Elements of Operational Modal Analysis and Extreme Value Analysis for Civil Structures

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General Information

The course will be divided into two main parts. The first will address the dynamic testing of large civil structures, while the second will focus on the statistical analysis of structural response under extreme conditions.

First, the course will introduce the students to the problems related to the dynamic test of large civil structures. The main techniques in the time (SSI) and frequency domain (FDD, EFDD) applied nowadays will be deeply illustrated along with the practical issues that can arise during the in-situ testing campaign. Lastly several case of study will be shown in detail to practically illustrate the aforementioned methods.

The second part will focus on statistical methods for extreme-value analysis, with the aim of estimating return levels associated with a prescribed annual probability of exceedance. Starting from the block-maxima (BM) framework and the GEV family, the course will then introduce the Peaks Over Threshold (POT) approach, covering key practical steps such as threshold selection, treatment of dependence (declustering), parameter estimation, and model diagnostics. Finally, the course will introduce the point-process approach, modelling threshold exceedances as a Poisson process and deriving return levels and related uncertainty estimates The course will be held online in English with the schedule attached below.

Materials

It is recommended the use of a laptop with the MATLAB © software for the exercitation.

Schedule

Dates	Description
07/04/2026 – 14-17	Introduction to the modal testing basis
13/04/2026 – 14-17	Frequency domain techniques
27/04/2026 – 14-17	Time domain techniques
04/05/2025 – 14-17	Practical issues in modal testing
14/05/2025 – 14-17	Classical extreme value theory and the Block Maxima Method (BM)
20/05/2025 – 14-17	Peak over Threshold (POT) and Point Process methods for extreme value statistics

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Dates	Description
	Total 18 Hours – 3 Credits

Other information

The final exam will be the discussion of the exercise that will be assigned at the beginning of the course to the students based on a real case of study.

For any information www.indicee.unifi.it - dott-dicea@unifi.it

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