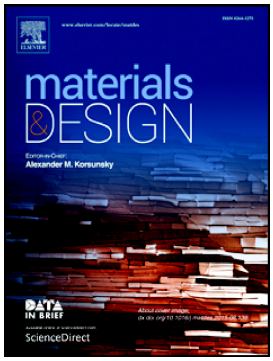

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Crashworthiness investigation of the bio-inspired bi-directionally corrugated core sandwich panel under quasi-static crushing load

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Abstract

The concept of mimicking natural materials to design novel lightweight structures with high capacity of energy absorption is of great interest at present. Enormous natural structures exhibit fascinating mechanical performance after hundreds of millions of years of convergent evolution. Odontodactylus scyllarus, known as the peacock mantis shrimp, whose dactyl strike is recognized as one of the rapidest and powerful creatures found in nature, has an enormous potential to act as excellent biomimetic protective system. In this paper, a novel lightweight bio-inspired double-sine corrugated (DSC) sandwich structure has been proposed to enhance the impact resistance. The out-of-plane uniform compression of the bio-inspired bi-directionally sinusoidal corrugated core sandwich panel has been conducted under the quasi-static crushing load. Compared with the regular triangular and sinusoidal corrugated core sandwich panels, the bio-inspired DSC core sandwich panels significantly improve the structural crashworthiness as well as reducing the initial peak force greatly. Finally, the influences of the wave amplitude, wave number and corrugated core layer thickness on the mechanical performance of the bio-inspired DSC core sandwich panel are investigated to seek for the appropriate structural parameters to optimize the energy absorption behavior.

Keywords: bio-inspired, sandwich structure, crashworthiness, energy absorption, FE simulation.

1. Introduction

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