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The analysis of the ultimate blast failure modes in fibre metal laminates

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Abstract

Finite element modelling has been applied to simulate various failure modes in fibre metal laminate (FML) panels under localized high intensity blast loading. A relatively simple material model, based on continuum damage mechanics, has been proposed to describe the constitutive response of the composite material in the FMLs. Simulations of the blast response of FMLs with various stacking configurations has been carried out, capturing both perforation and non-perforation failure modes. Blast loading was modelled by a pressure function applied on the front face of the FML panel. The definition of the pressure function accounts for both the temporal as well as the spatial distribution of the blast. The capability of the models has been assessed by comparing the predictions associated with both low and high intensity blast cases with published experimental data. Good qualitative and quantitative agreement has been observed for lay-ups with similar proportions of aluminium and composite. It is believed that the models can be employed for use in parametric studies that would facilitate the adoption of FMLs in wider engineering design.

Keywords: A. Layered structures; B. Impact behaviour; C. Deformation, Finite element analysis (FEA); D. Blast loading.

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