CFD Simulation for Thermo-Hydraulic Performance V-Shaped Discrete Ribs on the Absorber Plate of Solar Air Heater

Authors : J. L. Bhagoria, Ajeet Kumar Giri

Abstract : A computational investigation of various flow characteristics with artificial roughness in the form of V-types discrete ribs, heated wall of rectangular duct for turbulent flow with Reynolds number range (3800-15000) and p/e (5 to 12) has been carried out with k-e turbulence model is selected by comparing the predictions of different turbulence models with experimental results available in literature. The current study evaluates thermal performance behavior, heat transfer and fluid flow behavior in a v shaped duct with discrete roughened ribs mounted on one of the principal wall (solar plate) by computational fluid dynamics software (Fluent 6.3.26 Solver). In this study, CFD has been carried out through designing 3-demensional model of experimental solar air heater model analysis has been used to perform a numerical simulation to enhance turbulent heat transfer and Reynolds-Averaged Navier-Stokes analysis is used as a numerical technique and the k-epsilon model with near-wall treatment as a turbulent model. The thermal efficiency enhancement because of selected roughness is found to be 16-24%. The result predicts a significant enhancement of heat transfer as compared to that of for a smooth surface with different P' and various range of Reynolds number.

1

Keywords : CFD, solar collector, airheater, thermal efficiency

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