

**Course offered for the PhD program
in Civil, Chemical and Environmental Engineering
Curriculum in Structural and Geotechnical Engineering, Mechanics and Materials
Curriculum in Wind Science and Engineering
A.Y. 2024/2025 (XL cycle)**

(course is open for participation of students from other PhD cycles or programs)

1. Title

Signal processing and spectral analysis

2. Course Description

The aim of the Course is to provide basic knowledge and numerical tools for the processing and spectral analysis of signals, that play a fundamental role in the development of suitable models for dynamic actions on structures (e.g. wind-, seismic and human-induced loading), as well as for structural vibration monitoring and dynamic identification. Numerical applications in Matlab dealing with the analysis of signals deriving from different phenomena (e.g. stationary and non-stationary wind velocity recordings, human-induced loading, structural vibrations) are presented.

Course syllabus:

- Deterministic periodic, almost periodic and transient nonperiodic data. Data processing and Fourier Transform. Data sampling, Discrete Fourier Transform, Aliasing and Leakage.
- Random data: statistical and spectral analysis of stationary random processes.
- Random data: statistical and spectral analysis of non-stationary random processes, evolutionary spectral models, moving average extraction, introduction to time-frequency analysis (short-time Fourier Transform and wavelet analysis).

3. Course Organization

The course consists of lectures and exercises. Numerical applications in Matlab are introduced.

4. Teacher

Federica Tubino

5. Duration and credits

10 hours (2 credits)

6. Activation mode and teaching period

The minimum number of participants to activate the course is 3. The course will take place in June/July 2025.

7. Deadline for registration

The deadline for applications is May 15th, 2025. Please, send a confirmation e-mail to Federica Tubino, federica.tubino@unige.it.

8. Final exam

The final examination will be an oral presentation of an in-depth analysis of one of the topics covered by the Course or one homework assignment that addresses a problem of interest agreed between the student and the instructor.