Abstract Submitted
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On Taylor dispersion in liquid-cooled electronics applications[1]

B.S. TILLEY, Worcester Polytechnic Institute — We are interested in extending classical asymptotic approaches to allow for the spatial pattern wavenumber to vary on the macroscale variables and to find how changes in microstructure geometry affect macroscopic properties and transport. To this end, we consider here the thermal transport of a coolant through nonuniformly spaced laminates, as a simple model for heat sinks in electronics. Power is continuously being generated by the laminates, and the local rates of heat transport depend on convection, fluid inertia, buoyancy and Taylor dispersion in the coolant and conduction within both the fluid and the laminates. We find a coupled system of partial differential equations that describe the local microscale temperature and deviations from the Darcy pressure. Microscale values of all of these quantities are known in terms of the solutions to these effective eqautions. We are especially interested in geometries in the laminate spacing which allow for better thermal transport by the coolant for a prescribed power distribution. The choice of the channel geometries depend on the ability to transfer heat from the device to the enviornment, the orientation of the device with respect to gravity, and the available power needed to drive the fluid motion.

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