The Thermohydraulic Characteristics and Optimization Study of Radial Porous Heat Sinks Using Multi-Objective Computational Method

The use of porous media (PM) to improve conductive heat transfer has been at the focus of interest in recent years. Limited studies, however, have focused on heat transfer in radial heat sinks (RHSs) fully and partially saturated porous media with a different arrangement. As a development of the above-mentioned investigations, this research, therefore, addresses the ability of radial porous heat sink solutions to improve the thermohydraulic characteristics and reduce the effect of the second thermodynamics law. The response surface methodology (RSM) technique with ANSYS FLUENT-CFD is utilized to optimize the thermohydraulic features and the total entropy generation by the multi-objective optimum design for different design parameters such as porosity (Ø), inlet temperature (Tin), and applied heat flux (Q) simultaneously after achieving the optimum porous media arrangement related to the flow direction. The results show that, in terms of the flow direction, the optimum radial porous heat sink of the 100%PM model is recognized as providing the best results and the best option (fully saturated porous media). Moreover, a significant agreement between the predicted and numerical simulation data for the optimum values is also seen. The optimum and undesirable designs of the thermohydraulic features, the total entropy generation, and the optimum thermal management are detected in this investigation.