

# Computational Inverse Problems

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**Timetable:** 20 hrs. , Torre Archimede, Room 2BC/30 (2 two-hours lectures per week). Classes on Monday and Wednesday, 10:30 - 12:30. First lecture on Monday March 4th, 2019. Room: 318 DEI/G, Dept. of Information Engineering, DEI/G Building, 3rd floor.

## Course requirements:

- basic notions of linear algebra and, possibly, numerical linear algebra.
- the examples and homework will be in Python (the transition from Matlab to Python is effortless).

**Examination and grading:** Homework assignments and final test.

**SSD:** MAT/08

**Aim:** We study numerical methods that are of fundamental importance in computational inverse problems. Real application examples will be given for distributed parameter systems in continuum mechanics. Computer implementation performance issues will be considered as well.

## Course contents:

- definition of inverse problems, basic examples and numerical difficulties.
- numerical methods for QR and SVD and their application to the square-root implementation in PCA, least-squares, model reduction and Kalman filtering; recursive least-squares;
- regularization methods;
- numerical algorithms for nonlinear parameter estimation: Gauss-Newton, Levenberg-Marquardt;
- examples with distributed parameter systems in continuum mechanics; HPC implementations

## References:

F.Marcuzzi "Analisi dei dati mediante modelli matematici", <http://www.math.unipd.it/marcuzzi/MNAD.html>