

Numerical Study on Impact Resistance of Bio-Inspired Ceramic-Metal Composite Plates: Post-print

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Abstract

Complex combined bionic structures often exhibit superior performance compared to single structures. To investigate the impact resistance of bionic-structure ceramic-metal composite plates, a ceramic-metal composite plate model was established, considering brick-masonry and tortoise-shell bionic structures, and the processes of traditional ceramic-metal composite plates and bionic-structure ceramic-metal composite plates subjected to high-velocity projectile impact were simulated respectively. By comparing the residual velocities of projectiles after penetrating each structural composite plate, it was concluded that bionic-structure ceramic-metal composite plates are superior to traditional ceramic-metal composite plates in terms of impact resistance. Further comparative analysis of the projectile residual velocity during penetration, ceramic plate damage conditions, and energy dissipation results of each layer revealed that: the bionic structure exhibits locally more severe crack damage compared to the traditional structure, and the bottom ceramic plate has a larger ceramic damage cone angle; each layer of the bionic structure dissipates more energy than that of the traditional structure and prolongs the effective penetration time of the projectile; the adhesive layer can further suppress crack propagation and damage extent in the bionic structure.

Full Text

Preamble

This paper presents a comprehensive study on the application of advanced computational methods to address fundamental challenges in the field. We introduce a novel theoretical framework that integrates established principles with innovative approaches to improve upon existing methodologies. The following

sections detail our contributions, including theoretical developments, empirical validation, and practical implications for future research.

Note: Figure translations are in progress. See original paper for figures.

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