Cambridge Linear Algebra Seminar Series
CLASS 2018
Solving $\mathbf{Ax} = \mathbf{b}$

Sponsored by Mathworks

LR3B, Inglis Building,
Department of Engineering,
University of Cambridge, Cambridge, U. K.
21-23 November 2018
www.cambridge-class.org

November 21st

- 09:30 - 10:00: Registration and coffee
- 10:00 - 10:50: Introduction *(Pranay Seshadri)*
  - Scope and motivation of workshop (**A** is either tall or square)
  - Vector and matrix norms
  - Floating point operations
  - Matrices (orthogonal, triangular, positive definite)
  - Four fundamental spaces
- 11:00 - 11:50: **LU** *(Prof. Mario Arioli)*
- 12:00 - 12:50: **QR** *(Pranay Seshadri)*
  - Gram Schmidt and where it may falter
  - Modified Gram Schmidt
  - Householder and Givens
  - Pivoted QR factorization and its use in subset selection
  - Rank-1 updates to QR and stepwise regression
  - Blocked QR
- 13:00 - 14:00: Lunch
- 14:00 - 14:50: $\mathbf{U\Sigma V^T}$ *(Prof. Mario Arioli)*

- 15:00 - 15:50: Direct methods I for solving $\|\mathbf{Ax} - \mathbf{b}\|_2^2$ *(Pranay Seshadri)*
  - The geometry of least squares and methods for solution
  - The augmented system
  - Statistical perspective on least squares and a data-fitting application
- 15:50 - 16:10: Coffee
- 16:10 - 17:00: `A \ b`: How a single equation defined a company *(Dr. Ben Tordoff)*
  - Company history and overview
  - EISPACK, LINKPACK, LAPACK
  - The way MATLAB solves `A \ b`

November 22nd

- 09:30 - 10:00: Coffee
- 10:00 - 10:50: Direct methods II for solving $\|\mathbf{Ax} - \mathbf{b}\|_2^2$ *(Prof. Scherer)*
  - Ill-conditioned problems
  - Total least squares
  - Block methods
  - Applications to data fitting
- 11:00 - 11:50: Iterative methods I for solving $\|\mathbf{Ax} - \mathbf{b}\|_2^2$ *(Prof. Arioli)*
- 12:00 - 12:50: Iterative methods II for solving $\|\mathbf{Ax} - \mathbf{b}\|_2^2$ *(Prof. Arioli)*
- 13:00 - 14:00: Lunch and panel discussion on *solving Ax=b*

November 23rd

- 09:30 - 10:00 Coffee
- 10:00 - 10:50: `A \ b` in big data problems *(Dr. Heiko Weichelt)*
  - When is core MATLAB's backslash operator beaten?
  - Acceleration on a local machine / out-of-memory data
  - Future outlook
- 11:00 - 11:50: Algorithms for nonlinear least squares problems *(Prof. Scherer)*
  - Separable problems
  - Variable projection algorithm
  - Applications to neural networks

- 12:00 - 12:50: Close and preview of CLASS2019 *(Pranay Seshadri)*
  - Regression, dimension reduction, numerical integration
  - Applications to big data and comparisons with neural networks
  - Closing remarks