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On Compression Properties of Honeycomb Structures Using Flax/PLA Composite as Core Material

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Abstract : Sandwich structures based on cellular cores are increasingly being utilized as energy-absorbing components in the industry. However, determining ideal structural configurations remains challenging. This chapter compares the compression properties of flax fiber-reinforced polylactic acid (PLA) of empty honeycomb core, foam-filled honeycomb and double cell wall square interlocking core sandwich structure under quasi-static compression loading. The square interlocking core is fabricated through a slotting technique, whereas the honeycomb core is made using a corrugated mold that was initially used to create the corrugated core composite profile, which is then cut into corrugated webs and assembled to form the honeycomb core. The sandwich structures are tested at a crosshead displacement rate of 2 mm/min. The experimental results showed that honeycomb outperformed the square interlocking core in terms of their strength capability and SEA by around 14% and 34%, respectively. It is observed that the foam-filled honeycomb collapse in a progressive mode, exhibiting noticeable advantages over the empty honeycomb; this is attributed to the interaction between the honeycomb wall and foam filler. Interestingly, the average SEAs of foam-filled and empty honeycomb cores have no significant difference, around 8.7kJ/kg and 8.2kJ/kg, respectively. In contrast, its strength capability is clearly pronounced, in which the foam-filled core outperforms the empty counterparts by around 33%. Finally, the results for empty and foam-filled cores were significantly superior to aluminum cores published in the literature.

Keywords : compressive strength, flax, honeycomb core, specific energy absorption
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