SEMINAR

APPLIED MATHEMATICS AND MECHANICS

25 March 2019

A DCAMM seminar No. 739 will be presented by

Professor Grégoire Allaire
Department of Applied Mathematics
Ecole Polytechnique, Palaiseau, France

The title of the lecture is

Optimal design of modulated and oriented lattice materials by the homogenization method

Abstract:

This talk will discuss the optimization of so-called lattice structures made of periodically perforated material, where the microscopic periodic cell can be macroscopically modulated and oriented. This is a three-step process. First, one compute the homogenized properties of a well-chosen family of parametrized periodicity cells. Second, one optimize the homogenized formulation of the macroscopic problem, which is an easy task of parametric optimization. Third, the optimal microstructure is projected on the macroscopic domain at a desired lengthscale, which is a delicate issue, albeit computationally cheap. The combination of these three steps is a topology optimization method for lattice structures.

The main novelty of our work is the third projection step which amounts to build a global orientation of the microstructures. It requires a regularization of the orientation and the construction of a diffeomorphism following this orientation. In 2-d, such a diffeomorphism is built thanks to a conformal treatment of the optimal orientation, ensuring that, although the periodicity cell has varying parameters and orientation throughout the computational domain, the angles between its members or bars are preserved. In 3-d, conformality cannot be achieved and a different direction-by-direction reconstruction is proposed. Several numerical examples are presented for compliance minimization in 2-d and 3-d. The issue of possible singularities in the orientation field will be briefly discussed. This is a joint work with Perle Geoffroy-Donders and Olivier Pantz.

DATE: **Friday, 5 April 2019**

TIME: **10:45 – 11:30 incl. questions**

PLACE: **414-061E**

All interested persons are invited.

Niels Leergaard Pedersen

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