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Progressive Failure Analysis with MD Nastran and Genoa

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ABSTRACT

Progressive failure analysis of composites is a critical topic in many aerospace and automotive applications. For many real world problems in this area, there is a strong need for micro-mechanical modeling of the composite integrated with a robust non-linear finite element solver. Real-world micro-mechanical modeling includes the prediction of damage due to micro-cracking, fiber breakage, matrix plasticity, etc as well as the evaluation of material property degradation due to this damage. Seamlessly integrating this technology into a non-linear finite element package that, in turn, can cater to complex geometric, material and contact non-linearities allows the accurate simulation of composites in real-world scenarios.

In this work, we describe recent developments in composites technology at MSC, wherein material modeling technology of the Genoa product from Alphastar Corp. has been integrated into the flagship MD Nastran product from MSC Software Corp. The material modeling features in Genoa are combined with the full range of capabilities available in MD Nastran for non-linear statics and dynamics. Different modeling capabilities offered in the MD Nastran Genoa product are described, including constituent analysis of fiber/matrix properties, braided fibers and honeycomb modeling.

The modeling capabilities are illustrated with a number of applications in composite failure analysis. These applications highlight the Genoa enabled capabilities in MD Nastran to evaluate damage onset, evolution as well as assess the associated degradation in material stiffnesses in complex composite applications.