HEAT TRANSFER ANALYSIS OF HELICAL COILED DOUBLE PIPE HEAT EXCHANGE

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Abstract

A CFD package (ANSYS FLUENT 15.0) was used for the numerical study of heat transfer characteristics of a helical coiled double pipe heat exchanger for counter flow. The CFD results when compared with the results from different studies were well within the error limits. The study showed that the effective configuration of heat transfer performances of the counter-flow. The simulation was carried out for fluid to fluid heat transfer characteristics for different fluids, solids and different inlet temperatures were studied. Effectiveness of Helical water combination gives more effectiveness16.33%than other combinations. From the velocity vector plot it was found that the fluid particles were under going an oscillatory motion inside both the pipes. From the pressure and velocity contours it was found that along the outer side of the pipes the velocity and pressure values were higher in comparison to the inner values.

Keywords: Heat Exchangers, Helical Coiled Heat Exchanger

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Introduction:
Heat exchanger is a device, such as an automobile radiator, used to transfer heat from a fluid on one side of a barrier to a fluid on the other side without bringing the fluid into direct contact (Fogiel, 1999). Usually, this barrier is made from metal which has good thermal conductivity in order to transfer heat effectively from onefluid to another fluid. Besides that, heat exchanger can be defined as any of several devices that transfer heat from a hot to a cold fluid. In engineering practical, generally, the hot fluid is needed to cool by the cold fluid. For example, the hot vapor is needed to be cool by water in condenser practical. Moreover, heat exchanger is defined as a device used to exchange heat from one medium to another often through metal walls, usually to extract heat from a medium flowing between two surfaces. The double pipe or the tube in tube type heat exchanger consists of one pipe placed concentrically inside another pipe having a greater diameter. The flow in this configuration canbe of two types: parallel flow and counter-flow. It can be arranged in a lot of series and parallelcon figurations to meet the different heat transfer requirements. Of this the helically arranged stands out as it has found its place in different industrial applications. As this configuration is widely used, knowledge about the heat transfer coefficient, pressure drop, and different flow patterns has been of much importance. The curvature in the tubes creates a secondary flow, which is normal to the primary axial direction of flow. This secondary flow increases the heat transfer between the wall and the flowing fluid. And they offer a greater heat transfer area within a small space, with greater heat transfer coefficients. Study has been done on the types of flows in the curvedpipes, and the effect of Prandt land Reyn olds number on the flow pattern sandon Nusselt numbers. The two basic boundary conditions that are faced in the applications are constant temperature and the constant heat flux of the wall.

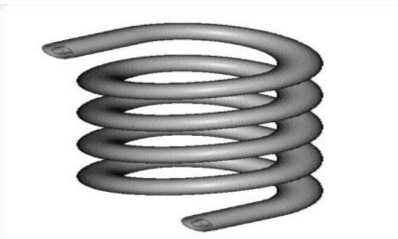


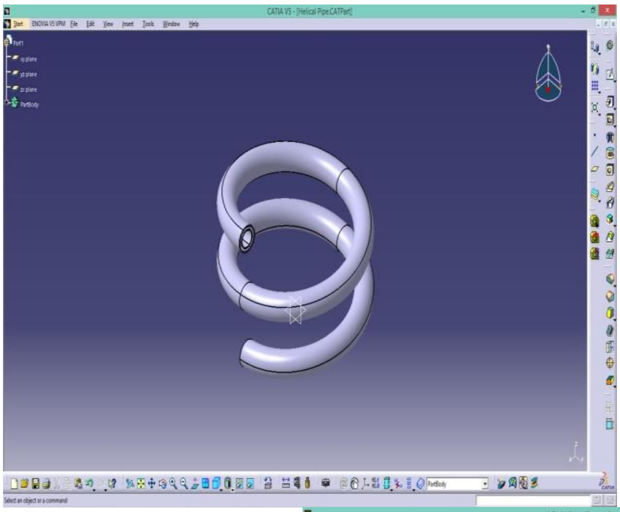
Fig6: DoublepipeHelicalCoil

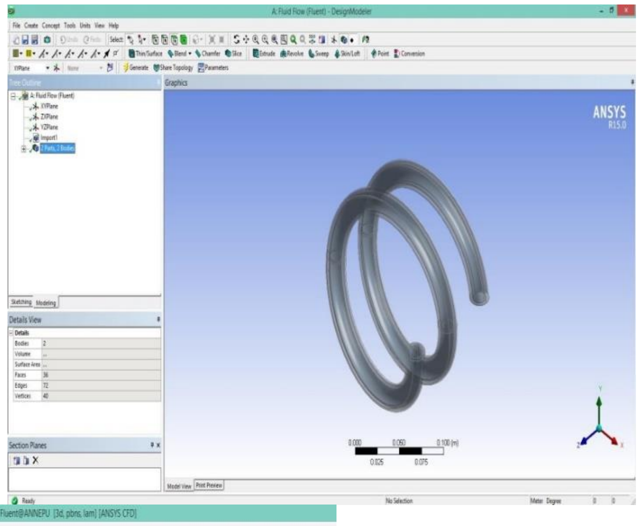
Fig7: Close-upof doublepipecoil

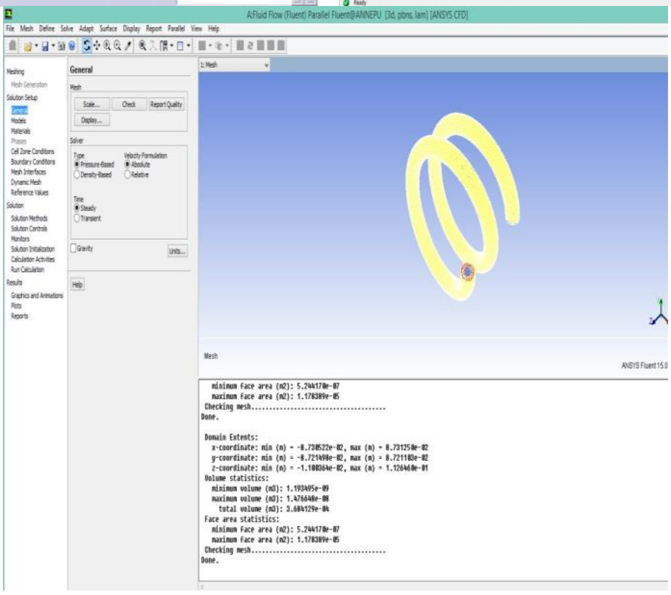
The local nusselt number and also the effect of curvature ratio, vertical position and the pitch of the heat exchanger.[1]

J.S.Jayakumarobservedthattheuseofconstantvalues forthetransferandthermalpropertiesof the fluid resulted in inaccurate heat transfer coefficients. Based on the CFD analysis results acorrelation was developed in order to evaluate the heat transfer coefficient of the coil. In this study, analysis was done for both the constant wall temperature and constant wall heat flux boundary conditions. The nusselt numbers that were obtained were found to be highest on the outercoil and lowest in the inner side. Various numerical analyses were done so as to relate the coilparameters to heat transfer. [2]Timothy J. Rennie studied the heat transfer characteristics of a double pipe helical heatexchanger for both counter and parallel flow. Both the boundary conditions of constant heat fluxand constant wall temperature were taken. The study showed that the results from the simulationswere within the range of the pre-obtained results. For dean numbers ranging from 38 to 350 the overall heat transfer coefficients were determined. The results showed that the overall heat transfer coefficients varied directly with the inner dean number but the fluid flow conditions in the outerpipe had a major contribution on the overall heat transfer coefficient. [3]

Results and Discussions
A CFD package (ANSYS FLUENT 15.0) was used for the numerical study of heat transfer characteristics of a helical coiled double pipe heat exchanger for counter flow. The CFD results when compared with the results from different studies were well within the error limits. The study showed that the effective configuration of heat transfer performances of the counter-flow. The simulation was carried out for fluid to fluid heat transfer characteristics for different fluids, solids and different inlet temperatures were studied.







Conclusion

Effectiveness of Helical Tube Heat Exchanger is calculated on different fluids and solid configurations. Water combination gives more effectiveness **16.33%** than other combinations.

The fluid particles were undergoing anoscillatory motion inside both the pipes. From the pressure and velocity contours it was found thatalong the outer side of the pipes the velocity and pressure values were higher in comparison to theinnervalues.

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