Objective

"ACS will develop an integrated numerical and test approach for composite wing leading edge hailstone impact application with electrical ice protection system. We propose finite element free fast impact models satisfying the governing equations of impact mechanics coupled with cross-correlations of data from a series of tests organized in a building block approach. First we will develop a fast phenomenological semi-analytical impact model to provide rapid predictions of the impact force-time response. It uses laminate mechanics and continuous global spatial interpolation functions to drastically reduce the size of the problem and explicit time integration; Then a reduced phenomenological impact model, which will provide estimates of the maximum impact force, will be integrated with material Characterization and Qualification (MCQ) software and multi-scale progressive failure dynamic analysis (PFDA), to characterize the impact resistance of composite structures and to determine: type of failure (delamination, crippling, etc), damage footprint (which ply, length and width), energy absorbed during impact, and post-
impact residual strength. The model accounts for temperature and moisture effects and is suitable for conventional and hybrid composites. We assembled team of experts in aircraft composite design and impact dynamics. We developed GENOA durability and damage tolerance software and ANSYS user material routine for implicit progressive failure analysis. We will develop a user material routine for explicit dynamics. At the end a high-fidelity numerical GENOA-ANSYS FEA model will be available for composite leading edge structures impacted by hail. Predictions will be validated with test data and will provide impact response database to complement the experimental validation. The numerical model will capture damage not seen during general visual inspection and will facilitate inspection and maintenance of critical systems for continued operational safety.

Field of science

/Engineering and technology/materials engineering/composites
/Natural sciences/computer and information sciences/software
/Engineering and technology/mechanical engineering/vehicle engineering/aerospace engineering/aircraft

Programme(s)

Topic(s)

Call for proposal

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JTI-CS - Joint Technology Initiatives - Clean Sky

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Private for-profit entities (excluding Higher or Secondary Education Establishments)

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