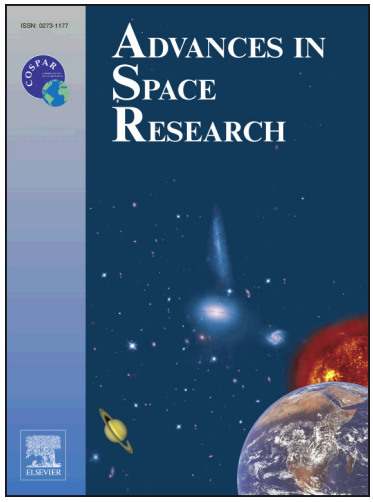

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A multi-node Model for Transient Heat Transfer Analysis of Stratospheric Airships

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Abstract

This paper describes a seven-node thermal model for transient heat transfer analysis of a solar powered stratospheric airship in floating condition. The solar array is modeled as a three node system, viz., outer layer, solar cell and substrate. The envelope is also modeled in three nodes, and the contained gas is considered as the seventh node. The heat transfer equations involving radiative, infra-red and conductive heat are solved simultaneously using a fourth order Runge-Kutta Method. The model can be used to study the effect of solar radiation, ambient wind, altitude and location of deployment of the airship on the temperature of the solar array. The model has been validated against some experimental data and numerical results quoted in literature. The effect of change in the value of some operational parameters on temperature of the solar array, and hence on its power output is also discussed.

Keywords: Thermal Modeling; Stratospheric Airship; High Altitude Airship; Transient Heat Analyses

1. Introduction and Background

There is a global interest in design and development of stratospheric airships (Epley, 1997), which can serve as a long endurance platform for deployment of equipment for several commercial and strategic applications

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