Identification and inverse problems in FEM modeling of materials and structures

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Abstract

Identification of constitutive properties of materials, as well as of structural properties, is a pivotal task in structural engineering. The aim of the 24-hour (3CFU) course is to provide an exhaustive overview of traditional and more recent strategies for inverse identification of constitutive and structural models within the framework of the nonlinear analysis of structures through the Finite Element Method.

The course is organized in theoretical lectures as well as practical sessions during which codes for nonlinear finite elements will be developed in a Matlab environment and in OpenSees (Open System for earthquake engineering simulation).

Program

Least-square problems; pseudo-inverse matrix; a probabilistic framework to inverse analyses based on information theory; Bayesian approach; Kalman filtering; Minimization algorithms and heuristic strategies; Fundamentals of nonlinear finite element models; Special purpose elements for fracture and plasticity; Sensitivity analyses by Direct Differentiation Methods (DDM).

Schedule

The course will be scheduled in June 2023 and will be held in presence.

Final Exam

Discussion of a written report focused on a case study selected by each student who needs to demonstrate the acquired skills in the modeling, identification and simulation of mechanical systems and materials typically adopted in aerospace, civil and mechanical engineering.