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PARAMETRIC IDENTIFICATION OF HEAT TRANSFER PROCESSES IN HEAT PIPES

Abstract

The modern development of space technology has led to a significant complication of both theoretical analysis and experimental studies of thermal processes to which spacecraft structures are subject, which has led to an increase in the role of using reasonable mathematical models.At the same time, in the design of thermal control systems, great importance is attached to experimental research. However, the need to conduct such tests under conditions as close as possible to natural ones leads to a sharp increase in the cost of experimental work. The complexity of the mathematical models used, the high cost of thermal experiments and tests, as well as the well-known shortcomings of traditional methods for processing and analyzing data from thermophysical studies make it urgent to develop new methods and tools for obtaining the maximum amount of information about the analyzed thermal system and the thermophysical characteristics of the materials used. In this regard, great and largely justified hopes are placed on highly efficient heat transfer devices, which are called "heat pipes". Indeed, heat pipes have a unique set of very valuable performance properties, such as ultra-high thermal conductivity, the absence of mechanically moving parts and the need for additional energy, excellent weight and size characteristics, and high reliability, which in many cases make them almost indispensable. Thus, the development of a unified methodology for applying inverse problems for solving complex problems of identifying mathematical models of heat transfer in heat pipes is an important area of research in the design of heat-loaded structures and experimental development of thermal modes of spacecraft. The paper analyzes and refines mathematical models of heat transfer in modern heat pipes used in spacecraft thermal control systems. By means of a computational experiment, the influence of various factors on the intensity of heat transfer is estimated. A computational algorithm for determining the coefficients of mathematical models of heat transfer in heat pipes has been developed. The main attention is paid to the computational efficiency of the developed algorithms. The results of the work can be used to develop a method for estimating the properties of multiphase systems of complex structure in relation to new generation space technology.