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Thermal Analysis of a Channel Partially Filled with Porous Media Using Asymmetric Boundary Conditions and LTNE Model

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Abstract : This work considers forced convection in a channel partially filled with porous media from local thermal non-equilibrium (LTNE) point of view. The channel is heated with constant heat flux from the lower side and is isolated on the top side. The wall heat flux is considered to be divided between the solid and fluid phases based on their temperature gradients and effective thermal conductivities. The general forms of the velocity and temperature fields are analytically obtained. To obtain the constant parameters for temperature equations, a numerical solution is considered. Using different thermophysical parameters, both velocity and temperature fields are comprehensively illustrated. Discussions regarding bifurcation phenomenon are provided. Since this geometry has not been considered yet, the present analysis is a useful addition to the literature on thermal performance of porous systems from LTNE perspective.

Keywords : local thermal non-equilibrium, forced convection, thermal bifurcation, porous-fluid interface, combined analytical-numerical solution
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