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Preface to a Special Issue of the International Journal of Solids and Structures on *Physics and Mechanics of Random Structures: From Morphology to Material Properties*

In honor of Professor Dominique Jeulin (Mines ParisTech)

This volume gathers contributions presented at the *International Workshop on Physics and Mechanics of Random Structures: From Morphology to Material Properties* held on the Ile d'Oléron (Atlantic coast, France), June 17–22, 2018 (Willot and Forest, 2018; Oleron, 2019). This exceptional workshop was organized on the occasion of the (official) retirement of Prof. Dominique Jeulin from his position at Mines ParisTech, where he has been working for more than 30 years to the development of mathematical morphology and physics and mechanics of random media. The topics of this workshop dealt with Prof. D. Jeulin's favorite research subjects:

- imaging techniques and image analysis
- random structures and microstructure characterization
- coupled problems in physics and mechanics
- homogenization methods in the mechanics and physics of heterogeneous materials
- generalized continua and defects in solids

- Fourier-based computational methods
- micro-mechanical modeling of polycrystals
- fiber composite materials
- transport properties and optimization.

The volume contains 20 original articles dealing with these topics written by outstanding authors from renowned universities and institutes in France, Germany, Great Britain, Mexico, USA, and several other countries.

Prof. D. Jeulin is well-known for his models of random microstructures established from systematic image analysis and for the determination of their local and effective properties including bounds and estimates. His contributions to a statistical definition of the representative volume element size for composite materials are largely used in the current research and engineering in the field of mechanics and physics of heterogeneous materials. His approach to science combines in a unique way systematic ob-



Vincenzo Capasso - Jean Serra - Dominique and Anne-Marie Jeulin.



Prof. John Willis, Pedro Ponte Castañeda and Pierre Suquet in Oléron (2018).

servations of microstructure images, mathematical and analytical modeling, and large scale simulations of microstructures and their physical properties. Prof. D. Jeulin has cooperated and is still cooperating with many distinguished international researchers in these fields and several of them are contributing to this volume.

He has established fruitful collaborations between his Centre de Morphologie Mathématique and Centre des Matériaux, two research institutes at Mines ParisTech. Many of his major scientific achievements originate from this pioneering combination of mathematical morphology and material sciences.

As a professor at Mines ParisTech, he has taught courses on image analysis and physics and mechanics of random media, attracting master and Ph.D. students, researchers and engineers from France and Europe.

Another unique feature of D. Jeulin's activities is his continuous interaction with industry, taking advantage of challenging industrial problems to find efficient solutions, and deriving innovative techniques of image analysis and numerical simulations of microstructures and their properties. The numerous Ph.D. students he has supervised were most often working within the framework of such industrial contracts, demonstrating that original scientific advances can emerge from solving practical problems stemming from engineering. Several former Ph.D. students have contributed to the workshop with presentations and posters, and with articles in this Special Issue.

Undoubtedly, Dominique Jeulin will continue working on exciting aspects of mathematical morphology and physics of random media.

We thank all the participants for their active contributions to the lively discussions during the Workshop and for their outstanding articles in this Special Issue, as well as Mines ParisTech, Armines, the Mécamat association, the ESIEE graduate engineering school, the International Society for Stereology & Image Analysis (ISSIA), and Électricité de France (EDF) for their support in organizing the event. The Editors of the International Journal of Solids and Structures are gratefully acknowledged for hosting this Special Issue on stimulating fields of mechanics and physics of materials and structures.

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