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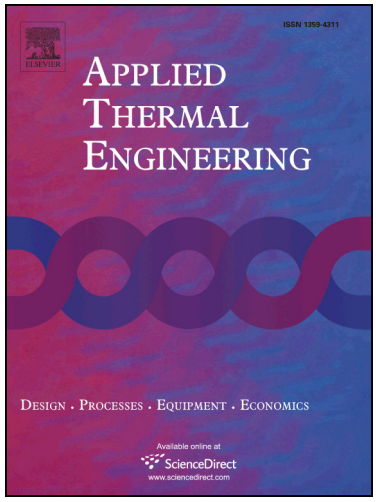

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Uniform Design for the Parameters Optimization of Pin-fins Channel Heat Sink

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Abstract: Total thermal resistance (TTR) is the main index to weigh the heat transfer capability of the pin-fins channel heat sink (PFCHS). The structural parameters and operational parameters of the PFCHS are important factors to influence the TTR of PFCHS. With the goal of achieving the lowest TTR of the PFCHS and modeling the relationship between the parameters and TTR, the structure of the PFCHS is illustrated in detail. Then, we schedule the experimental plan for the PFCHS based on the uniform design (UD), where the width of PFCHS, height of pin-fins, pressure drop of the fluid and power of the heat source are defined as the control parameters. According to the experimental data, a regression model is obtained to describe the relation between the control parameters and TTR, and then the optimal combination of the control parameters is determined. Verification tests show that the effectivity of the optimal parameters and the validity of the regression model.

Key words: total thermal resistance, uniform design, pin-fins, heat sink, optimization, regression analysis.

1 Introduction

Heat sinks have been diffusely used to enhance the heat transfer capability of the electronic devices and improve the reliability and lifetime of the electronic devices, such as the application of heat sinks in high power laser, light emitting diode (LED) and other electronic devices. For enhancing the heat transfer capability of heat sinks, the heat transfer characteristics of different heat sinks are widely studied. Tuckerman and Pease [1] presented a novel heat sink with micro-channel and studied the heat transfer of the new structure. Sparrow and Grannis [2] had optimized the structure of heat sink by inserting the pin-fins in the channel firstly.

To design the heat sink with pin-fins availably, researchers made great efforts to explore the

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