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Optimisation of Pin Fin Heat Sink Using Taguchi Method

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Abstract : The pin fin heat sink is a novel heat transfer device to transfer large amount of heat through with very small temperature differences and it also possesses large uniform cooling characteristics. Pin fins are widely used as elements that provide increased cooling for electronic devices. Increasing demands regarding the performance of such devices can be observed due to the increasing heat production density of electronic components. For this reason, extensive work is being carried out to select and optimize pin fin elements for increased heat transfer. In this paper, the effects of design parameters and the optimum design parameters for a Pin-Fin heat sink (PFHS) under multi-jet impingement case with thermal performance characteristics have been investigated by using Taguchi methodology based on the L9 orthogonal arrays. Various design parameters, such as pin-fin array size, gap between nozzle exit to impingement target surface (Z/d) and air velocity are explored by numerical experiment. The average convective heat transfer coefficient is considered as the thermal performance characteristics. The analysis of variance (ANOVA) is applied to find the effect of each design parameter on the thermal performance characteristics. Then the results of confirmation test with the optimal level constitution of design parameters have obviously shown that this logic approach can effective in optimizing the PFHS with the thermal performance characteristics. The analysis of the Taguchi method reveals that, all the parameters mentioned above have equal contributions in the performance of heat sink efficiency. Experimental results are provided to validate the suitability of the proposed approach.

Keywords : Pin Fin Heat Sink (PFHS), Taguchi method, CFD, thermal performance
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