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On the Influence of Thermal Radiation Upon Heat Transfer Characteristics of a Porous Media Under Local Thermal Non-Equilibrium Condition

Authors : Yasser Mahmoudi, Nader Karimi

Abstract : The present work investigates numerically the effect of thermal radiation from the solid phase on the rate of heat transfer inside a porous medium. Forced convection heat transfer process within a pipe filled with a porous media is considered. The Darcy-Brinkman-Forchheimer model is utilized to represent the fluid transport within the porous medium. A local thermal non-equilibrium (LTNE), two-equation model is used to represent the energy transport for the solid and fluid phases. The radiative heat transfer equation is solved by discrete ordinate method (DOM) to compute the radiative heat flux in the porous medium. Two primary approaches (models A and B) are used to represent the boundary conditions for constant wall heat flux. The effects of radiative heat transfer on the Nusselt numbers of the two phases are examined by comparing the results obtained by the application of models A and B. The fluid Nusselt numbers calculated by the application of models A and B show that the Nusselt number obtained by model A for the radiative case is higher than those predicted for the non-radiative case. However, for model B the fluid Nusselt numbers obtained for the radiative and non-radiative cases are similar.

Keywords : porous media, local thermal non-equilibrium, forced convection heat transfer, thermal radiation, Discrete Ordinate Method (DOM)
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