

MechNanoTruss project
Postdoctoral position (2 years)

Robust design of polymer nanotruss scaffolds

Three-dimensional lithography (two-photon polymerization) enables the manufacturing of polymeric materials with an architected microstructure of tailorable geometry. Starting from elementary 3D arrangements of nanotrusses, in the 100-nanometer size, one can build complex scaffolds, in centimeter scale size, by repeating the elementary arrangement periodically. The fabrication of macroscopic samples of these hierarchical materials opens the way to various applications, from biocompatible scaffolds to ultra-light vibration absorbing layers.

In order to bridge the gap between the existing manufacturing technology and real world applications robust and reliable design are needed for the assessment of these structures. The *MechNanoTruss Project*, a french-swiss project funded jointly by <http://www.agence-nationale-recherche.fr> and <http://www.snf.ch> aims at understanding the mechanics of biocompatible polymer nano-lattices and at developing a robust method to design them.

The hired postdoctoral researcher will work in the team *Structures* of the *Laboratoire de Mécanique des Solides (LMS)* at Ecole Polytechnique, <http://www.lms.polytechnique.fr> under the supervision of Prof. Andrei Constantinescu and in close contact with the team of Prof. Chiara Daraio, *Chair of Mechanics and Materials*, <http://www.mechmat.ethz.ch/> at ETH.

The goal of the post-doctoral project is to:

- (i) predict numerically quasistatic monotonic or cyclic tensile loading and the dynamic behavior of the nanotruss scaffolds and lifetime.
- (ii) create a multiscale design method of macroscopic heterogeneous and anisotropic structures based on databases of elementary nanotrusses.

The candidates must hold a PhD in mechanics of applied mathematics. The required skills are therefore a combination of expertise in mechanical and mathematical modeling, structural computations, and optimization and readiness to keep a collaborative dialogue with the colleagues manufacturing the nanolattices and performing experiments.

The contract is a CNRS postdoctoral research position under the french law. Office space, computer access and financial support for collaborative travelling to ETH and conferences will be provided. The hiring process will start in January 2016 but the position is open until it is filled.

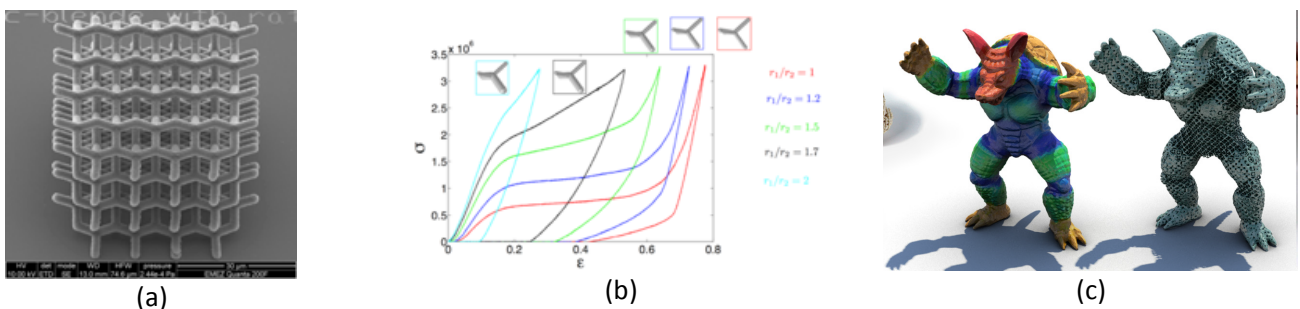


Figure 1: (a) Example of a polymer-based nanolattice fabricated by PI Daraio's group at ETH with <http://www.nanoscribe.de/en/> on a polymeric resist. Scanning Electron Microscopy image of a lattice. (b) Experimental characterization of the compressive response of different lattices with varying geometrical parameters, subjected to indentation tests (unpublished results from PI Daraio's group) (c) Examples of soft-hard (blue and red) structures manufactures as an assembly of elementary cells [Disney Research].

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