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MINISYMPOSIUM ON:

INVERSE PROBLEMS FOR PARAMETER IDENTIFICATION

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Motivation and purposes.
Methods for the parameter identification through inverse analysis (namely by minimization of the discrepancy between measured and computed quantities) are at present spreading in several engineering and technological fields. In fact, the synergistic integration of computational and experimental mechanics, which represents the peculiar feature of inverse analysis, turns out to be fruitful, and sometimes necessary, in a number of practical situations for a variety of reasons, namely: the availability of effective *ad hoc* mathematical theories and tools; the growing realism and complexity of material models (with more and more parameters not directly measurable by standard tests); the deterioration of many socially important existing structures and the need for their reliable diagnostic analysis before retrofitting provisions.
The objective of this Minisymposium is to provide an international forum for presentations and discussion ofresearch results concerning practical methods centered on inverse analysis, for mechanical characterization of materials through calibration of their constitutive models and for diagnostic analysis of existing possibly deteriorated structures, with reference to representative classes of engineering and industrial situations.

Items to be dealt with.
Fundamentals: mathematical procedures for constrained minimization of possibly nonconvex and nonsmooth functions; numerical solution methods and algorithms (direct search; first and second order minimization algorithms; mathematical programming); soft computing

procedures (genetic algorithms, artificial neural networks); identification methods with "batch" use of experimental data; sequential methods such as Kalman filter and its extensions; statistical processing of measurement noise and modelling errors; sensitivity analyses of measurable quantities with respect to the parameters to identify; some representative and partly innovative experimental techniques related to parameter identification (indentation, small-punch, atomic force microscope, laser profilometers, radar and laser monitoring, etc.).
Calibration of material models on the basis of experimental tests: elasto-plasticity of metals; inelastic and fracture behaviours of quasi-brittle materials (concrete, ceramics); visco-elasto-plasticity of polymers; interface models for joints; constitutive modelling of heterogeneous materials (composites and laminates); assessment of local constitutive parameters through tests at the macroscale in average variables: parameter estimation by indentation tests associated to imprint mapping and by “small punch” tests. Meaningful applications to engineering problems concerning structural components in various industries and in microtechnologies. Specifically, diagnostic analysis of structures based on in situ monitoring and nondestructive tests: main causes of structural damages (deterioration phenomena such as aggregate-alcali-reaction in concrete; extreme loadings); parameters representative of structural damages; typical equipment for in situ tests and monitoring of structures and industrial components; sensitivity analysis; inverse analyses to diagnostic purposes; representative applications to concrete dams, bridges, monumental structures and industrial components.