

# Applied Linear Algebra \*

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**Calendario:** 16 ore, Martedì e Giovedì, dalle 10.30 alle 12.30. Prima lezione Martedì 2 settembre. Lezioni successive: 4, 9, 11, 23, 25, 30 settembre, 2 ottobre. Aula DEI/G (Piano 3, Dipartimento di Ingegneria dell'Informazione, Via Gradenigo 6/a)

**Prerequisiti:** A good working knowledge of basic notions of linear algebra, as e.g. presented in [5].

**Tipologia di esame:** Prova scritta e/o homeworks

## Obiettivi del corso:

Concepts and techniques of linear algebra will be studied, which are important for applications and computational issues. A wide range of exercises and problems will be presented such that a practical knowledge of tools and methods of linear algebra can be acquired.

## Programma del corso:

- *Matrix equations and inequalities:*  
Lyapunov and Riccati equations, stability and inertia, matrix functions
- *Krylov subspaces and numerical methods:*  
Arnoldi's algorithm, Ritz eigenvalues, iterative methods
- *Positive matrices and positive operators:*  
Perron-Frobenius theory, stochastic matrices, M-matrices and positive evolutions
- *Singular values and generalized inverse:*  
Polar form, singular value decomposition, generalized inverse, least squares problem, norms, low-rank approximation
- *Perturbation theory:*  
Eigenvalue perturbations, pseudospectra,  $\mu$ -values

## References:

- [1] L. N. Trefethen and D. Bau Numerical Linear Algebra. SIAM, 2000.
- [2] A. Berman and R. J. Plemmons. Nonnegative Matrices in the Mathematical Sciences. Classics in Applied Mathematics. SIAM, 1994.
- [3] R. Bhatia. Matrix Analysis Springer, New York, 1997.
- [4] J. W. Demmel. Applied Numerical Linear Algebra. SIAM, Philadelphia, 1997.
- [5] E. Gregorio and L. Salce. Algebra Lineare. Edizioni Libreria Progetto, Padova, 2005.
- [6] R. A. Horn and C. R. Johnson. Matrix Analysis. Cambridge University Press, Cambridge, Massachusetts, 1985.
- [7] R. A. Horn and C. R. Johnson. Topics in Matrix Analysis. Cambridge University Press, Cambridge, 1991.

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\* corso in comune con la Scuola di Dottorato in Ingegneria dell'Informazione