Plastic collapse and energy absorption of circular filled tubes under quasi-static loads by computational analysis

Abstract

This study presents the finite element analysis of plastic collapse and energy absorption of polyurethane-filled aluminium circular tubes under quasi-static transverse loading. Increasing focuses were given to impact damage of structures where energy absorbed during impact could be controlled to avoid total structure collapse of energy absorbers and devices designed to dissipate energy. ABAQUS finite element analysis application was utilized for modelling and simulating the polyurethane-filled aluminium tubes, different set of diameter-to-thickness ratios and span lengths, subjected to transverse three-point-bending load. Different sets of polyurethane-filled aluminium tubes subjected to the transverse loading were modelled and simulated. The failure modes and mechanisms of filled tubes and its capabilities as energy absorbers to further improve and strengthening of empty tube were also identified. The results showed that plastic deformation response was affected by the geometric constraints and parameters of the specimens. The diameter-to-thickness ratio and span lengths had shown to play crucial role in optimizing the PU-filled tube as energy absorber.