CFD Analysis of SAH on Subtracted Duct V-Type Array Ribs on Surface

MD Iftekhar[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— The unique view of V rib subtracted material on solar air heater duct to to improve design and efficiency and thermal efficiency to investigate for cfd analysis on it. To verify cfd analysis to v type rib will look after design parameter such as W/w=2 and e/w= 0.032 and e/W= 0.016and p/e=21.88, etc. to investigate numerically match with experimentally data to execute design parameter for arrays on duct as given dimension, mentioned in specification .As acquire Reynolds no. ,its k-omega range of turbulency to compute data to design parameter to perform better thermal efficiency to get better performance. Analysis will have to achieve to better performance result to get better acquire experimental result.

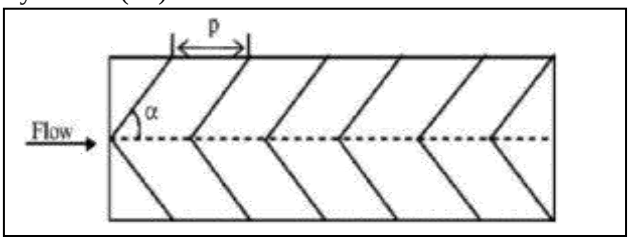
Keywords: CFD for v-type, SAH of v-rib

I. Introduction

Cfd analysis as numerically for V-type subtracted rib arrays on duct with respected geometry with various angles of attack with help of various contour of turbulent, pressure. Temperature etc.

II. Specification of Design

Length(W) = 210 mm
Breath(L) = 650 mm
Thickness = 20 mm
Hydralic Diameter(D) = 45.12 mm
Rib height(e) = 3.3 mm
Rib pitch(P) = 72.22 mm
Angle (α) = 20°, 35°, 40°
Reynold no.(Re) = 4000-9000



III. Geometry & Meshing

The single arc geometry dawn in CAD software as follows

Fig. 1: Geometry of Single arc plate of SAH

After modeling, we have meshing the model so next process of numerical method.

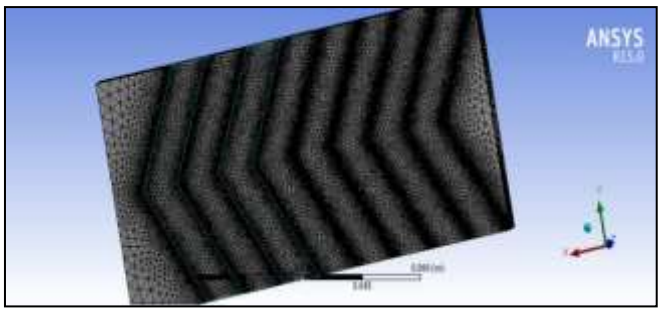


Fig. 2: Mesh of Model

Meshing detail

Type of element	Tetrahedral
No. of nodes	524011
No. of Elements	274181

IV. Boundary Condition

A. 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%

B. 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

V. Result & Discussion

Contour for turbulence for K-omega due to subtraction rib efficiency improved and uniform turbulent get better performance.

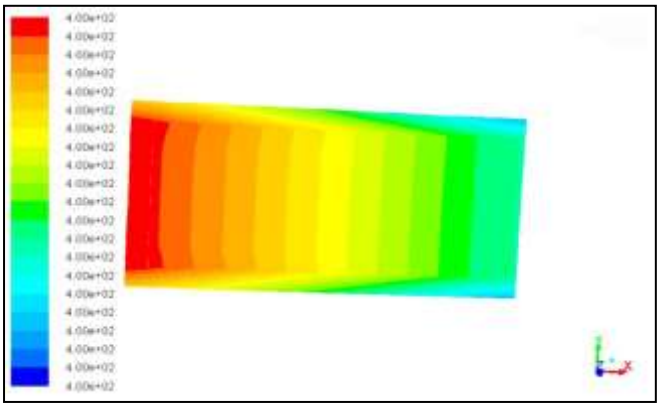


Fig. 3: Turbulent contour

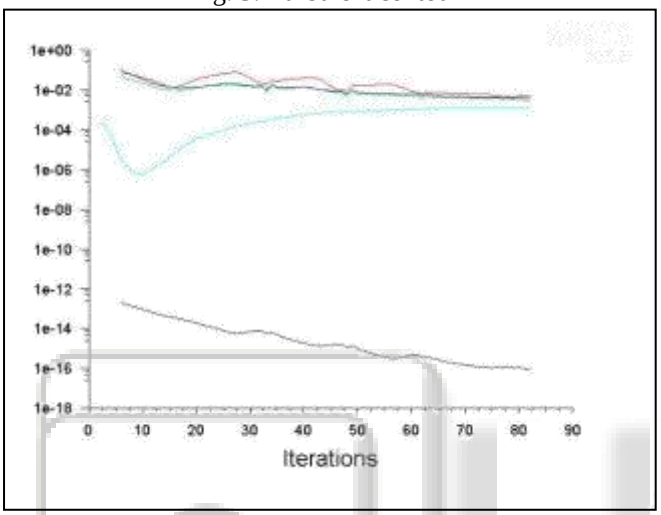


Fig. 4: Result graph

VI. CONCLUSION

Before analysis of CFD we knwen that as experimental says to v-type rib was excellent performance so we got better efficiency after getting result so.

REFERENCES

[1] Ahn S. W., 2001, the effects of roughness types on friction factors and heat transfer in roughened rectangular duct, International Communications in Heat and Mass Transfer, 28(7): pp. 933-942.

[2] Momin A. M. E., Saini J. S. and Solanki S. C., 2002, Heat transfer and friction in solar airheater duct with V-shaped rib roughness on absorber plate, International Journal of Heat and Mass Transfer, 45(16): pp. 3383-3396.

[3] Chandra P. R., Alexander C. R. and Han J. C., 2003, Heat transfer and friction behaviors in rectangular channels with varying number of ribbed walls. International Journal of Heat and Mass Transfer, 46(3): pp. 481-495.

[4] Tanda G., 2004, Heat transfer in rectangular channels with transverse and V-shaped Broken ribs, International Journal of Heat and Mass Transfer, 47(2): pp. 229-243.

[5] Sahu M. M. and Bhagoria J. L., 2005, Augmentation of heat transfer coefficient by using 90 broken transverse ribs on absorber plate of solar air heater, Renewable Energy, 30(13): pp. 2057-2073.

[6] Chang S. W., Liou T. M. and Lu M. H., 2005, Heat transfer of rectangular narrow channel with two opposite scale-roughened walls, International Journal of Heat and Mass Transfer, 48(19): pp. 3921-3931.

[7] Bhagoria J. L., Saini J. S. and Solanki S. C., 2002, Heat transfer coefficient and friction factor correlations for rectangular solar air heater duct having transverse wedge shaped rib roughness on the absorber plate, Renewable Energy, 25(3): pp. 341-369.

[8] Chaube A., Sahoo P. K. and Solanki S. C., 2006, Analysis of heat transfer augmentation and flow characteristics due to rib roughness over absorber plate of a solar air heater, Renewable Energy, 31(3): pp. 317-331.

[9] Jaurker A. R., Saini J. S. and Gandhi B. K., 2006, Heat transfer and friction characteristics of rectangular solar air heater duct using rib-grooved artificial roughness, Solar Energy, 80(8): pp. 895-907.

[10] Wang C., Guan Z., Zhao X. and Wang D., 2006, Numerical simulation study on transpired solar air collector, Renewable Energy Resources and a Greener Future, Vol. VIII-3-4

[11] Karmare S. V. and Tikekar A. N., 2007, Heat transfer and friction factor correlation for artificially roughened duct with metal grit ribs, International Journal of Heat and Mass Transfer, 50(21): pp. 4342-4351.

[12] Layek A., Saini J. S. and Solanki S. C., 2007, Second law optimization of a solar air heater having chamfered rib–groove roughness on absorber plate, Renewable Energy, 32(12): pp.1967-1980.

[13] Aharwal K. R., Gandhi B. K. and Saini J. S., 2008, Experimental investigation on heattransfer enhancement due to a gap in an inclined continuous rib arrangement in a rectangular duct of solar air heater, Renewable Energy, 33(4): pp. 585-596.

[14] Promvonge P. and Thianpong C, 2008, Thermal performance assessment of turbulent channel flows over different shaped ribs, International Communications in Heat and Mass Transfer, 35(10): pp. 1327-1334.

[15] Saini S. K. and Saini R. P., 2008, Development of correlations for Nusselt number and friction factor for solar air heater with roughened duct having arc-shaped wire as artificial roughness, Solar Energy, 82(12): pp. 1118-1130.

[16] Saini R. P. and Verma J., 2008, Heat transfer and friction factor correlations for a duct having dimple-shape artificial roughness for solar air heaters. Energy, 33(8): pp. 1277-1287.

[17] Saini, R. P. and Singal S. K., 2008, Investigation of thermal performance of solar air heater having roughness elements as a combination of inclined and transverse ribs on the absorber plate, Renewable Energy, 33(6): pp. 1398-1405

