

## Simulation and Experimentation of Solar Thermal Collector for Air Heating System Using Dynamic Ribs

**Authors :** Nishitha Chowdary, Prabhav Dwivedi

**Abstract :** Solar radiation (or insolation) is responsible for 174 petawatts (PW) of energy reaching the Earth's atmosphere. About one-third of this is reflected in space. Solar energy is by far the most abundant source of energy on Earth. In this study to use solar energy to the fullest in a solar air heater, An analysis of a solar air heater duct roughened with fixed cylindrical ribs in 3-D has been done using CFD. These fixed cylindrical ribs have a uniform circular cross-section and are placed in transverse in-line and staggered arrangements. The orientation of ribs has been fixed and is perpendicular to the in-flow direction. Cylindrical ribs are arranged periodically with fixed pitch; therefore, one pitch length is only considered in the present study. Validation has been done with smooth as well as with roughened duct and is matched perfectly with the developed correlations. Geometric parameters, namely rib height ( $e$ ), ranges from 1 to 2 mm and pitch ranges from 10 to 40 mm are used in the present investigation. Thermo-hydraulic performance parameters in terms of average Nusselt number and friction factor have been extracted for Reynolds number ranging 5000–18000 to optimize the performance of roughened duct.

**Keywords :** cylindrical ribs, solar air heater, thermo-hydraulic performance factor, roughened duct

**Conference Title :** ICRA CFD 2021 : International Conference on Recent Advances in Computational Fluid Dynamics

**Conference Location :** Paris, France

**Conference Dates :** December 30-31, 2021