

Transient free convection from a vertical plate subjected to a change in surface heat flux in porous media

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In this paper we examine the general transient natural convection response arising due to a sudden change of the level of uniform flux dissipation rate from a vertical surface which is embedded in a porous medium. From an analytical investigation of the governing boundary-layer equations both a series solution which is valid at small values of the non-dimensional time and a solution which is valid at large times, when the transport of energy is steady, are derived. A numerical, transient formulation of the full unsteady boundary-layer equations is developed using an explicit finite-difference scheme. The numerical temperature profiles are observed to closely follow the small time solution initially and evolve along a curve which approaches the steady-state solution asymptotically. Results are presented to illustrate the occurrence of transients from both an increase and a decrease in the levels of existing energy inputs.

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