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Control for Fluid Flow Behaviours of Viscous Fluids and Heat Transfer in Mini-Channel: A Case Study Using Numerical Simulation Method

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Abstract : The control for fluid flow behaviours of viscous fluids and heat transfer occurrences within heated mini-channel is considered. Heat transfer and flow characteristics of different viscous liquids, such as engine oil, automatic transmission fluid, one-half ethylene glycol, and deionized water were numerically analyzed. Some mathematical applications such as Fourier series and Laplace Z-Transforms were employed to ascertain the behaviour-wave like structure of these each viscous fluids. The steady, laminar flow and heat transfer equations are reckoned by the aid of numerical simulation technique. Further, this numerical simulation technique is endorsed by using the accessible practical values in comparison with the anticipated local thermal resistances. However, the roughness of this mini-channel that is one of the physical limitations was also predicted in this study. This affects the frictional factor. When an additive such as tetracycline was introduced in the fluid, the heat input was lowered, and this caused pro rata effect on the minor and major frictional losses, mostly at a very minute Reynolds number circa 60-80. At this ascertained lower value of Reynolds numbers, there exists decrease in the viscosity and minute frictional losses as a result of the temperature of these viscous liquids been increased. It is inferred that the three equations and models are identified which supported the numerical simulation via interpolation and integration of the variables extended to the walls of the mini-channel, yields the utmost reliance for engineering and technology calculations for turbulence impacting jets in the near imminent age. Out of reasoning with a true equation that could support this control for the fluid flow, Navier-stokes equations were found to tangential to this finding. Though, other physical factors with respect to these Navier-stokes equations are required to be checkmated to avoid uncertain turbulence of the fluid flow. This paradox is resolved within the framework of continuum mechanics using the classical slip condition and an iteration scheme via numerical simulation method that takes into account certain terms in the full Navier-Stokes equations. However, this resulted in dropping out in the approximation of certain assumptions. Concrete questions raised in the main body of the work are sightseen further in the appendices.

Keywords : frictional losses, heat transfer, laminar flow, mini-channel, number simulation, Reynolds number, turbulence, viscous fluids
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