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PROGRESSIVE FAILURE OF IMPACT-DAMAGED COMPOSITE OMEGA STIFFENERS

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Summary: This presentation describes a combined experimental testing and computational progressive damage analysis program on carbon fiber reinforced plastic omega frames subjected to low-velocity impact damage and subsequent post-impact four-point bend testing. The progressive damage analysis is employed to inform the optimization of lay-up configuration to minimize the extent and size of damage in the form of through-thickness delamination and matrix cracks. Similar modelling approaches with smeared-crack and cohesive elements have been employed in previous analysis of progressive damage of open-hole composite laminates under tensile [1] and compressive loads [2], accounting for effects of scaling and ply blocks. The results of the present work show that the progressive damage models are able to predict the extent of damage suffered by the frames under impact load and the residual strength of these frames under four-point bend tests. The relative sensitivity of the predicted damage sizes and residual strength to the assumed and measured composite properties such as fracture toughness and failure criteria parameters are also studied. It was also found that adding some plies with fibers in the transverse direction of the frames could reduce the extent of damage under impact load and therefore increase the residual strength under bending.

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