

Carlos Santiuste Romero

Analysis and modelisation of composite beams subjected to impulsive loads

University Carlos III of Madrid (Spain) - 2007

Contact : csantius@ing.uc3m.es

In this PhD thesis the behaviour of laminate beams has been studied under dynamic bending loads. Composite materials are frequently used in the aeronautic and aerospace industries because of their excellent specific mechanical properties. A simplified analytical model was developed considering interlaminar shear stresses and the bending-torsion coupled effect. The influence functions method was applied to solve model equations because this method is independent of the boundary conditions. The influence functions method was validated by comparing the results with those found by the finite element method and experimental tests. A mechanical behaviour model for laminates considering multiple failure models and erosion criteria was implemented in a commercial finite element code. This model was validated by simulating composite failure under impulsive bending loads by comparison with experimental results. The model was applied to study the influence of impact energy in the dynamic bending test results. The bending damage tolerance of composite beams after two kinds of low velocity impact was studied. The damage was evaluated by ultrasonic inspection and the residual mechanical properties were estimated by a three-points bending test because beams usually work under bending loads. The kind of impact and the impact energy were analyzed as the most important factors in the bending residual properties.

www.dymat.org