Moving Beyond the Finite Elements: Fan Blade – Bird Strike Analysis by using SPH Methodology

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Summary:

Bird strike is an actual threat for the integrity of aircraft structures. Particularly endangered component is the engine itself, where the biggest threat zone is the intake region covered by the fan blades turning at high speeds. Because of the difficulties and costs of testing this kind of impacts, numerical simulations are essential.

Simulating high speed impact events need advanced numerical treatment of some challenging problems such as; severe distortions, penetration, erosion, high strain-rate sensitivity, wave propagation etc. However, especially when the distortions become very severe, finite element algorithms are not always adequate. More recently meshless methods (or particle methods) have been developed and applied to solve these problems efficiently. In this study, Lagrangian, Arbitrary Lagrangian-Eulerian (ALE) and Smoothed Particle Hydrodynamics (SPH) models of a bird strike scenario through a turbo-fan jet engine intake is modeled, simulated and compared. Simulations are conducted by using a 3D non-linear explicit dynamics numerical solver, LS-DYNA. Fan blades and the disk of a turbo-fan jet engine are reverse engineered for the simulations.

Keywords:

Meshless methods, SPH, bird strike.

