M3/4/5N9 Computational Linear Algebra

Prof Colin Cotter

Autumn Term 2019

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office: 755 Huxley.
Scheduling:

- Lectures: Varies from week to week, please see timetable
- Office Hours: 15:00 Mondays; Weeks 2 10, 755 Huxley

Assessment:

- Project 1 (20%): To be assigned 22 Oct; Due 5 Nov
  You will be registered for this course after submitting Project 1!
- Project 2 (20%): To be assigned 19 Nov; Due 3 Dec
- Project 3 (60%): To be assigned 10 Dec; Due 12 Jan
- Mastery (20% of final raw mark): To be assigned 10 Dec; Due 12 Jan

Projects should comply with the Project Guidelines. This will be distributed and discussed when Project 1 is released.
Course material:

- All course material will be posted on Blackboard: bb.imperial.ac.uk
- Books: Numerical Linear Algebra by Trefethen and Bau, Matrix Computations by Golub and Van Loan
- Intended course topics:
  - Fundamentals: Matrix-vector and matrix-matrix multiplication; Basic definitions of range, nullspace, rank, etc; Vector norms, inner product, and orthogonal vectors; unitary matrices and projectors.
  - QR decomposition: QR decomposition; classical and modified Gram-Schmidt, Householder triangularization; least- square problems.
  - Method analysis: Operation count; matrix norms and conditioning; floating point arithmetic; stability and accuracy
  - LU decomposition: Gaussian elimination; pivoting; Cholesky decomposition; special linear systems.
  - Eigenvalue problems: Hessenberg or tridiagonal form; Rayleigh quotient and inverse iteration, QR algorithm with and without shifts
  - Iterative methods: Classical iterative methods; Krylov subspace methods: Arnoldi iteration, GMRES, Lanczos Iteration, Conjugate gradients, Preconditioning