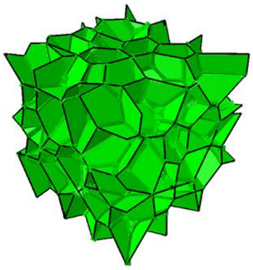
MULTIFOAM

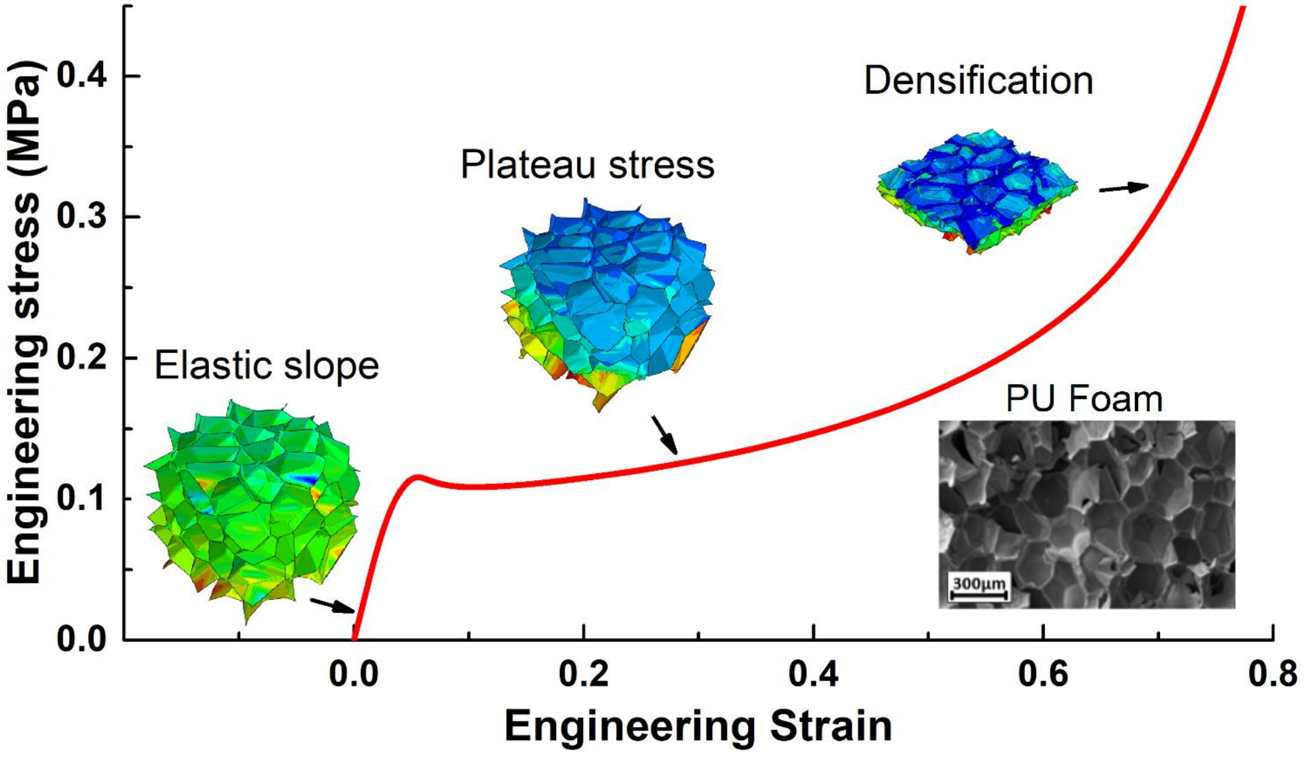


Software description

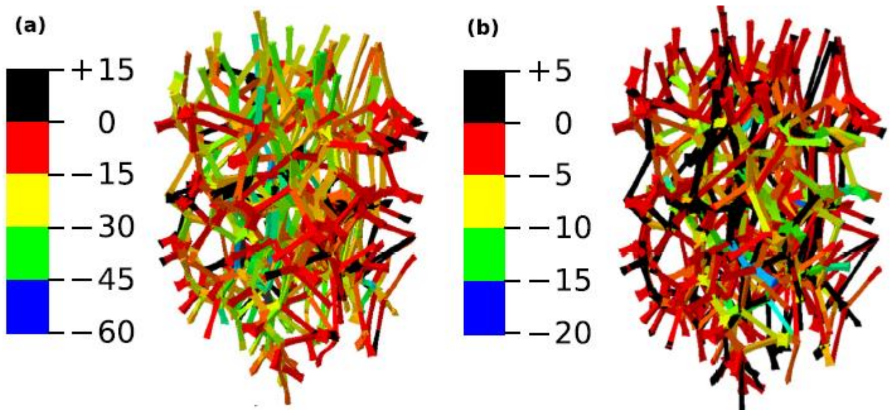
MULTIFOAM is a simulation tool developed within the framework of computational micromechanics by IMDEA Materials to predict the mechanical behavior of low to medium density foams with open and closed-cell microstructure. The representative volume element of the microstructure is built from a number of parameters (density, cell size distribution, anisotropy and type, struts and walls mass fraction, mechanical properties of bulk material, etc.). The mechanical properties of foam under different loading conditions (including compression until full densification) are then computed by means of the finite element analysis (Abaqus/explicit) of the representative volume element.

MULTIFOAM is a ready-to-use software package developed using Python which includes a Graphical User Interface. The finite element based modelling strategy of the MULTIFOAM has been extensively validated in the case of polyurethane foams. The tool is fully automatized and could be used for design optimization.

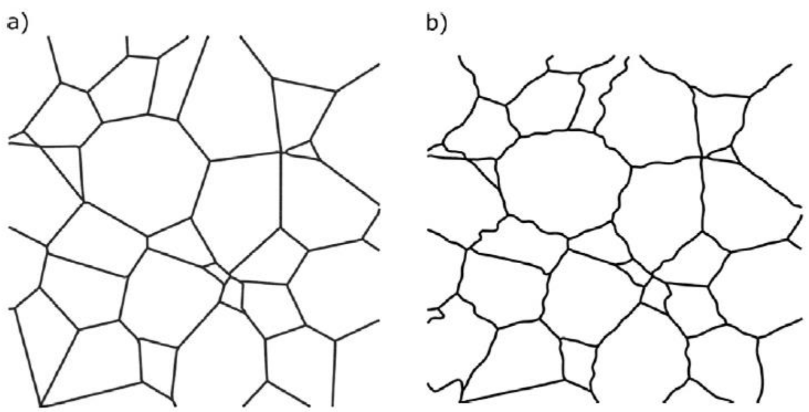
MULTIFOAM capabilities



Simulation of the mechanical response of a closed-cell polyurethane foam in compression. The model takes into account the influence of the gas pressure within the cells and of the contact between struts during crushing.



Contour plot of the axial forces in the strut network of the anisotropic foam. (a) Vertical compression parallel to the rising direction of the foam. (b) Horizontal compression perpendicular to the rising direction of the foam.



Central cross-section of the representative volume element showing the deformation of the cell walls. (a) Initial cell wall structure. (b) Cell wall structure after 6% compressive strain.

Supplementary data

Transfer Opportunity: Software license

References:

1. M. Marvi-Mashhadi. *Multiscale characterization and modelling of polyurethane foams* (Doctoral dissertation,Polytechnic University of Madrid, 2018).
2. M: Marvi-Mashhadi,, C. S. Lopes, and J. LLorca. "*Modelling of the mechanical behavior of polyurethane foams by means of micromechanical characterization and computational homogenization*." International Journal of Solids and Structures 146, 154-166, 2018.
3. M. Marvi-Mashhadi, C. S. Lopes, and J. LLorca. "*Effect of anisotropy on the mechanical properties of polyurethane foams: An experimental and numerical study*." Mechanics of Materials 124, 143-154, 2018.

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