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Title: Numerical investigation of semiempirical relations representing the local Nusselt number magnitude of a pin fin heat sink

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Abstract: Heat transfer augmentation study using air jet impingement has recently attained great interest toward electronic packaging systems and material processing industries. The present study aims at developing a nondimensional semiempirical relation, which represents the cooling rate (Nu) in terms of different geometric and impinging parameters. The spacing of the fin (S/d(p)) and the fin heights (H/d(p)) are the geometric parameters, while the impinging Reynolds number (Re) and nozzle-target spacing (Z/d) are the impinging parameters. During the plot of the Nusselt profile, three vital secondary peaks are observed due to local turbulence of air over the heat sink. To incorporate this nonlinear behavior of the Nusselt profile in developing nondimensional empirical relations, the Nusselt profiles are divided into different regions of secondary rise and fall. Four different sets of the semiempirical relation using regression analysis are proposed for Z/d <= 6, H/d(p) <= 4.8 with S/d(p) <= 1.58, S/d(p) > 1.58 and for Z/d > 6, H/d(p) > 4.8 with S/d(p) <= 1.58, S/d(p) > 1.58. These empirical relations benefit the evaluation of the cooling rate (Nu) without any experimentation or simulation.

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