

Titolo: Optimization Algorithms for Structural Engineering Problems: Design, Monitoring, and Management.

Durata: 16h

Abstract:

This course covers recent implementations of optimization algorithms, as a formal expression of the digitalization process affecting structural engineering.

Preliminarily, the course introduces the concepts of digitalization in the built environment, comprehensively describing the processes to which optimization procedures can be applied, and how this phenomenon affects all the stakeholders involved. The course will describe all the objectives according to which optimization can be pursued, ranging from sustainability to improved structural performance.

The core of the course is the thorough discussion of several successful applications of algorithmic methodologies to processes belonging to different phases of the life cycle of a structure.

The course quickly surveys the formalisms behind the three pillars of an optimization problem - objective function, decision variables, and restrictions - and sketches a classification of different classes of problems and the general criteria that guide the selection of the most appropriate and effective solution approaches.

Concerning the design phase, the seminar will address topology optimization and the automated performance-based design for rationalizing the specific design requirements of complex structures. For the use phase, instead, the focus will be on the monitoring and maintenance processes, addressing model updating techniques, and stochastic algorithms for the optimal planning of cost-efficient and sustainable maintenance schedules.

The course will also emphasize the specific components of the algorithms that achieved the best performances in recent papers, such as biased random key genetic algorithms and ant colony optimization.

Final exam: seminar. Formulation and discussion of a structural optimization problem of interest and the associated solution methods.