Investigation of Heat Transfer Increment in Electronic System Surfaces by Different Air Jet Impingement Applications

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Abstract

The impinging jet technique is a high-performance cooling technology for microchips which are basic elements of electronic systems and having high heat generation rates in small volumes. In this study, the improvement of heat transfer of the microchips used in all technological products today by air impinging jet has been examined. For this purpose, numerical research has been carried out on the cooling of copper plate surfaces with two different patterns, reverse triangle and reverse semi-circle shaped having 1000 W/m^2 constant heat flux in rectangular cross-section ducts with adiabatic surfaces, by one and double air jets with distances of D_h and $2D_h$ between them. Numerical computation has been performed for energy and Navier-Stokes equations as steady and three-dimensional by employing the Ansys-Fluent computer program with the k-epsilon turbulence model. The obtained results have been compared with the numerical and experimental results of the study in the literature and it has been seen that they are compatible with each other. The results have been presented as the mean Nu number and the variation of surface temperature for each of both patterned surfaces in single and double jet channels with different distances. Streamline and temperature contour distributions of the jet flow along the channel for different H/D_h ratios and jet numbers have been evaluated for both patterned surfaces. In double-jet and $2D_h$ distance channels compared to D_h, at $H/D_h = 12$ and Re = 11,000, the Nu number increases of 67% and 65.9% have been observed on the first-row reverse triangle and semi-circular patterned surfaces, respectively.

Keywords: Impinging jet, cooling, electronic system