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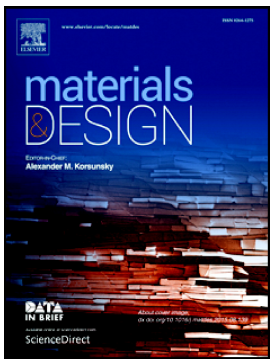

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Anisotropic in-plane mechanical behavior of square honeycombs under off-axis loading

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Abstract

Square honeycombs show a strong anisotropy when loaded in different orientations. In this paper, a new theoretical approach is proposed to describe the in-plane yield strengths of the square honeycombs in different directions. The analytical solutions are validated by the finite element simulations and the experiments. The results indicate that the in-plane strengths of the square honeycombs show great anisotropy, which can be expressed as functions of the in-plane off-axis angles. The square honeycombs show high yield strengths in the principal directions and low yield strengths in the in-plane off-axial directions. However, the yield strengths in the principal directions under shear loading are much lower than those in the in-plane off-axial directions. In addition, four typical deformation processes are observed both in experiments and numerical simulations when the honeycombs are compressed in different directions. An interesting rotating deformation mechanism is observed in the in-plane off-axial direction compression with small angles. The results of this study are hoped to contribute to develop the in-plane off-axis mechanical properties of honeycombs for the engineering applications.

Keywords

Anisotropic properties; Yield strength; Square honeycombs; Finite element simulation; In-plane compressive tests

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