An Experimental and Numerical Study of Bird Strike on a 7075 Aluminum Double Plate

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ABSTRACT

Aircraft are heavily used for civil rapid transportation, agriculture application, military and homeland security, anti-drug smuggling and also for the recreational purpose. Therefore, to design and manufacture aircraft that can reduce major hazards is a very important issue for us to achieve [1]. Bird strikes represent a growing threat to aircraft safty. According to a joint FAA/USDA/WS/NWRC report on the period 1990-2002, the number of reported bird strikes per annum on US-based civil aircraft tripled from 1,719 in 1990 to 5,976 in 2002 [2]. In order to fulfil the airworthiness requirements, the bird impact response of aircraft structures are evaluated by means of intensive experimental and numerical activities [3].In the research of bird striking, the bird impact experiment is the most effective method. But the existing data of experimental results are highly disperse, so that they do less help for the design of aircraft structure and also cost more. Therefore, the numerical studies become essential to design the aircraft components. This paper presents an experimental and numerical study of bird strike on a 7075 –T6 aluminum double plate. The experiments are carried out at a desired impact velocity of 150 m/s. The explicit finite element software PAM-CRASH is used to simulate the bird strike experiments and a coupled SPH-FE method is adopted, where the bird is modeled using the SPH method with the Murnaghan EOS and the structure is meshed with finite elements. The material parameters are identified by an optimization process and the simulated dynamic responses of displacement and strain of the plate as well as the final deformation and damage caused by bird strike are compared with experimental measurement to verify the numerical model. Good agreement between the simulation results and the experimental data suggests that the coupled SPH-FE method can provide an effective tool in designing bird-strike resistant aircraft components.

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