UNIVERSITÀ DEGLI STUDI DI NAPOLI FEDERICO II

DOTTORATO DI RICERCA / PHD PROGRAM IN
INFORMATION TECHNOLOGY AND ELECTRICAL ENGINEERING

Module Title: Matrix Analysis for Signal Processing with MATLAB Examples

Lecturer:

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CV: *Massimo Rosamilia received the B.S. (Hons.) and M.S. degrees in computer engineering from the University of Salerno, Fisciano, Italy, in 2017 and 2019, respectively, and the Ph.D. degree (cum laude) in information technologies and electrical engineering from the University of Naples Federico II, Naples, Italy, in 2023. He is currently an assistant professor (RTDa) with the University of Naples Federico II. His research interests include statistical signal processing with applications to radar detection and estimation problems.*

The course is framed in the context of RESTART project, spoke 7, under the Italian National Recovery and Resilience Plan (NRRP) of NextGenerationEU, partnership on "Telecommunications of the Future" (PE00000001 - program "RESTART").

Credits: 3

Overview

The course provides an overview on some topics in matrix theory together with their intrinsic interaction with and application to signal processing. The most important and "useful" tools, methods, and matrix structures are emphasized and complemented with MATLAB examples. The lectures cover basic matrix structures and operations, the concept of matrix norm, orthonormal matrices, Householder transformations, Givens rotation, QR factorization, singular value decomposition, positive (negative) semidefinite matrices and their eigenvalue characterization, Schur complement, Cholesky factorization, matrix gradient, least square problems, Kronecker product.

Schedule

Lecture	Date	Time	Room	Topics
1	06/05/2025	15-17	Aula Riunioni (2nd building, ground floor)	Basic matrix structures and operators. MATLAB examples.
2	08/05/2025	15-17	Aula Seminari (ex Softel, 3rd building, 1st floor)	Matrix norms. Orthonormal matrices, Matrix inverse. MATLAB examples.
3	12/05/2025	15-17	Aula Riunioni (2nd building, ground floor)	Singular Value Decomposition. Quadratic forms and positive (negative) semidefinite matrices. MATLAB examples.
4	19/05/2025	15-17	Aula Riunioni (2nd building, ground floor)	Schur complement. Cholesky factorization Eigenvalues and Eigenvectors. Matrix calculus. MATLAB examples.
5	20/05/2025	15-17	Aula Riunioni (2nd building, ground floor)	Matrix Gradient. Least Square problems. Kronecker product. MATLAB examples.
6	29/05/2025	15-17	Aula Seminari (ex Softel, 3rd building, 1st floor)	Householder transformations. Givens rotation. QR factorization. MATLAB examples.
7	03/06/2025	15-17	Aula Riunioni (2nd building, ground floor)	Exercises and assessment test

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