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Unsteady Conjugate Natural Convective Heat Transfer and Entropy Generation in a Porous Semicircular Cavity
(2018) *Journal of Heat Transfer*, 140 (6), art. no. 62501, . Cited 2 times.

Abstract
The problem of unsteady conjugate natural convection and entropy generation within a semicircular porous cavity bounded by solid wall of finite thickness and conductivity has been investigated numerically. The governing partial differential equations with the corresponding initial and boundary conditions have been solved by the finite difference method using the dimensionless stream function, vorticity, and temperature formulation. Numerical results for the isolines of the stream function, temperature, and the local entropy generation due to heat transfer and fluid friction as well as the average Nusselt and Bejan numbers, and the average total entropy generation and fluid flow rate have been analyzed for different values of the Rayleigh number, Darcy number, thermal conductivity ratio, and the dimensionless time. It has been found that low values of the temperature difference reflect the entropy generation, mainly in the upper corners of the cavity, while for high Rayleigh numbers, the entropy generation occurs also along the internal solid-porous interface. A growth of the thermal conductivity ratio leads to an increase in the average Bejan number and the average entropy generation due to a reduction of the heat loss inside the heat-conducting solid wall. Copyright © 2018 by ASME.

2-s2.0-85043721285
Document Type: Article
Publication Stage: Final
Source: Scopus