**ABSTRACT**

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 obtimum *THEP* value of 1.93 could be obtained for the case C1 and *Re* number of 5,000.