

9th Int Conference on Computational Methods (ICCM9) Rome - Aug 6-10th

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Thematic Lecture

On the Dynamics of Highly Nonlinear Lattice Materials

This talk is aimed at presenting the mechanical response and the wave dynamics of highly nonlinear lattice materials, and at discussing how such systems can be employed for the design by computation of new mechanical metamaterials. The main focus is on lattices with tensegrity architecture and their multifaceted mechanical behavior. Tensegrity concepts are ubiquitous in nature and appear, e.g., in every cell, in the microstructure of the spider silk, and in the arrangement of bones and tendons for control of locomotion. The talk will highlight how it is possible to employ the geometrically nonlinear response of tensegrity units to create complex global systems (the metamaterials) with unprecedented mechanical properties.

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Fernando Fraternali is Professor of Structural Mechanics in the Department of Civil Engineering at the University of Salerno, Italy. He received his B.Sc. and M.Sc. degrees in Civil and Environmental Engineering from the University of Salerno, and a Ph.D. in Multiscale Mechanics from King's College London. F. Fraternali has participated as a PI or co-PI in various research projects funded by the Italian National Research Council, the Ministry of Education, the Ministry of Foreign Affairs (Italy-USA scientific cooperation), and US research agencies. Most of his research work concerns computational mechanics; multiscale numerical modeling and simulation of materials and structures; and the computational design and engineering of innovative materials, such as highly nonlinear phononic crystals, environmentally compatible composite materials, nanomaterials and biomaterials. Prof. Fraternali was awarded a Fulbright Research Scholarship for the academic year 2005/06 and has been Visiting Professor at the Graduate Aerospace Laboratories of the California Institute of Technology since September 2005 (several periods), and the Department of Mechanical and Aerospace Engineering, University of California, San Diego, USA, from August 2012 through to the present. Recently, he received the "Bdr2017 Award – Category Green Economy" for the University of Salerno spin-off [Newmatt](#) within the Startup Competition on Innovation and Entrepreneurship "Borsa della Ricerca 2017" (Fisciano, May 2017, [link](#)); the "2015 Hetenyi Award" from the Society for Experimental Mechanics, Inc. (Bethel, CT 06801, USA; June 2014); the "Contributions to the Variational Theory of Fracture" Award from the Vibration and Wave Propagation Laboratory of the Georgia Institute of Technology (Sept. 2012); and the "Contributions to Understanding the Behavior of Waves in Granular Systems" Award from the Granular Science Laboratory of the New Jersey Institute of Technology (Aug. 2012). Prof. Fraternali is on the Board of Editors of the International Journals: Mechanics Research Communications (Elsevier, ISSN: 0093-6413); World Journal of Engineering (Multi-Science Publishing Co. Ltd, ISSN: 1708-5284); Frontiers in Materials (Frontiers Publishing, ISSN: 2296-8016); Curved and Layered Structures (De Gruyter Open, ISSN: 2353-7396) and Ingegneria Sismica - International Journal of Earthquake Engineering (Patron Editore, ISSN: 0393-1420). F. Fraternali is Guest Editor of the special issue "Multi-Scale Modeling and Characterization of Innovative Materials and Structures" of Mechanics Research Communications (Elsevier, ISSN: 0093-6413). Volume 58, Pages 1-156 (June 2014, [link](#)), and the special issue "Composite Lattices and Multiscale Innovative Materials and Structures" of Composites Part B: Engineering (Elsevier, ISSN: 1359-8368), Volume 115, Pages 1-504 (15 April 2017, [link](#)).