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Tytuł: Wpływ zmian sił masowych na zjawiska cieplno-przepływowe zachodzące w pulsacyjnej rurce ciepła

Summary

In this paper an adaptation of the Pulsating Heat Pipe (PHP) to a machine used in the paint industry has been carried out. The technological challenge was to retain the existing design of the mixer, while the scientific challenge was to carry out a theoretical analysis of the energy transport process, using a pulsating heat pipe in a non-inertial system. It should be noted that, as of the date of undertaking the research subject, the literature review has revealed a lack of scientific papers concerning the theoretical or experimental analysis of the pulsating heat pipe in a vertical rotating system. The result of the work done in the last five years are three publications and three patent applications (two applications accepted by the Patent Office of the Republic of Poland up to the date of submission), and their content is a component of the dissertation. The paper consists of six main chapters describing the performed activities in chronological order.

In the introduction, the reader is introduced to the issues involved with the heat pipes. The introductory chapter is concerned with outlining the historical background of the emergence of heat pipes and their main division in terms of structure and basis of operation.

The second chapter is a definition of the aim and thesis of the dissertation. This section describes the scope of work that needed to be done in order to obtain original results that contribute significant and new content to the field.

The numerical model is a chapter on the work, which is an extension of the model proposed by Zhang et al. [1]. Commonly used mathematical models, to simulate the flow and analyze the temperature profile in a pulsating heat pipe, tend to take into account the influence of physical (amount and type of working fluid) or geometric parameters (shape, diameter of the flow channel), while ignoring the variation of mass forces acting on the anlyzed system. The purpose of the calculations is to identify parameters that have a significant influence on the heat transfer process, which will allow for a better understanding of the phenomena occurring during energy transport in a vertical rotating system.

The fourth chapter describes the process of creating the test stand from the conceptual design to the actual device. It contains information about both the design elements and the components that make up the complete control and measurement system of the device. This part of the work describes the measurement procedure.

The next section presents the results of laboratory tests along with their analysis and validation against numerical calculations. This part of the work presents an experimental analysis of the influence of changing the rotational speed, heat flux or filling ratio of the device on its thermal efficiency. All the mentioned parameters have been tested in detail in successive series of measurement campaigns.

Finally, in the sixth chapter, a summary is given together with a discussion of the obtained results. The form of the conclusion covers the entire scope of the work performed, i.e. theoretical (based on the model) and experimental, which led to the confirming the existence of the optimum velocity of the system, for which its thermal efficiency is characterized by a maximum value.