SEMINAR

APPLIED MATHEMATICS AND MECHANICS

23 July 2025

A DCAMM seminar No. 788 will be presented by

Distinguished Professor Graeme W. Milton
Department of Mathematics, University of Utah
Salt Lake City, USA

The title of the lecture is

From Pentamodes to Cable Webs to Masonry Structures

Abstract:

Pentamode materials are a class of materials that are useful for guiding stress. Like fluids they can support only one loading. Unlike fluids this loading is not necessarily hydrostatic but could be a combination of hydrostatic and shear loadings. In particular, they have been proposed for acoustic cloaking by guiding stress around objects and have been physically constructed. A key feature of the original class of pentamode materials is that each vertex in the material is the junction of 4 double cone elements. Thus, the tension in one element determines the tension in the other elements, and by extension uniquely determines the stress in the entire metamaterial. Here we show how this key feature can be extended to discrete wire networks, supporting forces at the terminal nodes and which may have internal nodes where no forces are applied. In usual wire or cable networks, such as in a bridge or bicycle wheel, one distributes the forces by adjusting the tension in the wires. Here our discrete networks provide an alternative way of distributing the forces through the geometry of the network. In particular the network can be chosen so it is uniloadable, i.e. supports only one set of forces at the terminal nodes. Such uniloadable networks provide the natural generalization of pentamode materials to discrete networks. We extend such a problem to compression-only 'strut nets' subjected to fixed and reactive nodal loads. These systems provide discrete element models of masonry bodies. In particular, we solve the arch problem where one wants the strut net to avoid a given set of obstacles and also allow some of the forces to be reactive ones. This is joint work with Ada Amendola, Guy Bouchitte, Andrej Cherkaev, Antonio Fortunato, Fernando Fraternali, Ornella Mattei, and Pierre Seppecher.

DATE: **Tuesday, 12 August 2025**

TIME: **13:00 – 13:45**

PLACE: **Building 414, Room 061B**
          DTU, Technical University of Denmark

REGISTRATION for virtual participation at the following link:

https://dtudk.zoom.us/j/68614811750?pwd=jiF3QmsDuasbXKQ2VDTdqNIGJZZ742.1

Danish pastry, coffee and tea will be served 15 minutes before the seminar starts.

All interested persons are invited.

Jan Becker Høgsberg

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