

Numerical comparative study on fully-developed mixed laminar convection in two different physical models of parabolic trough solar receiver tube

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Abstract – In this work, a numerical study is presented on the effect of the buoyancy force induced by a non-uniform heat flux NUHF on a laminar air flow in the solar absorber of a parabolic trough collector PTC. The temperature and velocity distributions as well as the development of Nusselt number “Nu” and friction factor “f” were analysed for two physical models of PTC. The study is carried out with a Reynolds number of 2200, a Grashof number covering the range 1×10^6 - 6×10^6 and an angle of inclination of the cylinder of $\alpha = 0^\circ$ (horizontal). Calculating the values of “Nu” and “f” showed larger values in the Jeter-PTC case ($\varphi_{rim} = 90^\circ$, GC=20) than in the LS2-PTC ($\varphi_{rim} = 70^\circ$, GC=22.7) case. We deduce that the hydrodynamic and thermal characteristics in the case of mixed convection are affected by the physical model of the chosen PTC.

Keywords – Buoyancy Force, Parabolic Trough Collector, Grashof Number, Mixed Convection.