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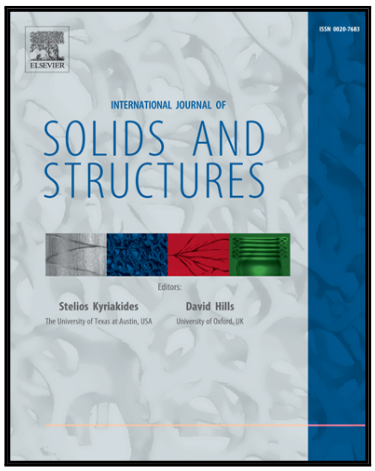

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Combined effect of pores concavity and aspect ratio on the elastic properties of a porous material

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Abstract:

The present paper focuses on materials containing superellipsoidal pores described by equation $|x_1|^{2p}+|x_2|^{2p}+|x_3/\gamma|^{2p}=1$. This shape is concave when $0<p<0.5$ and convex when $p>0.5$. They are oblate when γ<1 and prolate for γ>1 Combined effect of two shape factors - parameter p describing the concavity and aspect ratio γ describing extend of oblateness/prolateness - on compliance contribution tensor is analyzed numerically and approximated analytically for most important case of $p<1$. It is shown that, in this case, the combined effect is equal to the product of two effects considered separately. The obtained approximate expressions are used to calculate the effective elastic properties of a heterogeneous material containing pores of superellipsoidal shape.

Keywords: Superellipsoid, concavity parameter, aspect ratio, compliance contribution tensor, effective elastic properties

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