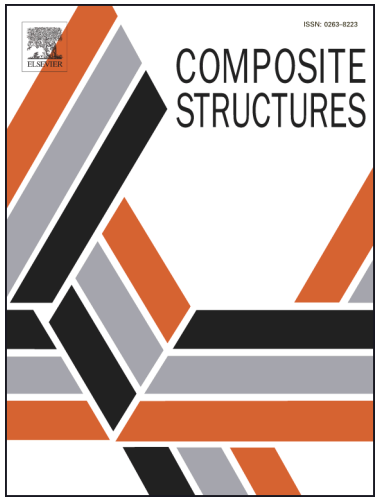

Crush behaviors of polyvinyl chloride cellular structures with liquid filler

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Crush behaviors of polyvinyl chloride cellular structures with liquid filler

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Abstract: In this work, the crush behaviors of hemi-ellipsoid polyvinyl chloride cellular structures (PVC-CS) with liquid filler (i.e. water) are experimentally studied. The load capacity and energy absorption characteristics of the liquid filled PVC-CS are significantly enhanced due to the additional support of liquid filler and the lateral expansion of PVC-CS, compared with the hollow PVC-CS without sealing. Besides, both the hollow and liquid filled PVC-CS are flexible and their deformations are fully reversible upon compression (for compressive strain up to 0.8) owing to the superelasticity of PVC. The effects of PVC hardness and strain rate on the crush behaviors of hollow and liquid filled PVC-CS are also explored. A homogeneous material model is developed by incorporating viscosity into the hyperelastic Yeoh model, which can describe the impacting behaviors of the liquid filled PVC-CS. The results presented in this work provide guidelines for designing and engineering high-performance energy absorption structures that are resilient, flexible, and of high energy absorption density.

Key words: Energy absorption; Liquid filler; Homogeneous material model; Crush behaviors; Strain rate effect

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