Research Paper

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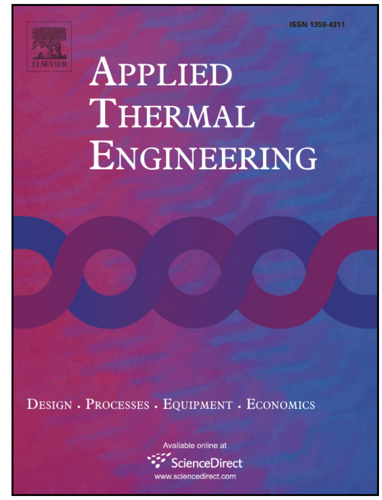

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Manufacturing Phase Embedded Design Optimization of Extruded Heat Pipes for Space Applications

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Highlights

- A model was proposed to compute the heat transport capacity of extruded heat pipes
- Model embodies not only the thermal aspects but also extrusion and EDM constraints
- Predictive performance of the model was demonstrated on experimental results
- Different working fluids, groove types and geometric parameters were studied
- Model outcome were applied to a heat removal problem on a telecom satellite

Abstract

In this paper, an algorithm for the computation of maximum heat transport for grooved heat pipes was presented. The algorithm embodies not only the thermal mathematical model and the container constraint but also the manufacturing limitations imposed by the current state of the art of extrusion and electrical discharge machining technology. The algorithm was implemented to a computer code and its predictive performance was demonstrated for varying groove parameters such as shape, width, depth, angle, diameter with different working fluids and at different operating temperatures. The heat pipes with optimized performances were then used in the analysis of a heat removal problem that may be encountered in telecommunication satellites.

1. Introduction

Having the ability to transport relatively **large amounts of** heat through a small cross section, requiring a small temperature difference between its two terminals, not requiring an extra device to pump the fluid inside **and** being able to work even in a non-gravitational medium, **make heat pipes** (HPs) an effective tool for heat removal in space applications.

HPs consist of three elements; container, working fluid and wick structure. Among different types of wick structures (groove, sintered and mesh) characterizing the heat pipes, grooved