MODELING OF AIRCRAFT FUSELAGE DROP TEST

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ABSTRACT

With tremendous increase in air traffic and increasing number of aircraft fatalities, studies towards structural responses and occupant kinetics during crash scenarios have become key issues for researchers and engineers. The structural behavior of fuselage of an aircraft plays a vital role in occupant responses in an event of crash. The Federal Aviation Administration has imposed requirements governing the resultant accelerations, velocities, lumbar loads during a typical vertical drop test of aircraft. Costs of such tests make it difficult to conduct them frequently. With the advances in computational power, it has become possible to simulate the physical tests numerically with accuracy to a great extent. This research aims on simulating a typical vertical drop test conducted by FAA at Langley Research Center, NJ. A 10 ft fuselage section of B737-200 from Fs-400 to FS-500A was drop tested in September 1999. Along with other standard parts, the section contained an auxiliary fuel tank mounted beneath the passenger floor and a cargo door on the copilot side to access cargo area. Finite element code LS Dyna was used to develop a FE model of this section to analyze the structural response of the fuselage during the test. The results observed from the simulation and those from the physical tests prove the potential of the FE codes to represent the real life processes. Occupant responses as seen in the physical test are validated using multi body analysis code MADYMO. In order to simplify the simulation, a model of a single seat with Hybrid II anthropomorphic test dummy representing average male passenger in United States is developed. The typical accelerations observed in the FE model are within 10% variation as compared to the accelerations from actual test. Also, the lumbar loads predicted from the MADYMO model, are within 15% variation as compared to physical tests.