National Institute of Technology Rourkela

Registration Seminar

Seminar Title	: Numerical Study of Thermal Performance Evaluation of Solar Air Heat Duct using Rib Turbulators
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Venue	: ME-001 (SEMINAR HALL)
Date and Time	: 03 Oct 2024 (11.00 PM)
Abstract	: This article uses the CFD approach to present heat transfer augmentation and flow characteristics in solar air heater ducts (SAHD) with diamond-shaped rib turbulators. In this study, a two-dimensional computational domain is considered, and the absorber plate of SAHD is made from aluminum, which is exposed to a consistent heat flux of 1000 W/m². The numerical exercise is carried out using the ANSYS Fluent R22 code to analyze the effect of different dimensionless parameters that are crucial in characterizing fluid flow and heat transfer dynamics. The parameters of interest include Reynolds number (Re), relative roughness pitch (P/e), relative roughness height (e/Dh), and relative roughness pitch to width ratio (P/w). The investigation gives rise to significant outcomes as presented in terms of average Nusselt number enhancement factor, average enhancement friction factor, thermogeometric performance parameter (TGPP), solar air heater performance index (SAHPI), pumping power and visualization of different fluid properties for the SAHD. The study was done in two sections, where in section I, P/e and e/Dh varied from 7.14 to 10 and 0.042 to 0.029, respectively. It is found that P/e = 10 and e/Dh=0.029 produce an SAHPI of 2.29. In section II, keeping a fixed value of e/Dh = 0.029, optimized rib geometry was obtained by varying P/w = 8, 10, 13.334, 20, 40, and it is found that P/w of 20 has a maximum SAHPI of 2.511. For both analyses, Reynolds numbers are varied from 4000 to 18000, and the RNG ⬚⬚ &minus ⬚⬚ model with enhanced wall treatment is chosen. The correlations are established for the average Nusselt number and friction factor considering the &lsquoRe and P/w&rsquo. Keywords: SAHD, TGPP, SAHPI, diamond-shaped rib turbulators, nozzle effect.