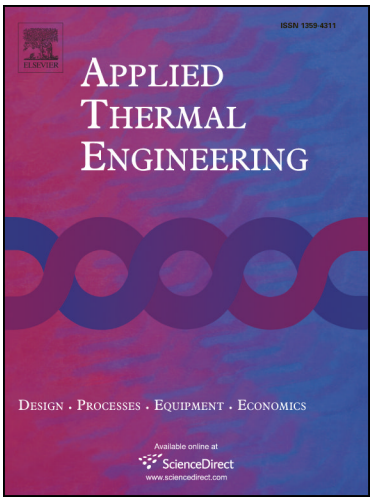

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Heat transfer enhancement in solar air heater duct with conical protrusion roughness ribs

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Abstract

Application of protrusion rib roughnesses on the absorber plate of solar air heater (SAH) duct can effectively enhance the heat transfer rate irrespective of pressure drop penalty. This paper presents the numerical investigation of SAH duct, roughened with conical protrusion ribs. Effect of relative ribs pitch ($6 \le p/e \le 12$) and relative ribs height ($0.020 \le e/D \le 0.044$) on Nusselt number and friction factor have been studied for the range of Reynolds number from 4000 to 16000. Thermal efficiency of roughened duct have been determined using useful energy gain to air and heat losses to environment. The maximum thermal efficiency (η) and efficiency enhancement factor (EEF) are found as 69.8% and 1.346, respectively. Correlations of friction factor and Nusselt number have also been developed as function of Reynolds number and roughness parameters of conical ribs.

Keywords: Heat transfer enhancement, Efficiency enhancement factor, Conical rib, Solar air heater

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