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USE OF INTERNAL THREADS OF DIFFERENT PITCHES TO ENHANCE HEAT TRANSFER IN A CIRCULAR CHANNEL

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ABSTRACT

In last most of the year the use of various method for enhance the heat transfer has been reported by several researchers. This work deals with experimental investigation of the forced convection heat transfer through a Circular channel. The various heat transfer parameters considered for study are Nusselt number, heat transfer coefficient, heat transfer rate and Reynolds Number. By Analyasis result, conclusion for enhancement of heat transfer.

KEYWORDS: Internal Threads, Enhancement, Heat Transfer and Turbulent Flow

INTRODUCTION

In Circular channel, Passive, Active and Combined techniques are used for improving the heat transfer. But passive techniques are one of the most effective technique used for enhance the heat transfer. Passive techniques are also used in solar air heaters, electronic cooling equipment's (heat sinks), biomedical devices, turbine airfoil cooling etc. In passive techniques heat transfer rate is increased by making surface modifications such as protrusions, dimples and pin fins. Increase heat transfer in this devices performance can lead to more economical design which can help to make energy, material & cost savings. The need to increase the thermal performance of system, thereby affecting his devices energy, material & cost savings have led to development & use of many techniques termed as Heat transfer Augmentation. A. Zehforoosh, S. Hossainpour and A. A. Tahery [1]studied the heat transfer enhancement of forced convection in various counter flow porous channels with a joint aluminum plate was studied, using control volume technique and SIMPLE procedure for the velocity-pressure Coupling. The results show that the more the Darcy, Reynolds or Prandtl number decreases, the more effectiveness of heat exchanger increases. The results of this study clearly demonstrate that using porous structure in the parallel channels with counterflow is an effective method to augment the effectiveness. P. Promvonge S. Eiamsa-ard[2] carried out experiment on circular tube fitted with conical-ring turbulators and a twisted-tape swirl generator has been investigated experimentally. In the experiments, two enhancement heat transfer devices are applied. One is the conical-ring used as a turbulator and placed in the tested tube and the other is the twisted-tape swirl generator placed at the core of the conical-ring. Air as the tested fluid is passed both enhancement devices in a Reynolds number range of 6000 to 26,000. Two twisted-tapes of different twist ratios, Y=3.75, and 7.5, are introduced in each run. The experimental results of heat transfer and friction characteristics in a uniform heat flux tube with combined conical-ring and twisted-tape insert have been reported. It is found that the smaller twist ratio is, the larger the heat transfer and friction factor for all Reynolds numbers. The average heat transfer rates from using both the conical-ring and twisted-tape for Y=3.75, and 7.5, respectively, are found to be 367% and 350% over the plain tube. However, the friction factor from using both devices also increases considerably.

From the above literature, it is very much clear that swirl flow devices have a high potential to increases heat transfer. Most of researcher experiment carried out in rectangular channel. Motivation from this, the present analysis the formation of turbulent flow for more heat transfer

EXPERIMENTAL SETUP

The forced convection setup required for this study is shown in Figure 1 below.

Figure 1

DATA REDUCTION

The study was carried out under constant heat and external force convection regime. Steady flow of air and the variation of velocity of flowing air by adjusting its flow rate determine the different values of parameter

RESULTS AND DISCUSSIONS

Heat transfer experiment on the circular channel with internal threads of different pitches and data was is used for finding parameters like Nusselt number, heat transfer coefficient and heat transfer rate. Experimental findings has been plotted in the form of graphs, mainly

- Re vs Nu
- Re vs Nu
- Ff vs Re

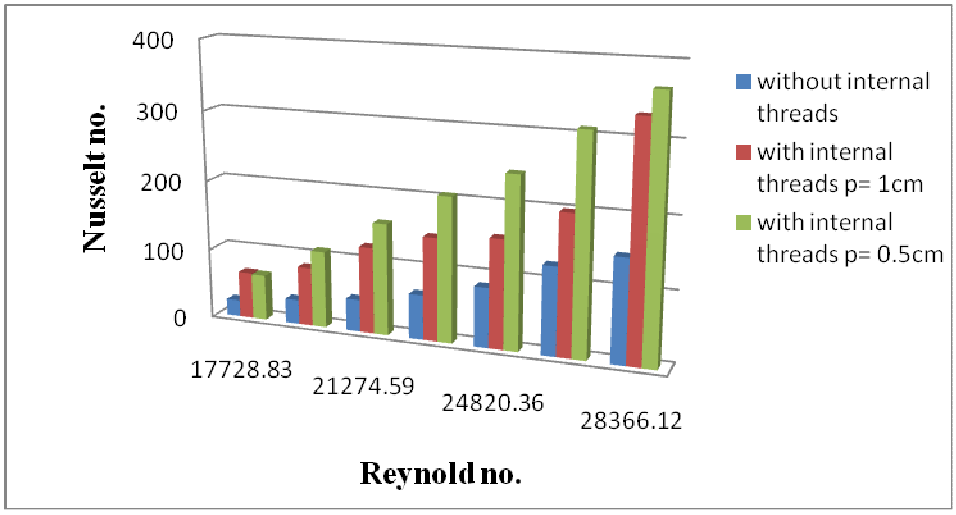

Figure 2: Shows the Variation of Nusselt Number 'Nu' with Reynolds Number 'Re' for the Internal Threads in Circular Channel

Results of the effects of internal threads of different pitches (p=0.5cm & p= 1cm) on heat transfer rate and flow friction are presented. Verification of the heat transfer and friction of the plain tube is performed by comparing with the previous correlations under a similar condition as shown in above Figures. respectively. The present plain tube data is found to

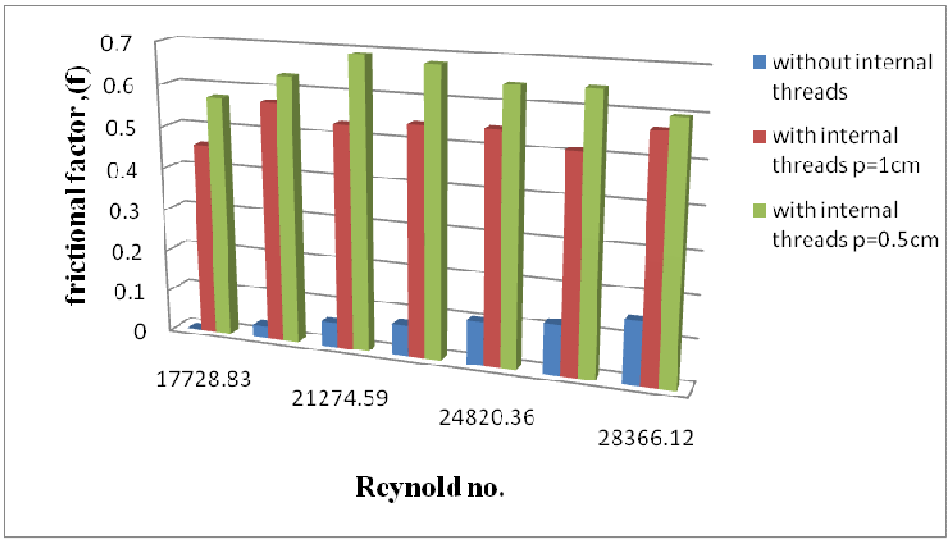

Figure 3

Above figure show the increase in the friction factor if increases in Reynolds numbers. Maximum friction is for internal threads of pitch p= 0.5cm as well as Minimum for the plain tube.

CONCLUSIONS

In this study an experimental investigation of the effect of air flow over a circular channel with internal threads of different pitches. The main conclusions are

- Nusselt number ‘Nu’ increases with Reynolds number ‘Re’.
- Friction factor ‘f’ increases with Reynolds number ‘Re’ in all the cases.
- The Heat transfer rate ‘Q’ increases as Reynolds number ‘Re’ increases for all the cases.

REFERENCES

1. A. Zehforoosh, S. Hossainpour and A. A. Tahery Numerical Investigation of Forced Convection Heat Transfer for Laminar Flow in Various Parallel Porous Channels. International Journal of Innovation, Management and Technology, Vol. 1, No. 3, August 2010 ISSN: 2010-0248 pp 252-258.
2. P. Promvonge, S. Eiamsa-ard Heat transfer behaviors in a tube with combined conical-ring and twisted-tape insert. Elsevier Ltd. 2007 pp 0735-1933.
3. W. Liu1, K. Yang, Z.C. Liu, T. Z. Ming, A.W. Fan, C. Yang Mechanism of Heat Transfer Enhancement in the Core Flow of a Tube and Its Numerical Simulation The Open Transport Phenomena Journal, 2009 pp 1877-7295/09.
4. M. A. K. Chowdhuri, R. A. Hossain, M. A. R. Sarkar An experimental investigation of turbulent flow heat transfer through tube with rod-pin insert International Journal of Engineering, Science and Technology Vol. 3, No. 4, 2011, pp. 76-81.

5. P. K. Nagarajan and P. Sivashanmugam Circular Tube Fitted with Right-Left Helical Inserts with Spacer World Academy of Science, Engineering and Technology Vol:58 2011-10-22 pp 980-984.
6. Dr. A. G. Matani, Swapnil A. Dahake Experimental study on heat transfer enhancement in a tube using conter/co-swirl generation International Journal of Application or Innovation in Engineering & Management Volume 2, Issue 3, March 2013 ISSN 2319 – 4847 pp 100-105.
7. Nihad Dukhan, Kuan-Chih Chen Heat transfer measurements in metal foam subjected to constant heat flux Elsevier Ltd.2007 pp 624-631.
8. Ta-Sung Huang, Pai-Hsiang Wang,Yu-Wei Chiu and Jiin- Yuh Jang Heat and Fluid Flow Analysis over Different Tube Inserts of Recuperator China Steel Technical Report, No. 21, (2008) pp. 67－76.
9. Chitakorn Khanoknaiyakarn, Phudit Chaidilokpattanakul and Pongjet Promvonge Heat Transfer and Friction Behavior in a Channel Fitted with Triangular and Rectangular V-shaped Ribs The First TSME International Conference on Mechanical Engineering 20-22 October, 2010, Ubon Ratchathani pp 132-138.
10. Prabal Talukdar, Subhash C. Mishra, D. Trimis, Franz Durst Combined radiation and convection heat transfer in a porous channel bounded by isothermal parallel plates International Journal of Heat and Mass Transfer 47 (2004) pp 1001–1013.