

Guest-editorial

Special issue: Selected papers from the *11th International Conference on Fracture*, 21–25 March 2005, Torino, Italy

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Prof. Ing. Alberto Carpinteri, Guest-editor and ICF11 Chairman.

This special issue of the International Journal “*Strength, Fracture and Complexity*” reports the most interesting contributions from the Mini-Symposium on “Complexity, Scaling and Nonlinearity in the Mechanics of Advanced Materials”, held in Torino (Italy), on March 21–23, 2005, in the wider framework of the 11th International Conference on Fracture (ICF11), the World forum on fracture, fatigue, material strength, structural damage and integrity, which every four years is organised in most different parts of the Planet. The related International Society – International Congress on Fracture (ICF) – was founded by the Editor-in-Chief of this Journal, Professor Takeo Yokobori, in 1965 – exactly forty years ago – and is today the premier international body for promoting worldwide cooperation among scientists and engineers on the above mentioned topics. ICF11 has been organised under the High Patronage of the President of the Republic of Italy, under the auspices of the Ministry of Infrastructures and Transportation of the Italian Government, and of the National Science Foundation of Italy (CNR), with the

scientific support of the leading continental institutions on the subject of the conference: the European Structural Integrity Society (ESIS), and the American Society for Testing and Materials (ASTM).

The so-called “Complexity Sciences” represent a subject of fast-growing interest in the Scientific Community. They have entered also our more circumscribed Communities of Material Science and Material Strength, as the title of the present journal may confirm. Under the label of “Complexity Sciences” we usually comprehend a large variety of phenomena, theories, approaches and techniques: nonlinear dynamics, deterministic chaos, nonequilibrium thermodynamics, fractal geometry, intermediate asymptotics, renormalization group theory, catastrophe theory, self-organised criticality, neural networks, cellular automata, fuzzy logic, etc. Complex systems lie somehow in between order and randomness and exhibit some common characteristics, such as: sensitivity to initial conditions, pattern formation, spontaneous self-organisation, emergence of cooperation and collective properties, hierarchical or multiscale meso-structures, scaling and size effects. We could try to summarize by saying that the nonlinearity in the constitutive laws may produce complex structures and scale-dependent behaviours. Principal scope of the Mini-Symposium was that of providing insight into the role of complexity in the fields of Solids and Fracture Mechanics. The included cases are concerned with the structural behaviour of composite structures with snap-back instabilities (an example of cusp catastrophe), the occurrence of fractal patterns and geometrically self-similar morphologies in deformation, damage and fracture of heterogeneous materials, the apparent scaling in the nominal mechanical properties of disordered materials, the acoustic emission criticality in progressive structural collapses, the microcracking accumulation, coalescence and percolation versus the macrocrack formation, the dynamic crack propagation and bifurcation with material fragmentation, etc.

The Volume is subdivided into the following four different thematic sections (see Contents’ partition).

- (1) Meso-, micro- and nano-structural aspects.
- (2) Dynamical aspects.
- (3) Hydraulic fracturing.
- (4) Concrete and quasi-brittle materials.

The Guest-Editor of this special issue wishes to thank all the Authors of the papers for the outstanding scientific level of their contributions, as well as the Editor-in-Chief of the Journal for his very kind hospitality. Special thanks are also due to Doctor Marco Paggi for his precious collaboration in the organization of the Mini-Symposium as well as in the production of the present volume.

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