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Simulation of Bird Strike on Airplane Wings by Using SPH Methodology

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Abstract : According to the FAA report, 142603 bird strikes were reported for a period of 24 years, between 1990 – 2013. Bird strike with aerospace structures not only threaten the flight security but also cause financial loss and puts life in danger. The statistics show that most of the bird strikes are happening with the nose and the leading edge of the wings. Also, a substantial amount of bird strikes is absorbed by the jet engines and causes damage on blades and engine body. Crash proof designs are required to overcome the possibility of catastrophic failure of the airplane. Using computational methods for bird strike analysis during the product development phase has considerable importance in terms of cost saving. Clearly, using simulation techniques to reduce the number of reference tests can dramatically affect the total cost of an aircraft, where for bird strike often full-scale tests are considered. Therefore, development of validated numerical models is required that can replace preliminary tests and accelerate the design cycle. In this study, to verify the simulation parameters for a bird strike analysis, several different numerical options are studied for an impact case against a primitive structure. Then, a representative bird mode is generated with the verified parameters and collided against the leading edge of a training aircraft wing, where each structural member of the wing was explicitly modeled. A nonlinear explicit dynamics finite element code, LS-DYNA was used for the bird impact simulations. SPH methodology was used to model the behavior of the bird. Dynamic behavior of the wing superstructure was observed and will be used for further design optimization purposes.

Keywords : bird impact, bird strike, finite element modeling, smoothed particle hydrodynamics
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