# Numerical Simulation Analysis and Its Performance on Double Arch Having Width with Staggered Pattern over SAH Plate

**Gulshan Kumar Bisen[1] Prof. Suresh Kumar Badholiya[2]**
[1]Research Scholar [2]Associate Professor
[1,2]Department of Mechanical Engineering
[1,2]BITS, Bhopal (M.P.), India

*Abstract*— To aim the design has to get for W/w ,e/w and g/d,d/D ,P/e are 2,.02 and 0.5, 6.25 respectively of the plate having wedge broken are for multi pattern to get acquired turbulent on surfaces so get efficient design to meet our aim. If the surfaces meet design parameter on turbulent convert into heat transfers to work abstract. So that designed to new design for heaving multiple arcs on wedge gab similarly pattern to have it. The solar heater plate gets heated from solar energy on plate so that design all parameter meet to all acquired properties. So that CFD analysis done as multi arc pattern, so we can do that CFD phase run on pattern design to analyzed all thermodynamics properties to be abstracted so our design get gives more efficient and all parameter such that temperature ,pressure etc. Contour will gives more accurately so that will meet our efficiency done over the design.

***Keywords:*** CFD, SAH on CFD

## I. INTRODUCTION

To investigate of arrays of double arc rib on rectangular duct with different design parameter with design specification to get better efficiency and thermal efficiency for that get best result for better computational analysis to get better rip pattern results.

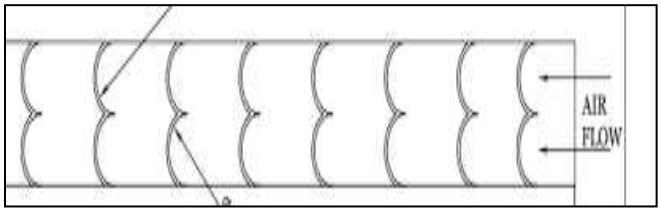
Solar energy is one of the environmentally compatible sources of renewable energy. It is most recognized as one of the promises that can conserve the Earth to survive in a reasonable shape. Solar energy is virtually unlimited. The Sun is the primary source of renewable energy and it harvest more abundant than any other type of energy. A conventional solar air heater generally consists of an absorber plate with a parallel plate below forming a passage of high aspect ratio through which the air to be heated flows. As in the case of the liquid flat-plate collector, a transparent cover system is provided above the absorber plate, while a sheet metal container filled with insulation is 'provided on the bottom and sides.

## II. LITERATURE REVIEW

We study more ever single arc and double arc paper we done as per convention design with help of our result as CFD analysis for preprocessing as final one post processing. That a reason we got unique results. Mention as meshing and final one as follows.

So we can form the problem formulation that's the reason done wide width and increase as e values too as compare the relative one classical research says that an our objectives meets.

## III. SPECIFICATION OF DESIGN




- Length(W) = 300 mm
- Breath(L) = 500 mm
- Thickness = 30 mm
- Hydralic Diameter(D) = 42.24 mm
- Rib height(e) = 3.2 mm
- Rib pitch(P) = 20 mm
- Angle (α) = 20°, 35°, 40°
- Reynold no.(Re) = 4000-9000

## IV. GEOMETRY & MESHING

### A. Geometry

The double arc wide width geometry dawn in CAD software as follows

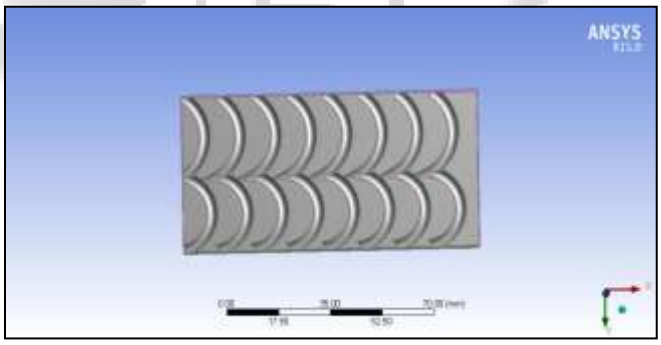



Fig. 1: Geometry of SAH

There is meshing geometry as follows and detail too.

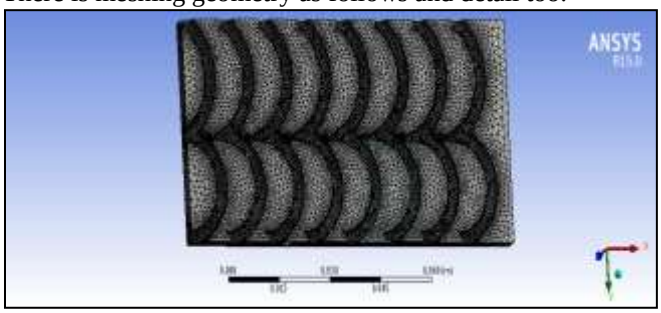



Fig. 2: Meshing

Meshing detail

| Type of element | Tetrahedral |
|---|---|
| No. of nodes | 624011 |
| No. of Elements | 374181 |

## V. BOUNDARY CONDITION

At Inlet

| Condition | Value |
|---|---|
| Pressure | 0.2 bar |
| Temperature | 320 k |
| Velocity(m/s) | 0.3 m/s |
| Turbulent model | K-omega |
| Density of fluid on duct | 1.225 kg/m$^3$ |
| Turbulent intensity | 5% |

At Outlet

| Condition | Value |
|---|---|
| Pressure | 0.4 bar |
| Temperature | 400 k |
| Velocity(m/s) | 0.6 m/s |
| Turbulent model | K-omega |
| Turbulent intensity | 5 % |
| Wall | Segmental flow region |
| Wall | No slip condition |

## VI. RESULT & DISCUSSION

The improvement in their performance has been and is still of major concern to theorists and practitioners. The issue of exchanging heat between the calporting fluid (air) and the absorber within a solar collector relies mainly on the value of the heat transfer coefficient. This coefficient is a mine of factors that affect the heat exchange between working fluid and heated surfaces. Therefore, it is an ambitious attempt to work on such a topic. In this study, we reviewed the different configurations of flat plate solar air collectors by highlighting three main groups: single-pass solar air collectors, double-pass solar air collectors, and multi-pass solar air collectors. We showed the various parameters in the design of solar energy collectors on which it is possible to act to enhance the thermal transfer phenomenon between the caloporting air and the absorber-plate, and thus to favor the energetic efficiency while assuring an optimal temperature augmentation. The investigations on different models and configurations with various heat transfer enhancement strategies of solar energy collectors were shown in various stages, i.e., modelling, control, measurement, and visualization of field or flow of air, determination of the heat transfer, control of friction loss and pressure drop, and evaluation of the thermal performance by the measurement of the augmentation in the temperature of the working fluid so our designed get done. There is a contour called temperature contour

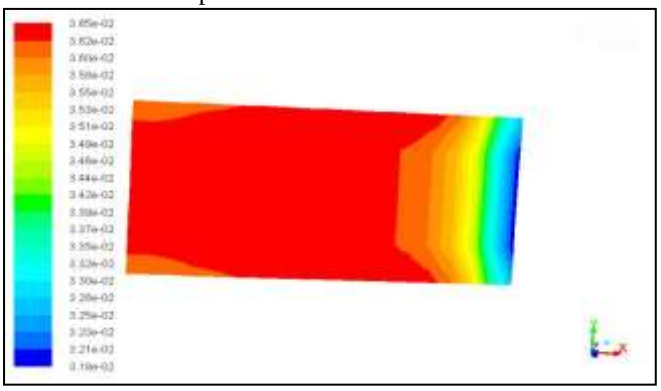


Fig. 1: Temperature contour

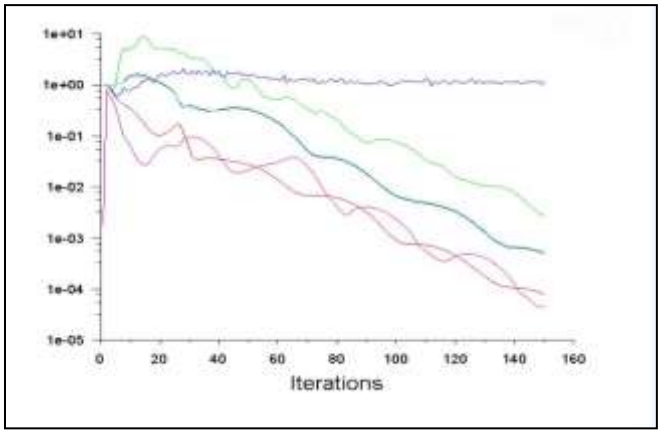



Fig. 2: Result graph

## VII. CONCLUSION

The Numerical investigations were conducted on solar air heater duct roughened with broken double arc shaped ribs. The staggered rib piece was fixed at a distance of the main arc rib pitch on the downstream side of gap. The following conclusions are drawn from the present study:

A 2-dimensional CFD analysis has been carried out to study heat transfer and fluid flow behavior in a rectangular duct of a solar air heater with one roughened wall having rectangular and broken double arc-rib roughness. The effect of Reynolds number on the heat transfer coefficient and friction factor have been studied. In order to validate the present numerical model, results have been compared with available experimental results under similar flow conditions. CFD Investigation has been carried out in medium Reynolds number flow (Re = 4000–9,000). And all physical and thermodynamic properties have studied.

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