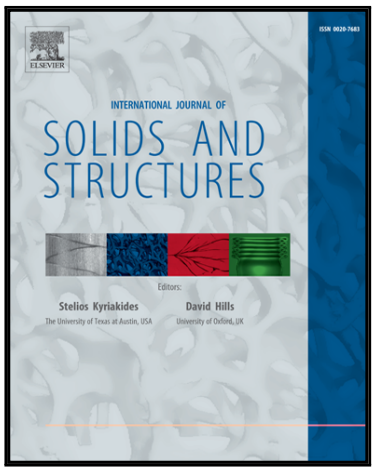

Microstructure characterization and homogenization of acoustic polyurethane foams: measurements and simulations

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Microstructure characterization and homogenization of acoustic polyurethane foams: measurements and simulations

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Abstract

The sound absorption ability of porous materials is strongly related to the underlying microstructure. In this paper, acoustic properties of a polyurethane (PU) foam are determined from its microstructure with a computational homogenization method. The foam is analyzed using X-ray computed tomography (CT) and scanning electron microscopy (SEM). Based on the obtained microstructure information, a parallel model of a fully-open and a partially-open Kelvin cell with thin membranes is built to represent the foam. The corresponding effective material parameters, including the dynamic density and the stiffness tensor, are obtained by applying a computational homogenization approach. Numerical simulations of an impedance tube test based on Biot's equations with parameters obtained from the homogenization are compared with the measured sound absorption coefficients. Considering the limitations of the simplified microscopic model, a good agreement between the measurements and the simulation results for the PU foam is found.

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