Title

DESIGN AND ANALYTICAL ANALYIS OF AN ANISOGRID PREPREG STRUCTURE CONCEPT

Abstract text

This paper reports on results of a conceptual design phase, aimed at the development of a new anisogrid concept for aircraft fuselage structures. The weight saving potential is analyzed in comparison with an orthogonal stiffened skin structure, satisfying fundamental requirements of airworthiness for airframes.
The novelty of the structural concept is load bearing skin in addition to the grid structure and the usage of prepreg material with 60% fiber volume ratio in combination with a fiber placement manufacturing process. As a result the ribs can be built up as a laminate with different orientations to increase damage tolerance and crack growth resistance compared to unidirectional built up ribs. The different orientations are placed as pre-stacked tape material which reduces the manufacturing effort significantly. Fabric layers are added in this stacking which are facing the rib sides and are forming a large interface from the rib structure to the load bearing skin. In consequence of the intersecting rib directions a design that interrupts some of the layers in the rib knot area has been invented to avoid laminate thickening.
While the static strength of the ribs especially in tension will be reduced drastically, the resulting triangular bays of the load bearing skin has a highly increased buckling resistance. This optimization field is analyzed analytically for different pure loads and load combinations and is compared to an orthogrid structure with orthogonal stiffened load bearing skin. The loads are derived from different panel positions of a single aisle fuselage with representative flight and ground load cases. For the weight saving potential analysis, the anisogrid and orthogrid structure are sized with the same sizing criteria including panel stiffness, strength criteria, local skin and stiffener stability and global panel stability.

Keywords

AIRFRAME, PANEL DESIGN, ANISOGRID STRUCTURE, LATTICE STRUCTURE, DESIGN

Authors 3

NIEMANN, STEFFEN (GERMAN AEROSPACE CENTRE // COMPOSITE STRUCTURES AND ADAPTIVE SYSTEMS)

WAGNER, RONALD (GERMAN AEROSPACE CENTRE // COMPOSITE STRUCTURES AND ADAPTIVE SYSTEMS)

HÜHNE, CHRSTIAN (GERMAN AEROSPACE CENTRE // COMPOSITE STRUCTURES AND ADAPTIVE SYSTEMS)