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NUMERICAL METHODOLOGIES FOR SIMULATING BIRD-STRIKE ON COMPOSITE WINGS

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Abstract

During its service life, an airplane can experience impact events with different foreign objects. In case of impact with a flying bird, the term “*Bird Strike*” is commonly adopted. Bird strike can be catastrophic, especially when small general aviation airplanes are involved. Indeed, the Federal Aviation Administration (FAA), to prevent catastrophic failures with casualties, obliges airplanes to be able to complete the flight after an impact with a medium dimensions bird. Hence, it is clear that, when designing aerospace components, the potential effects of the bird strike events must be taken into account to guarantee the structural integrity and, as a consequence, the passengers and the pilot safety. In order to optimize the costs, the experimental activity for certification purpose should be suitably prepared and driven by an extensive campaign of numerical simulations. Therefore, the accuracy and the effectiveness of the numerical models able to simulate the bird strike event and its consequences on the structural integrity become of major concern when designing aerospace components. In this paper, the numerical methodologies, commonly adopted for the simulation of the bird strike event, are presented and assessed focusing on their capability to predict the induced damage and the composite components’ residual strength.

keywords: Bird Strike, Bird modeling, Lagrangian method, ALE method, SPH method, CEL method, composite structures

1. Introduction

Impact with flying birds also called “bird strikes” can be critical for flight safety especially when small general aviation airplanes are involved. Nowadays, collisions between airplanes and birds are becoming much more frequent because of the increasing air traffic. The Federal Aviation Administration airworthiness rules obliges an airplane to be able to complete the flight after an impact with a bird of medium dimension. Indeed, during the certification process, an airplane must prove its capability to land safely after a representative impact event [1]. The bird strike event is a short duration (milli-seconds range)/high intensity loads event characterized by a strong interaction among the impact energy, the bird deformation and the airplane component structural behavior.

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