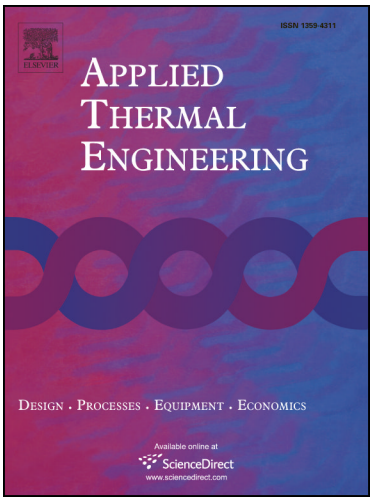

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Numerical investigation on heat transfer enhancement of heat sink using perforated pin fins with inline and staggered arrangement

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Abstract

The current work investigates the heat transfer enhancement of heat sink using perforated pin fins with linear and staggered arrangement. Pin fins of various shapes with different perforation geometries namely circular, diamond shaped and elliptical type are considered in this analysis. Three dimensional CFD simulations have been performed to study the effects of number and shape of the fin, geometry and dimension of the perforation for both the arrangements. Results show that heat dissipation rate of perforated fins up to certain perforation number and size are always higher than the solid ones and with the variation in fin shape and perforation geometry heat transfer rate improves significantly. Moreover, better system performance is observed for staggered arrangement than inline arrangement. Conversely, pressure drop through heat sink decreases by increasing number and size of perforations though it varies with fin shape and fin arrangement. Optimization analysis using MOORA as well as entropy generation minimization method have been done to predict the best perforated fin which dissipates maximum heat transfer against minimum pressure loss. Finally, exergy analysis has been performed to calculate second law efficiencies of heat sinks using various types of perforated fins for both the arrangements.

Keywords: Perforated fin; System performance; MOORA; Exergy analysis; Pressure drop; Entropy generation

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