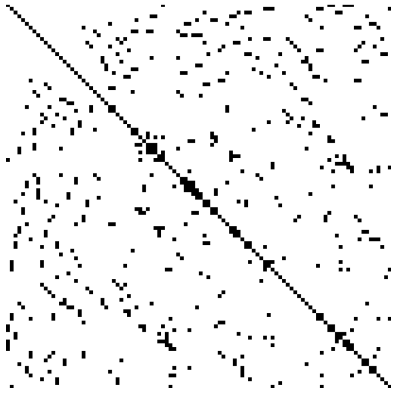
MATH 665 Numerical Linear Algebra
(Topics in Graduate Mathematics)

Spring 2013, UAF



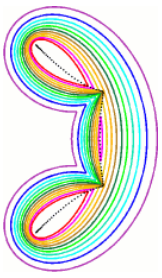
Linear algebra is everywhere in the application of mathematics. Huge linear systems are solved constantly on computers. The science and engineering world depends on it.

This course will describe how matrices and vectors can be handled in a stable, fast, and accurate manner. We will place these topics in their correct mathematical context—finite-dimensional vector spaces—but the emphasis will be on geometric, algorithmic, and practical understanding. We will cover these tools and topics:

- singular value decomposition (SVD), a.k.a. principal component analysis
- conditioning of problems and stability of algorithms
- Gauss elimination and its variants for structured matrices
- over- and under-determined systems
- least squares methods
- power and QR methods for eigenvalues
- Krylov subspace methods, iterative linear algebra

We will use MATLAB, or free tools OCTAVE or PYTHON/SCIPY. Most lectures and homework assignments will have nontrivial computational examples. Introductory MATLAB examples at the beginning of the course will bring students up to speed with that tool. And there will be some proofs; they will make up about 30% of the homework.

The course is for graduate students and advanced undergraduates. Students in all fields with a need for computation are encouraged: statistics, computer science, geophysics, engineering, biology. Students in mathematics will see important ideas which are missing in undergraduate linear algebra and graduate algebra.



Instructor: Ed Bueler `elbueler@alaska.edu` 474-7693

Time & room: MWF 1:00-2:00 pm, room Reichardt 204

Textbook: Trefethen & Bau, *Numerical Linear Algebra*, SIAM Press 1997 ($47 at amazon)

Prerequisites: Undergraduate linear algebra plus mathematical maturity. (Unofficially: *MATH 314 Linear Algebra or equivalent. Recommended: MATH 421 Applied Analysis OR MATH 401 Introduction to Real Analysis.*)

Details: 3.0 credits, CRN 39623

Website: `http://www.dms.uaf.edu/~bueler/Math665S13.htm`