# NUMERICAL INVESTIGATION ON HYDRODYNAMIC FIELD CHARACTERISTICS FOR TURBULENT FLOW OF WATER-$TiO_2$ NANOFLUID IN A CIRCULAR TUBE

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## ABSTRACT

The hydrodynamic field characteristics of $TiO_2$-water nanofluid flowing in a circular tube under turbulent flow regime have been numerically investigated. A single phase fluid model in conjunction with two-equation turbulence model was employed in commercial soft ware package to determine the different turbulent quantities of nanofluid with different volume concentrations. Effects of nanoparticle volume concentrations on the turbulent quantities profiles of the hydrodynamic field are presented and discussed. The present study disclosed a novel features, for the first time to the author's knowledge; for the hydrodynamic characteristics of nanofluids. For example, with volume concentration $\varphi$ = 9 % of $TiO_2$, the turbulent shear stress and turbulent kinetic energy were increased by 400 % of the base fluid, while, the turbulent eddy viscosity increased by 100 % and the dissipation rate of turbulent kinetic energy increased by 800 % of the base fluid. Moreover, the dimensionless constants κ and B in the well-known logarithmic velocity profile were found to be nanoparticle volume concentration dependents. Ultimately, in case of $TiO_2$-water nanofluid, the turbulent kinetic energy and shear stress have been revealed to satisfy the near-wall limiting behaviour similar to the base fluid. Further numerical studies focusing on other nanofluids are needed to judge the reported surprising simulated results.

**KEYWORDS:** Nanofluids, Numerical Simulation, Nanoparticle, Turbulent Flow, Laminar Flow