

Effects of Roughness Elements on Heat Transfer During Natural Convection

Authors : M. Yousaf, S. Usman

Abstract : The present study focused on the investigation of the effects of roughness elements on heat transfer during natural convection in a rectangular cavity using a numerical technique. Roughness elements were introduced on the bottom hot wall with a normalized amplitude (A^*/H) of 0.1. Thermal and hydrodynamic behavior was studied using a computational method based on Lattice Boltzmann method (LBM). Numerical studies were performed for a laminar natural convection in the range of Rayleigh number (Ra) from 103 to 106 for a rectangular cavity of aspect ratio (L/H) 2 with a fluid of Prandtl number (Pr) 1.0. The presence of the sinusoidal roughness elements caused a minimum to the maximum decrease in the heat transfer as 7% to 17% respectively compared to the smooth enclosure. The results are presented for mean Nusselt number (Nu), isotherms, and streamlines.

Keywords : natural convection, Rayleigh number, surface roughness, Nusselt number, Lattice Boltzmann method

Conference Title : ICNE 2015 : International Conference on Nuclear Engineering

Conference Location : Paris, France

Conference Dates : November 19-20, 2015