ANISOGRID COMPOSITE LATTICE STRUCTURES – DEVELOPMENT AND AEROSPACE APPLICATIONS

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ABSTRACT

The presentation is an overview of the recent Russian experience in development and applications of Anisogrid (Anisotropic Grid) composite lattice structures. Anisogrid structures have the form of cylindrical (in general, not circular) or conical shells and consist of a dense system of unidirectional composite helical, circumferential and axial ribs made by continuous filament winding [1,2]. Typical composite lattice space structures are shown in the Figure.
High weight and cost efficiency of Anisogrid structures is provided by high specific (with respect to density) strength and stiffness of unidirectional ribs used as the basic load-carrying elements of the structure and by automatic winding process resulting in low-cost integral structures. Anisogrid structures proposed about thirty years ago are under serial production in Central Research Institute of Special Machinery which develops lattice interstages, payload attach fittings (adapters) and spacecraft structures for Russian space programs. By now, about 25 successful launches have been undertaken with Anisogrid composite lattice structures.

The following particular problems are discussed in application to Anisogrid composite lattice structures:

Fabrication processes.
Design and analysis methods.
Mechanical properties of the basic structural elements.
Application to space launchers, i.e.,
  - interstage structures,
  - payload adapters.
Application to spacecraft structures, i.e.,
  - spacecraft bodies,
  - truss elements for space platforms,
  - thermo-stable beam elements.
Application to load-carrying structures of commercial airplanes.

The presentation is illustrated with numerous pictures demonstrating development of numerous types of full scale Anisogrid structures – interstage structures with diameter about 4 m, adapters, spacecraft bodies and structural elements with length up to 10 m.

REFERENCES