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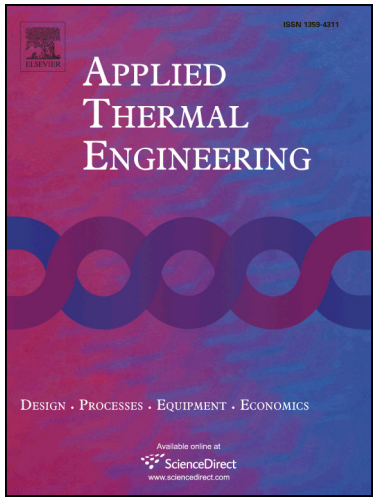

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Viscous dissipation generation by an incompressible fluid flow through an adiabatic cylinder filled with a porous medium

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Abstract*:*

A numerical study of viscous dissipation heat generation by an incompressible fluid through an adiabatic cylinder filled with a porous medium is carried using Darcy-extended Brinkman-Forchheimer model and taking into account the porosity variation. The energy transport model is based on the local non-thermal equilibrium assumption with consideration of viscous dissipation effects. Dimensionless equations of the problem are solved numerically. Velocity, viscous dissipation heating and temperature distributions are presented and analyzed. The influence of various parameters on the temperature field and viscous dissipation distribution is investigated and examined throughout this paper. It is found that viscous dissipation resulted in significant generation of heat for lower Reynolds number and Darcy number and for high Eckert number. All of the ranges are implicitly clarified within pertinent maps. The temperature difference between fluid and solid phases is also performed incorporating the effect of various parameters.

Keywords: Forced convection; Cylindrical packed bed; Porous medium; Viscous dissipation; Thermal non-equilibrium; Numerical simulation.

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