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Influence of axial and oblique impact loads on crush response properties of square tube structures made with FRP pultruded composites

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Abstract

There is a great interest on a structure, especially automotive structure to absorb large energy to reduce collision. In the collision, crush might occur axially, obliquely, laterally or diametrically. In this research, axial and oblique impact loads are considered using INSTRON 8801 Impact Testing Machine with 100 kN load capacity. The required energy absorption to collapse the square tube made by fiber E-glass and polyester composite is examined. Four specimens having same dimension are chamfered at 45° at top end to form trigger mechanism. The quasi-static impact stacking sequences with four angles are applied on each specimen to observe the crush behaviours. From the results, the more crushing composite tubes undergoes before collapse occurs, the more energy the tube material and structure absorbs. It is also found that the energy absorbed in the square tube is decreased significantly when the impact angle is raised.

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Nomenclature

FRP	fiber reinforced plastic
CFM	continuous filament mats
FEM	finite element method
E_s	total specific crush energy absorbed (kJ/kg)
E	total energy absorbed (kJ)
CLE	crushing load efficiency ratio (%)
α	impact angle (°)
d_{max}	maximum crushed displacement (mm)

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