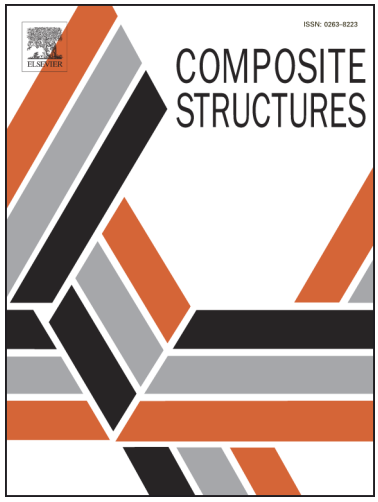

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Pressurised Composite Tubes as Variable Load Energy Absorbers

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Abstract

An experimental evaluation of the crushing behaviour of pressurised composite tubes is presented, with the intent to develop a variable load energy absorbing system. The influence of plug triggering radius on the energy absorption characteristics was determined. Seven different trigger radii were tested from 0 mm (sharp corner) to 6 mm. Experiments were performed under quasi-static (5 mm/min) and low speed (900 mm/min) conditions. It was found that there was a strong negative, yet nonlinear, correlation between the plug radius and the steady state crushing force of the tubes. The overall energy absorption of the composite tube specimens tested at higher crushing speed was slightly higher than those specimens tested at a lower rate.

Internal pressurisation is presented as a method to vary the crushing force of the tubes. A novel sealing-crushing system was demonstrated to achieve a simultaneously crushing and pressurised tube. The tubes were then axially crushed at two internal pressure levels: 9 bar and 18 bar. It was found that the force due to internal pressure did contribute to the crushing force of the tubes and was a significant proportion of the unpressurised crush force (up to 60% in one case). The potential for an adaptable composite crushing element under a range of impact energy scenarios was also demonstrated for the development of a proposed variable load energy absorber for realistic crash conditions.

Keywords

Crashworthiness

Pressurised composite tubes

Variable load energy absorber

Carbon fibre