

Geometrical Mechanics for Inflatable Structures

Inflatable structures have low mass and can be stowed in a small volume. These characteristics make inflatable structures desirable for use in space applications. Typical materials for inflatable structures are usually thin polymers and have low or negligible stiffness. This lack of significant stiffness requires inflatable structures to carry load in tension, with bending and compression undesirable load-carrying mechanisms.

Many configurations are possible for inflatable membrane structures, such as cylinders, spheres and spheroidal surfaces, and configurations using lobes. The structural behaviour of the inflatable structures depends strongly on their geometry. Understanding this geometrical mechanical effect is fundamental to design and development of inflatable structures. Aspects of structural behaviour of interest to designers and analysts are the membrane stress, structural efficiency and structural stability.

This presentation provides an overview of the importance of these geometrical effects for inflatable structures. In particular, the presentation shows how simple modifications to the global geometry can have significant effects on the membrane stress and structural efficiency.