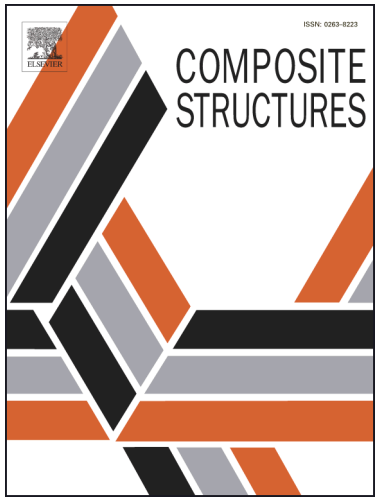

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Buckling of stomatopod-dactyl-club-inspired functional gradient plates: A numerical study

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Abstract

The translation of natural (or biological) structures into synthetic materials offers a spectrum of feasible pathways towards enhanced or even unprecedented material properties for a wide range of applications. Inspired by excellent mechanical properties of stomatopod dactyl club, herein we propose a new functionally graded material (FGM) model that can adequately describe the characteristics of hierarchical structures in the stomatopod dactyl club. The proposed FGM model is incorporated into extended finite element method with stabilized discrete shear gap to investigate the mechanical buckling behavior of the plate made of materials similar with that in stomatopod dactyl club. The critical buckling factors for cracked FGM plates are computed and analyzed. Numerical results show that the design motif of bioinspired FGM increases the normalized buckling factor, even higher than that of homogenous plates, which suggests that the stability of plates can be enhanced by the use of bioinpsired FGM. The proposed FGM model opens a broad avenue to explore more fascinating mechanical