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Turbulent natural convection cooling of electronic components mounted on a vertical channel

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Abstract

The paper presents a numerical simulation of conjugate, turbulent natural-convection air cooling of three heated ceramic components, which are identical and mounted on a vertical adiabatic channel. A two-dimensional, conjugate heat transfer model and the standard k–ϵ turbulence model were used to obtain the dynamic and thermal fields. The finite-volume method has been used to solve the model equations throughout the entire physical domain (solid and fluid). After validation of the method with available measurements for a single source, it was applied to investigate the effects on cooling of spacing between the heated electronic components and of the removal of heat input in one of the components. The former modification led to better cooling while the latter can be partially advantageous only when the non-powered components are mounted between the powered ones: this reduces the temperature of the powered components situated downstream from the non-powered component. © 1999 Elsevier Science Ltd. All rights reserved.

Keywords: Air cooling; Natural convection; Electronic components; Turbulence

1. Introduction

In many electronic cooling situations, arrays of heat-dissipating components are mounted on vertical (or inclined) parallel plate channels that are open to the ambient at opposite ends. The simplest method of cooling these arrays is by circulating air vertically via natural convection. This method of cooling of electronic equipment continues to play an important role in their thermal management, because it provides the advantage of low noise and high system

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