

Heat and Flow Analysis of Solar Air Heaters with Artificial Roughness on the Absorber

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Abstract : Solar air heaters (SAH) are widely used in heating and drying applications using solar energy. Their efficiency needs to be improved to be competitive towards solar water heater. In this work, our goal is to study heat transfer enhancement in SAHs by the use of artificial roughness on the absorber. For this purpose, computational fluid dynamics (CFD) simulations were carried out to analyze the flow and heat transfer in the air duct of a solar air heater provided with transverse ribs. The air flows in forced convection and the absorber is heated with uniform flux. The effect of major parameters (Reynolds number, solar radiation, air inlet temperature, geometry of roughness) is examined and discussed. To highlight the effect of artificial roughness, we plotted the distribution of the important parameters: Nusselt number, friction factor, global thermohydraulic performance parameter etc. The results obtained are concordant to those found in the literature and shows clearly the heat transfer enhancement due to artificial roughness.

Keywords : solar air heater, artificial roughness, heat transfer enhancement, CFD

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