UNSTEADY CONJUGATE FORCED CONVECTION HEAT TRANSFER FROM A POROUS SPHERE TO A SURROUNDING POROUS MEDIA

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ABSTRACT

The unsteady, conjugate, forced convection heat transfer from a permeable sphere embedded in another porous media has been analysed. The radiative effects, viscous dissipation and the work done by pressure changes are considered negligibly. Local thermal equilibrium between the two phases is assumed. The flow inside and outside the sphere was considered 2D, steady, viscous and incompressible. For the velocity field, the semi - analytical expressions derived by Grosan et al., Transp. Porous Med. 81 (2010) 89 – 93, was used. The heat balance equations were solved numerically in spherical coordinates system by an alternating direction finite difference method. The influence of the physical properties ratios (thermal conductivity ratio and heat capacity ratio) and the radial surface velocity on the heat transfer rate was analysed for sphere Peclet numbers, $Pe \leq 10^3$. Numerical results obtained for the internal and external problems are also presented.

Keywords: **Conjugate heat transfer; porous sphere; porous media; forced convection; thermal equilibrium;**