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Numerical Optimization of Trapezoidal Microchannel Heat Sinks

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Abstract : This study presents the numerical simulation of three-dimensional incompressible steady and laminar fluid flow and conjugate heat transfer of a trapezoidal microchannel heat sink using water as a cooling fluid in a silicon substrate. Navier-Stokes equations with conjugate energy equation are discretized by finite-volume method. We perform numerical computations for a range of 50 □ Re □ 600, 0.05W □ P □ 0.8W, 20W/cm2 □ □ 40W/cm2. The present study demonstrates the numerical optimization of a trapezoidal microchannel heat sink design using the response surface methodology (RSM) and the genetic algorithm method (GA). The results show that the average Nusselt number increases with an increase in the Reynolds number or pumping power, and the thermal resistance decreases as the pumping power increases. The thermal resistance of a trapezoidal microchannel is minimized for a constant heat flux and constant pumping power.

Keywords : microchannel heat sinks, conjugate heat transfer, optimization, genetic algorithm method
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