

Crashworthiness by Analysis: Verifying FEA Modeling Capabilities by Accident Reconstruction

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Abstract

FE model of a generic single-aisle narrow body transport aircraft was used for crash analysis to compare deformations to those observed in the Turkish Airline Flight 1951 crash in Amsterdam in 2009. Developing validated FE models helps to expand the scope of research and to obtain clear understanding of concepts which can be translated into requirements for safety. The cost of using analytical tools versus performing tests enables us to study several iterations which would otherwise be impossible especially for large scale structures such as airframes. CAD and FE model of a generic narrow body aircraft were created. A 10-ft section of the narrow body was compared to FAA 10-ft section drop tests [1] to exhibit the validity of the model. Impact surface was represented by a generic soil model created from a NASA research paper [2]. FE analysis of full aircraft crash was conducted using LS-DYNA and deformations were compared to the accident data from Turkish Airlines.

The validation of soil model and 10-ft section was successfully carried out with good correlation to data available.

Once validated, the full aircraft FE model will help answer many questions. Some areas of research include the importance of boundary conditions in evaluating crashworthiness characteristics of an airframe, the effect of cargo (varied stiffness and quantity) on the response of the airframe and the effect of impact surface on the response of the airframe.

References

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- [2] Fasanella, Edwin L., Jackson, Karen E., Kellas, Sotiris "Soft Soil Impact Testing and Simulation of Aerospace Structures", NASA Langley Research Center, Hampton, VA 23681.