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Marshall Space Flight Center



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Isogrid Design Handbook

A handbook has been published which presents information needed for the design of isogrid triangular integral-stiffened structures. It develops equations, methods, and graphs to handle a wide variety of loadings, materials, and geometry.

The handbook is divided into seven sections. Section I is an introduction describing the isogrid background and the use of the handbook. Section 2 presents the basic theory for analysis of an isogrid and summary at the end as a ready reference. Section 3 describes the characteristics and advantages of the isogrid, including some current and future applications for vehicle structure.

Section 4, the main part of the handbook, presents analytical methods for typical structures found in aerospace vehicles. Typical design approaches are described for each type of structure and methods of optimizing the structure for minimum weight are given. The method of analysis is followed by worked examples, which are given to guide the user in the application of the equations and of the graphs. The graphs enable the user to evaluate the isogrid structure quickly and accurately. The structural types presented are:

1. Spherical cap with reverse pressure.
2. Cylinders in compression, bending.
3. Cylinders under torsional shear.
4. Cylinders under uniform external pressure.
5. In-plane concentrated load in an infinite sheet.
6. In-plane concentrated load at the edge of a sheet.
7. Cutout reinforcement.
8. Open isogrid shear webs.
9. Open isogrid cylinders in compression, bending.
10. Open and skinned isogrid.

To date, other structural types such as cones have not been analyzed and are not included.

Section 5 describes the effect of node flexibility on the local stress distributions in the isogrid and recommends methods of analysis. Section 6 presents information on model, subscale, and full-scale testing. Finally, Section 7 provides information on manufacturing techniques developed on production hardware and in advanced research programs to date. The topics covered are:

1. Machining.
2. Power-brake forming.
3. Creep-and-age forming.
4. Compound curvatures.

Notes:

1. This handbook is not restricted to aerospace applications but may be used by marine and civil engineers and by students and designers without access to computers.
2. Requests for further information may be directed to:
Technology Utilization Officer
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