Spring 2014 COLLOQUIUM SERIES

GRANULAR AND MULTIPHASE FLOWS

Sponsored by

The Granular Science Laboratory

gsl.njit.edu

Prof. Fernando Fraternali

Department of Civil Engineering

University of Salerno

Fisciano, Italy

February 19, 2014

2:30 – 4:00 p.m.

Mechanical Engineering Center – Room 221

Dynamics of Energy Transport in Phononic Crystals

This talk presents a summary of recent researches on the optimal design of granular crystals and periodic arrays of tensegrity structures. Regarding granular metamaterials, we focus on topology, size, and material optimization of composite granular systems composed of particles with different material properties, arrangements and/or dimensions. We show that the optimal design of granular metamaterials through Evolutionary Algorithms (EAs) leads to significantly improvements in the energy trapping capability of the system. The EA-driven optimal design generates suitable topology, size, and material randomization by combining effects of wave disintegration and reflection at the interfaces between geometrical and/or mechanical discontinuities [a, b, c, d]. The second part of the talk deals with a novel application of tensegrity structures as tunable acoustic metamaterials. We show that such structures support a special type of solitary wave, whose profile depends on the wave speed and localizes on a single lattice spacing in the supersonic regime. This special feature of tensegrity structures suggests the use of tensegrity crystals as actuators capable of focusing pressure waves in very compact regions in space [e, f]. The introduction and the closure of the talk present different engineering applications of acoustic metamaterials, dealing with the control of the acoustic energy, shock and energy absorbing layers, actuating devices, acoustic lenses, and noise control.

Fernando Fraternali is an Associate Professor of Structural Mechanics in the Department of Civil Engineering of the University of Salerno, Italy. He received his B.Sc. and M.Sc. degrees in Civil Engineering from the University of Salerno, and a Ph.D. in Multiscale Mechanics from the King's College, London. Most of his research work concerns multiscale modeling and simulation of materials and structures, and the design, analysis and experimentation of innovative materials, such as highly nonlinear phononic crystals, environmentally compatible composite materials, nanomaterials and biomaterials. Prof. Fraternali has been awarded a Fulbright Research Scholarship for the Academic Year 2005/2006 and has been Visiting Professor at the Graduate Aerospace Laboratories of the California Institute of Technology, from September 2005 through present (several periods), and the Department of Mechanical and Aerospace Engineering, University of California, San Diego, USA, from August 2012 through present.

For further information, please contact Dr. A. Rosato (rosato@njit.edu; 973-596-5829)