Inverse estimation of the elastic and anelastic properties of the porous frame of anisotropic open-cell foams

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Abstract

An inverse method for measuring the elastic and anelastic properties of the frame of anisotropic open-cell foams is proposed. The frame is modelled using an augmented Hooke's law, which consists in writing the stiffness matrix as a superposition of elastic and anelastic contributions. The anelasticity is described using a fractional-derivative model, which provides a compact representation of the properties of the material, and orthotropic symmetry is assumed. The extraction of the properties of the frame consists of a fit of a set of transfer functions of a cubic sample of material placed between a vibrating base and a seismic mass, inside a vacuum chamber. Such inverse estimation procedure is formulated as an optimisation problem, which is implemented using the globally convergent method of moving asymptotes. In order to validate the approach in a case where the material properties are known, a numerically generated target is used. The transfer functions are well fitted and provide a good estimation of the stiffness matrix of the material, thus allowing for jointly estimating anisotropic stiffness and damping.

Presentation details:

- Session: characterisation and measurement techniques
- Oral presentation preferred
- No special requirements for the oral presentation

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