

The present study represents a computational analysis of two-dimensional air flow in a new designed configuration of a solar air heater (SAH). The shape of the installed ribs along the absorber plate is a combination of triangular and semi-circular nooks with variable height of three ribs simultaneously. The objective is to optimize the Thermo-Hydraulic Efficiency Parameter (*THEP*) of the SAH by characterizing the values of roughness height (*e*) and pitch (*P*) of the considered ribs which provides the optimum patterns. Various (*e*) and (*P*) values for varied Reynolds number (*Re*) between 3,800 and 18,000 are investigated. An imposed constant heat flux is considered, and governing equations describing the flow and heat transfer are solved numerically with the selected RNG k- ϵ for the turbulence modeling. The obtained results indicate that the *THEP* strongly depends on the different investigated geometric parameters and *Re* number. The optimum *THEP* value of 1.93 could be obtained for the case C1 and *Re* number of 5,000.