

Using the Concept of Dummy Heat Sources for Heat Transfer Enhancement in a Vertical Channel

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Abstract

Laminar forced convection is studied in a vertical rectangular channel with seven discrete heat sources and dummy heat sources mounted on a wall. The position of seven heat sources is fixed in an optimal arrangement. The heat transfer effects are investigated by numerical simulation and validated experiments by arranging six and eight dummy heat sources in different configurations. The heat flux of 1500 W/m^2 and the air velocities of 0.6, 1, and 1.4 m/s are considered. The bakelite, FR4 and the copper clad board are used as substrate board materials. The Reynolds number and the Nusselt number are respectively: $6560 \leq Re \leq 13000$ and $1.5 \leq Nu \leq 3$. The governing equations are solved using the finite element method in conjugate heat transfer interface of COMSOL Multiphysics® software. The dummy heat sources have a significant influence on the flow and heat transfer for low Reynolds numbers. In general, cases which show the lowest temperature distributions on the modules are those with copper clad board and six dummy heat sources.

Reference

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2. Shankar Durgam., Venkateshan S. P., Sundararajan, T. A Numerical and Experimental Study of Optimal Distribution of Rectangular Discrete Heat Sources under Laminar Forced Convection, Proceedings of 23rd national and 1st ISHMT_ASTFE International Conference organized by Liquid Propulsion Systems Centre (LPSC), Indian Space Research Organisation (ISRO), Trivandrum, Kerala-India, December 17 - 20, 2015.
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Figures used in the abstract

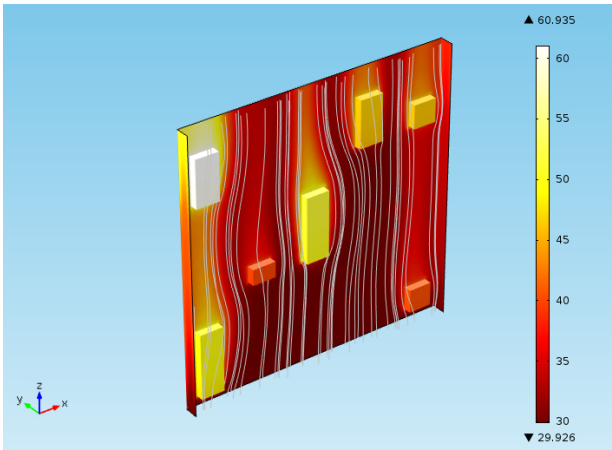


Figure 1: Arrangement of seven heat sources on bakelite substrate board.

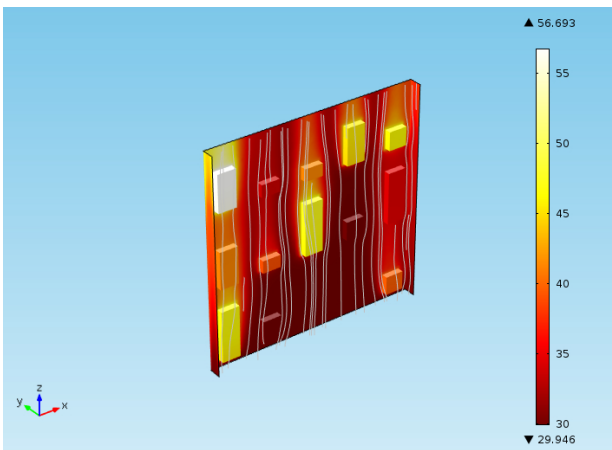


Figure 2: Arrangement of seven heat sources with six dummy heat sources on bakelite substrate board.

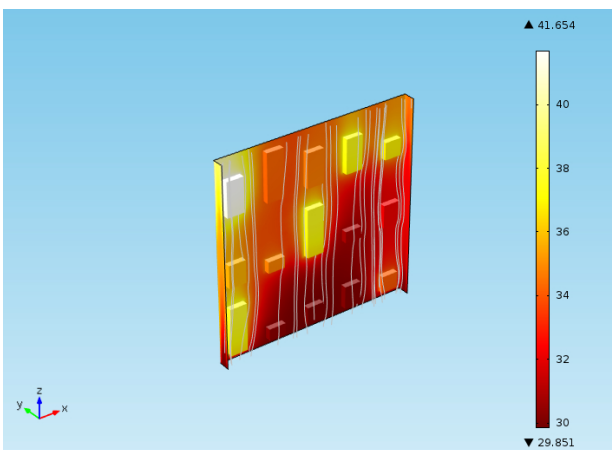


Figure 3: Arrangement of seven heat sources with eight dummy heat sources on copper clad board.