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Abstract

Aluminum sandwich panels with honeycomb core have been widely used as energy absorption structure in lightweight design. This study aimed to characterize the indentation and perforation behaviors of sandwich structures with different geometric configurations. The specimens with four characteristic geometric variables, namely, facesheet thickness, core height, honeycomb core thickness and side length of hexagon cell were tested experimentally. Photographs of cross-sectional view near the loading area and failure modes in the tests were investigated in detail. For the first time, digital image correlation (DIC) technique through an ARAMIS™ real-time optical strain measurement system was adopted for capturing the deformation process of lower skin by acquiring the displacement-time data. Three typical damage modes were identified from the force-displacement curves with different geometric parameters and configurations. It was found that the thickness of facesheet has the most significant effects on both force-displacement curves and energy absorption capacity. Changes in the core parameters have relatively small influences in total energy absorption but sizeable effects on the force-displacement curve and failure modes. A finite element model for predicting damage evolution was also developed and validated through the force-displacement relation and deformation process on the bottom skin. The damage mechanisms of the sandwich panel subject to quasi-static indentation and perforation were analyzed through the numerical models. The present study contributed on understanding how the geometric parameters affect the characteristics of indentation and perforation, thereby providing useful guidelines for its potential applications in impact engineering.

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