

Heat Transfer from Block Heat Sources Mounted on the Wall of a 3-D Cabinet to Ambient Natural Convective Air Stream

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Abstract : In this study the physical system under consideration is a three-dimensional (3-D) cabinet with arrays of block heat sources mounted on one of the walls of the cabinet. The block heat sources dissipate heat to the cabinet surrounding through the conjugate conduction and natural convection. The results illustrate that the difference in hot spot temperatures of the system (θ_H) for the situations with and without consideration of thermal interaction is higher for smaller Rayleigh number (Ra), and can be up to 94.73% as $Ra=10^5$. In addition, the heat transfer characteristics depends strongly on the dimensionless heat conductivity of cabinet wall (K_{wf}), heat conductivity of block (K_{pf}) and length of cabinet (A_x). The maximum reduction in θ_H is 70.01% when K_{wf} varies from 10 to 1000, and it is 30.07% for A_x from 0.5 to 1. While the hot spot temperature of system is not sensitive to the cabinet angle (Φ).

Keywords : block heat sources, 3-D cabinet, thermal interaction, heat transfer

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