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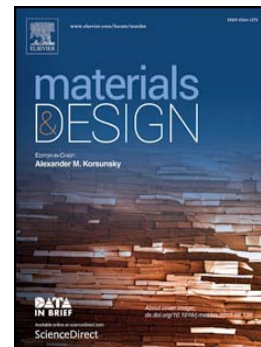
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Comparative Analysis of Energy Absorption Capacity of Polygonal Tubes, Multi-cell Tubes and Honeycombs by Utilizing Key Performance Indicators

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Abstract. With the excellent energy absorption of tubular structures, the axial crushing behavior of tubes of various section shapes has been extensively investigated, while multi-cell tubes and honeycombs structures have been designed to further improve their energy absorption performance. However, there is lack of unified criterion to appropriately evaluate the energy absorption capacity of tubular structures. In this paper, a carefully designed set of key performance indicators (KPIs) is utilized to assess and compare the energy absorbing performance of polygonal tubes, multi-cell tubes and honeycombs. A series of diagrams related the KPIs with non-dimensional parameters of various tubes are presented to demonstrate the influence of sectional configuration on the performance of polygonal tubes, as well as the effect of the cell number on that of multi-cell tubes and the effect of the cell package on that of honeycombs. The work is valuable to engineering designs and applications, as well as to the further studies of energy absorbers of other configurations.

Keywords: Energy absorption, key performance indicators (KPIs), polygonal tubes, multi-cell tubes, honeycombs

1. Introduction

Thin-walled structures are often used as energy absorbers to protect people and major structures in case of traffic accidents for land vehicles and emergent landing for aircrafts and spacecraft [1]. In the past decade, tubular structures, particularly circular and square tubes under axial compression/impact, have been investigated by various

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