming skills in MATLAB, Fortran, C, C++, Java.

**LECTURES:** MWF 10:40PM—11:30PM, Lockett 113.

**OFFICE HOURS:** MWF 11:30AM—12:30PM, Lockett 142.

**TEXTBOOK and LECTURE NOTES:**

*Scientific Computing—An Introductory Survey*, by Michael T. Heath, McGraw-Hill, 2002.

Lecture notes provided by the author will be posted on the course website or you can download them from the textbook website: <http://www.mhhe.com/engcs/compsci/heath>

**GRADE:** Midterm I = 20%, Midterm II = 20%, Homework and Programming Assignments = 30%, Final = 30%. I also plan to give quizzes. I will keep you posted on that.

**WHY TAKE THIS CLASS:** Scientific computing is ubiquitous in almost all fields of science and engineering. This course serves as a foundation class for scientific computing and is designed to train you if you are pursuing a career in computational sciences and engineering. This course must be appealing for students who are interested in numerical simulations. Especially, students who want to go in computational math, physics, biology, chemistry, and engineering.

**HOMEWORK:** Homework will be given regularly and to encourage you to do the homework, a certain fraction of the homework will directly be on the exams. Some homework assignments will contain computer projects. You may do these computer exercises using your choice of languages. My personal recommendation is to use MATLAB.

There are plenty of exercises at the end of each chapter. I expect that students will be able to solve most of them. These exercises make the textbook very valuable. I plan to assign computer exercises from the textbook as well.

**COURSE OUTLINE and SYLLABUS:**

## 1 SCIENTIFIC COMPUTING

- 1.1 Introduction;
- 1.2 Approximations in scientific computing;
- 1.3 Computer arithmetic;
- 1.4 Mathematical software.

## 2 SYSTEMS OF LINEAR EQUATIONS

- 2.1 Linear systems;
- 2.2 Existence and uniqueness;
- 2.3 Sensitivity and conditioning;
- 2.4 Solving linear systems;
- 2.5 Special types of linear systems;
- 2.6 Iterative methods for linear systems;
- 2.7 Software for linear systems.

## 3 LINEAR LEAST SQUARES

- 3.1 Linear least square problems;
- 3.2 Existence and uniqueness;
- 3.3 Sensitivity and conditioning;
- 3.4 Problem transformation;
- 3.5 Orthogonalization methods;
- 3.6 Singular value decomposition;
- 3.7 Comparison methods;
- 3.8 Software for linear least squares.

## 4 EIGENVALUE PROBLEMS

- 4.1 Eigenvalues and eigenvectors;
- 4.2 Existence and uniqueness;
- 4.3 Sensitivity and conditioning;
- 4.4 Problem transformations;
- 4.5 Computing eigenvalues and eigenvectors;
- 4.6 Generalized eigenvalue problems;
- 4.7 Computing singular value decompositions;
- 4.8 Software for eigenvalue problems.