

50011 - Computational Techniques - Lecture 1

Oliver Killane

23/01/22

Introduction

Syllabus

- Eigenvalues, eigenvectors and their generalisation
- Jordan form
- Singular value decomposition, with applications
- LU and QR decompositions
- Spectral Decomposition
- Least Squares Method
- Cholesky factorisation, with applications
- Iterative methods for solving linear systems
- Vector and matrix norms and condition numbers
- Metric spaces and convergence, application to linear equation solvers
- Laplace and Fourier transforms, with applications
- Functions of several variables
- Method of conjugate gradients and its role in optimisation

Assessment

15%	Assessed questions.
85%	Final Exam (90 minutes).

TimeTable

Manon Flageat

Tue	(17:00 → 18:00)	18/01	Course introduction, Vector and Matrix, Vector space.
Thu	(15:00 → 17:00)	20/01	Scalar product, Vector and Matrix norm.
Tue	(17:00 → 18:00)	25/01	Linear map in R, Eigenvalue and eigenvector.

Manon Flageat & Luca Grillotti

Thu	(15:00 → 17:00)	27/01	Generalised eigenvector and Jordan form, Generalisation to vector space of C.
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Luca Grillotti

Tue	(17:00 → 18:00)	1/02	Spectral Decomposition (first half).
Thu	(15:00 → 17:00)	3/02	Spectral Decomposition (second half), Singular Value Decomposition (first half).
Tue	(17:00 → 18:00)	8/02	Singular Value Decomposition (second half).
Thu	(15:00 → 17:00)	10/02	Cholesky Decomposition, Least Square Methods (beginning).
Tue	(17:00 → 18:00)	15/02	Least Square Methods.

Luca Grillotti & Viet Pham Ngoc

Thu (15:00 → 17:00) 17/02 QR Decomposition, Condition number.

Viet Pham Ngoc

Tue (17:00 → 18:00) 22/02 Metric space, convergence.

Thu (15:00 → 17:00) 24/02 Introduction to iterative solution to linear equations, Jacobi method.

Tue (17:00 → 18:00) 1/03 Gauss-Seidel method, Introduction to iterative methods for eigenvalues and eigenvector.

Thu (15:00 → 17:00) 3/03 QR decomposition.

Pancham Shukla

Tue (17:00 → 18:00) 8/03 Introduction to Transforms; Laplace Transform 1: Forward and Inverse.

Thu (15:00 → 17:00) 10/03 Laplace Transform 2: Properties, Differential Equations; Fourier Series.

Tue (17:00 → 18:00) 15/03 Fourier Transform (Continuous): Forward, Inverse, Properties.

Thu (15:00 → 17:00) 17/03 Fourier Transform (Discrete): DFT/FFT; Functions of Several Variables: Optimisation.