Full cycle stochastic analysis of composite structures under buckling loads. Design & manufacturing scatter

A. Pardo, J.C. Fernandez

Abel Pardo is working for Grupo TAM structural analysis department

Jose Carlos Fernández is working for Grupo TAM structural analysis department

Abstract: Structures in general are subject to uncertainty due to manufacturing, assembly, environment of work, loads, etc … This scatter more specifically is associated for example to tolerances of thickness, position, waviness, etc, material mechanical properties distribution, lay-up alignment axes. All these deviations can be taken into account with stochastic analysis to reduce the total cost of the project considering all the phases of product life (manufacturing, assembly, maintainability…) and make a global robust design.

The problem of optimization of composites structures can be addressed in spite of high number of design variables (angles, thickness, lay-up…), failure modes (buckling, strains, cohesive material…), and taking into account the previously mentioned scatter by means of iSight and Abaqus.

Analyses about the tolerances influence (material mechanical properties, thickness, waviness, lay-up alignment axes…) in the critical buckling results of a stiffened curved composite panel have been developed.

The tolerances whose values, in spite of complying with the aeronautical industry current design criteria, generate significant changes in the critical results are identified. On the other hand, the tolerances with very low influences in the critical failure modes are obtained, making possible therefore a cost reduction.

The use of these technologies allows finding improved structures, without an increase of manufacturing non conformities associated with highly optimized structures, and with similar analysis times.

Keywords: composite, buckling, stochastic, robust design, tolerances

Download the full conference paper