Buckling of interfacial layers in periodic cellular composite structures

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Abstract

The buckling of periodic cellular structures has been widely investigated by researchers for many years because of their special mechanical properties. For example, novel pattern transformation with auxetic behavior will occur as the periodic cellular structures are compressed beyond a critical value. The compressive strain corresponding to this critical load value is defined as critical strain, which is usually constant for materials with different Young's moduli and slightly drops as the Poisson's ratio of the materials decreases. In order to investigate the buckling behavior of periodic cellular structures, we fabricated the periodic cellular composite structures via multi-material 3D printer with different interfacial layers and simulate the structure with different material combinations and porosities. The finding raises the interesting phenomenon that whether the interfacial layer is stiffer or softer than the substrate, the critical strain proves to be lower than the single material periodic cellular structure. This research gives possibility to predict the critical strain for a limited combination of materials and porosities of the periodic cellular composite structures. We hope that our works could provide researchers a better solution to control the buckling critical strain of periodic cellular structures and thus may widen the use of this kind of structures.

Keywords: Buckling; composite; periodic cellular structure; interfacial layer