

MA 580: Numerical Analysis I

Lecture details

Instructor: Alen Alexanderian
Lecture time/location: 9:35AM-10:25AM MWF, SAS2225
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Office Hours: 12:00–1:00 MW or by appointment

Course Description

This is a first graduate course in numerical analysis, and is one of subjects of the qualifying exams for Ph.D. candidates in Mathematics. The topics covered in this course include: (1) vector and matrix norms, conditioning, errors and floating point arithmetic; (2) linear systems of equations (3) linear least-squares; (4) QR and SVD decompositions; (5) iterative methods for linear systems; (6) solution of nonlinear equations; (7) eigenvalue problems; (8) special topics (possible topics include nonlinear optimization, randomized linear algebra, intro to finite-element method).

Textbooks

- I. C. F. Ipsen, Numerical Matrix Analysis, SIAM, 2009.
<http://catalog.lib.ncsu.edu/record/NCSU2514760>
- C. T. Kelley, Iterative Methods for Linear and Nonlinear Equations, SIAM, 1995.
<http://catalog.lib.ncsu.edu/record/NCSU2512957>
- Desmond J. Higham and Nicholas J. Higham, Matlab Guide: Second Edition, SIAM, 2005
<http://catalog.lib.ncsu.edu/record/NCSU3108706>

These books are available (freely) online for NCSU users through NCSU library.

Other recommended literature

- David S. Watkins, Fundamentals of Matrix Computations, 3rd Edition. 2002.
- Lloyd N. Trefethen, David Bau, Numerical Linear Algebra 1st Edition. 1997.
- Kendall E. Atkinson, An Introduction to Numerical Analysis, second edition, Wiley, 1989.
- David Kincaid and Ward Cheney, Numerical Analysis, Brooks/Cole, 1996.
- James M. Ortega. Numerical analysis: A Second Course, volume 3 of Classics in Applied Mathematics. SIAM, second edition, 1990.
- Peter Deuffhard, Andreas Hohmann: Numerical Analysis in Modern Scientific Computing. An Introduction, 2nd edition, Springer, 2003.
- Alfio Quarteroni, Riccardo Sacco, Fausto Saleri: Numerical Mathematics, 2nd edition, Springer, 2007.
- Cleve Moler: Numerical Computing with Matlab, SIAM, 2007.

Grading Policy

The grading will be assigned on a 10-point scale: **A: 90 – 100, B: 80 – 89, C: 70 – 79, D: 60 – 69, F: ≤ 60** . The cutoffs for the +/- grades are determined at the end of the semester. Your final grade in this course will be determined by marks earned on about six homework assignments involving a mix of theory and computational experiments (60%) a midterm (15%) and a final exam (25%).

Exams

- Midterm exam date: Monday, October 9
- Final exam date: Wednesday, December 13, 8–11AM (at the usual classroom).

Homework The homework is weighted so heavily, because it includes the computational and theoretical exercises that are essential to understanding the course material. Also, an important part of your education at this stage is to learn how to present your results in the form of a professional-grade typeset report. Label each problem clearly, label equations as necessary, and produce high quality and easy to understand figures (use axis labels, captions, etc.) using for example Matlab. I encourage you to typeset your homework solutions in Latex (I will provide Latex source files for the homeworks). You must show complete work to receive full credit. This means that you should provide sufficient details such that others with similar background as yourself can reproduce your results.

Prerequisites

Calculus, background in linear algebra and ODEs, and some programming experience (we will use Matlab for the class assignments).

Academic Integrity Statement and Academic Dishonesty

Both faculty and students at North Carolina State University have a responsibility to maintain academic integrity. An informational brochure about academic integrity is available from the university and students are encouraged to obtain a copy.

"Academic dishonesty is the giving, taking, or presenting of information or material by a student that unethically or fraudulently aids oneself or another on any work which is to be considered in the determination of a grade or the completion of academic requirements or the enhancement of that student's record or academic career." (NCSU Code of Student Conduct)

Scholarly activity is marked by honesty, fairness and rigor. A scholar does not take credit for the work of others, does not take unfair advantage of others, and does not perform acts that frustrate the scholarly efforts of others. The violation of any of these principles is academic dishonesty. Penalties for a violation: For the first violation, you will receive a zero for your work and be put on academic integrity probation for the remainder of your stay at NCSU. The second violation may result in your suspension from NCSU. Both situations will involve the Office of Student Conduct.