

MATERIALS AND STRUCTURES SYMPOSIUM (C2)
Space Structures I - Development and Verification (Space Vehicles and Components) (1)

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RECENT ADVANCE ON DESIGN AND MANUFACTURING OF COMPOSITE ANISOGRID
STRUCTURES FOR SPACE LAUNCHERS

Abstract

Anisogrid composite shells have been developed and applied since the eighties by the Russian technology aiming at critical weight structures for space launchers, as interstages and cone adapters. The manufacturing process commonly applied is based on the wet filament winding. The paper concerns some new developments of design and manufacturing method recently performed at CIRA on significant structural models representative of this kind of structures. The framework of preliminary design is improved by introducing the concept of suboptimal configuration in order to match the stiffness requirement of the shell and minimize the mass, in conjunction with the typical design constraints. The proposed manufacturing process is based on an overall dry robotic winding process for the system of ribs and for the outer skin, with the aid of rubber tooling and new devices for automated deposition. Resin infiltration under vacuum bag and co-cure of the system of ribs and skin is finally applied out-of-autoclave, with the aid of a heated mandrel. With such approach an interstage structural model (scale factor 1:1.5) has been designed, manufactured and tested. Design requirements and loads refer to a typical space launcher whose baseline configuration is made in aluminium. The global mechanical test of the manufactured structure has confirmed the expected high structural performance. The possibility to reach substantial weight and costs saving in comparison with the aluminium benchmark has been fully demonstrated.