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CFD Analysis on Micro Channel with a Micro Fin on a Compact Heat Exchanger

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ABSTRACT

With the developing technology and requirement of superior cooling needs .the compact heat exchangers are quite popular with the industries these days. Especially in the field of Aeronautics, electronics and cryogenics. In the present study the CFD analysis of A micro channel with micro fin is developed to study the effect of the micro fin inside the Micro channel. Special emphasize is made to know the effects on density of fins on the various flow parameters inside the micro channels.

The study of convection heat transfer in a domain of conjugate boundary conditions is done in the present study. In this the CFD analysis is done on micro channel without fin, micro channel with single fin and micro channel with multiple fins for heat flux, temperature distribution and heat transfer rate at various flow parameters. By observing the three types of fin arrangements the micro channel with multiple fin is having high heat transfer rate.

I INTRODUCTION

Plate fin heat exchangers are broadly utilized as a part of vehicle, aviation, cryogenic and compound enterprises. They are described by high viability, smallness (high surface territory thickness), low weight and direct cost. In spite of the fact that these exchangers have been broadly utilized the world over for quite a few years, the innovations identified with their outline and make stay confined to a couple of organizations in created nations. As of late endeavors are being made in India towards the improvement of little plate fin heat exchangers for cryogenic and aviation applications. The present work constitutes a piece of this general exertion. Its concentration, be that as it may, is on the fundamental heat exchange and stream grinding marvels material to all plate fin heat exchangers.

Right now, heat exchangers have a wide range of industry applications. They are generally utilized as a part of space heating, refrigeration, control plants, petrochemical plants, oil refineries and sewage treatment . There are numerous kinds of heat exchanger outlines for different applications.

The real sorts of heat exchanger incorporate twofold pipe, shell-tube, plate and shell, plate fin, what's more, stage change heat exchangers. The stream in a heat exchanger can be organized as parallel stream, counter stream, and cross stream. New heat exchangers have been intended for rising warm designing fields, for example, scaled down heat exchanger for cooling hardware parts and frameworks, scaled down heterogeneously catalyzed gas-stage responses, thermoelectric generators, and so on. New materials, for example, polymers, have been investigated to create polymer heat exchangers for better fouling and erosion protection .Parallel-plated heat exchangers have been considered scientifically and tentatively to give definitions to heat exchanger outline.

A plate fin heat exchanger is a type of minimal heat exchanger comprising of a square of rotating layers of ridged fins and level separators known as separating sheets. A schematic perspective of such an exchanger is given in Fig. The creases serve both as optional heat exchange surface andcounter stream, parallel-plate heat exchangers numerically and hypothetically.

II BENEFITS AND DRAWBACKS PLATE FIN HEAT EXCHANGERS

(a) High warm viability and close temperature approach. (Temperature approach as low as 3K between single stage liquid streams and 1K amongst bubbling and consolidating liquids is genuinely normal.),

(b) Large heat exchange surface territory per unit volume (Typically 1000 m2/m3),

(c) Low weight,

(d) Multi-stream task (Up to ten process streams can trade heat in a solitary heat exchanger.), and

(e) True counter-stream task (Unlike the shell and tube heat exchanger, where the shell side stream is generally a blend of cross and counter stream.).

The central inconveniences of the plate fin geometry are :

(a) Limited scope of temperature and weight,

(b) Difficulty in cleaning of sections, which confines its application to clean and generally non-destructive liquids, and

(c) Difficulty of repair if there should arise an occurrence of disappointment or spillage between sections

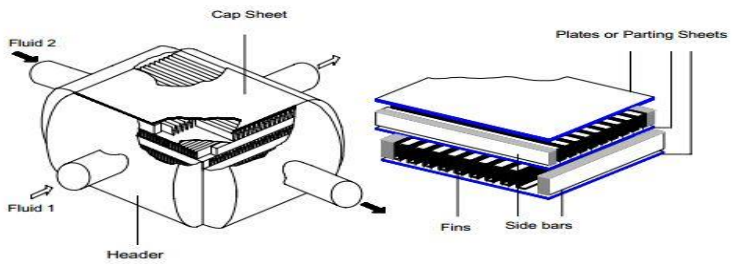

Fig 1 Model of compact heat exchanger

III RESULTS AND DISCUSSION

Various case study done on the model to study the effect of microfin on heat transfer placed inside the micro channel and to study the heat transfer rate with increase in the number of fins and the density of fins per unit area.

Case 1 : Microchannel tube with no fin

Case 2 : Microchannel with one fin

Case 3 : Micro channel with multiple fin

The following boundary conditions apply at the inlet of the micro channel

Flow rate 2 meters per second,

inlet temperature 300 degrees centigrade.

The outlet flow condition are assume to be atmosphere

Flow simulation as in case 1 Microchannel tube with no fin

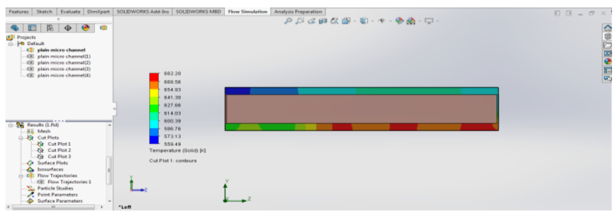

FIG 2 shows the without fin temperature at plot1

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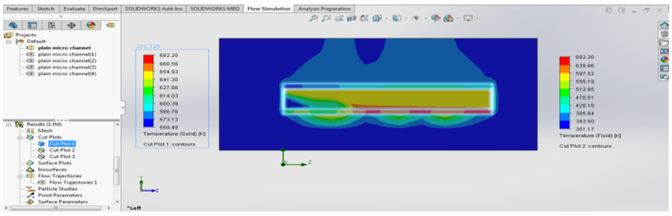

FIG 3 shows the without fin temperature at plot1,plot2

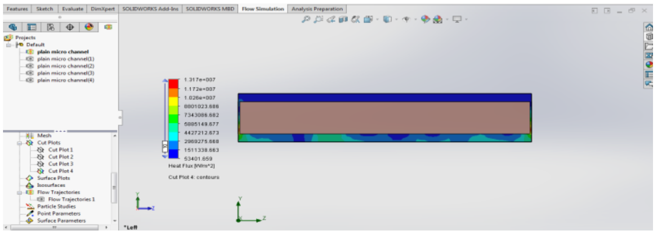

FIG 4 shows the without fin heat flux

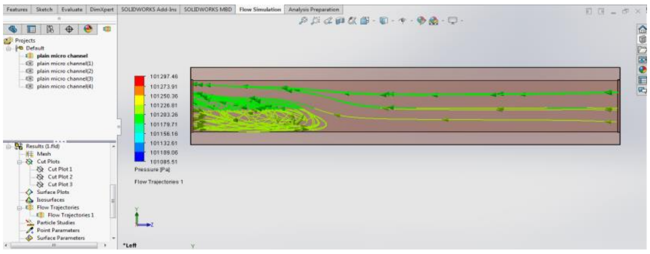

FIG 5 shows the without fin pressure

Flow simulation as in Case 2Microchannel with one fin

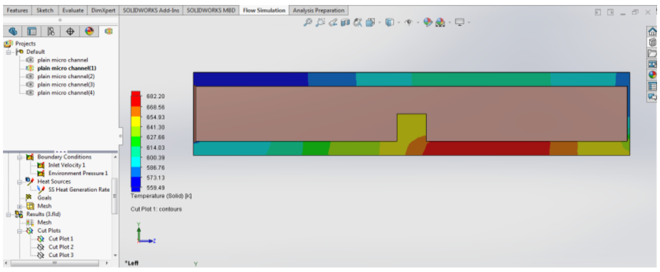

FIG 6 shows the with fin temperature at plot1

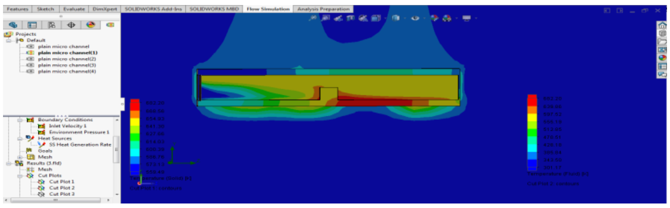

FIG 7 shows the with fin temperature at plot1,plot2

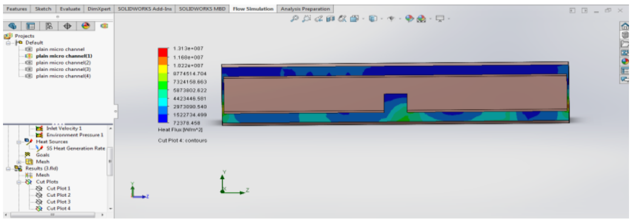

FIG 8 shows the with fin heat flux

Flow simulation as in Case 3 Microchannel with one fin

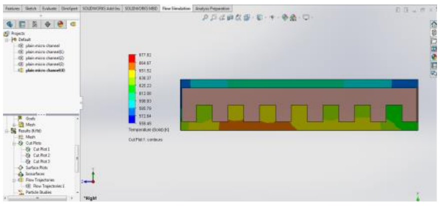

FIG 9 shows the with multiple fin temperature at plot1

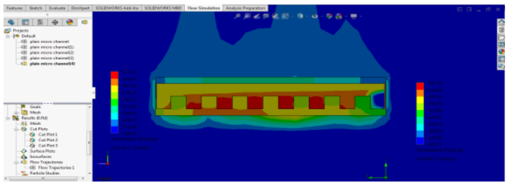

FIG 10 shows the with multiple fin temperature at plot1,plot2

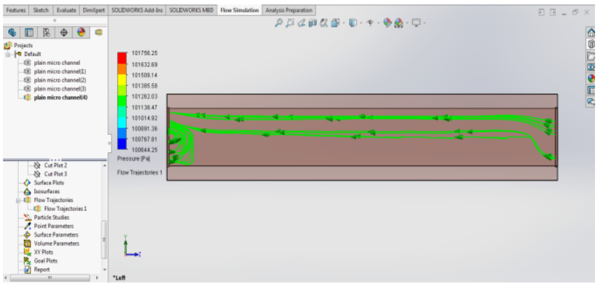

FIG 11 shows the with multiple fin pressure

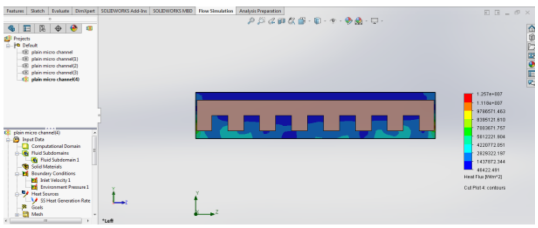

FIG 12 shows the with multiple fin heat flux

IV CONCLUSION

Heat transfer in micro channels of different conditions over a flow rate. Single-phase flow in the thermally developing laminar regimes was considered. The heat transfer coefficient increased with the development of turbulence at a given flow rate. Numerical simulations were carried out for developing flows in rectangular channels based on a conventional Navier–Stokes analysis, using a 3D flow simulation software.

The heat transfer rate in a simple micro channel for laminar flow model is studied for heat transfer rate using different conditions likeno fin followed by single fin and multiple fins. In the transitional stage and turbulent regimes, improved the heat transfer co-efficient .

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