

APPM 4/5720: Numerical Linear Algebra

Ian Grooms

Email: ian.grooms@colorado.edu

Office: ECOT 320

Lecture: FLMG 102, MWF at 10 a.m.

Lectures will be based on the following text:

Numerical Methods in Matrix

Computations by Ake Bjork, Springer
2015

This text is available in electronic format through the university library; a low-cost black and white paperback is also available for order through the university library. Supplementary material may be drawn from the following two texts:

Matrix Computations by Gene Golub and Charles van Loan, Johns Hopkins 2013
(third or fourth editions)

Iterative Methods for Sparse Linear Systems by Yousef Saad, SIAM 2003

GvL is a classic reference. A pdf copy of Saad's book is available free (i.e. *simul gratis et licet*) online.

Course Goals: We will develop and analyze algorithms for solving nonsingular linear systems of equations and least-squares problems, and for computing eigenvalues and eigenvectors. Along the way we will discuss classical matrix factorizations including (but

not limited to) LU, Cholesky, QR, and SVD.

We will cover direct and iterative methods for small and large, dense and sparse matrices.

Broadly speaking, we hope to cover the material in sections 1.2–1.5, 1.7, 2.1–2.4, 3.2–3.5, and 4.1–4.4 from Bjork. Time permitting, extra topics may be covered based on student interest.

Grade determination: The final course grade will be determined by a weighted average of homeworks (55%) and exams (45%).

Homework: You may work in groups on the homework, but each student must prepare and submit their own homework solutions.

Homework will include a mix of analysis and simulation; proficiency with Matlab or a similar computing language is required. You do not need to submit your code.

Exams: There will be 2 midterms and a final, each contributing 15% to the final grade. The final exam is not cumulative; it is essentially the third midterm. Midterms will be in-class and will include a mix of true/false and proofs. Notes, textbooks, and calculators (which will be useless. . .) will be allowed on the exams, but not computers or phones or neighbors!

University policies: See <http://www.colorado.edu/amath/academics/student-resources/policies> for the relevant university and department policies.