

Study of Flow Characteristics and Flow Optimization Inside a Cylindrical Pipe

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Abstract

Fluid flow in a cylindrical pipe needs to be characterized for various applications. The flow ideally should be laminar in nature as it provides many benefits. But the flow is never completely ideal. The flow tends to form vortexes or becomes turbulent owing to many factors like inlet angle, inlet velocity, protrusions in the path of flow etc. This work focuses on studying the characteristic behavior of flow inside a cylindrical pipe with non-laminar flow. It also aims at achieving laminar flow after a turbulence effect caused by some factor. It discusses the mechanisms in idealizing a flow and studies the effect of optimization methods employed like choosing a proper inlet angle, adjusting the inlet flow velocity, aligning the exhaust port. It also aims to discuss boundary layer effects when an obtrusive object placed in the flow and optimization of the flow with varying the object flow facing angle, characteristic length of pre-flow and post flow path of the fluid.

Reference

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- 2) S. M. Scott, D. James, Z. Ali and W. T. O'Hare, Optimising of the Sensing Chamber of an Array Of A Volatile Detection System-Fluid Dynamic Simulation, Journal of Thermal Analysis and Calorimetry, Vol. 76 (2004) 693–708.
- 3) Chu Wang, Lucy T. Zhang, Numerical modeling of gas–liquid–solid interactions: Gas–liquid free surfaces interacting with deformable solids, Computer Methods in Applied Mechanics and Engineering, Volume 286, 1 April 2015, Pages 123–146.

Figures used in the abstract

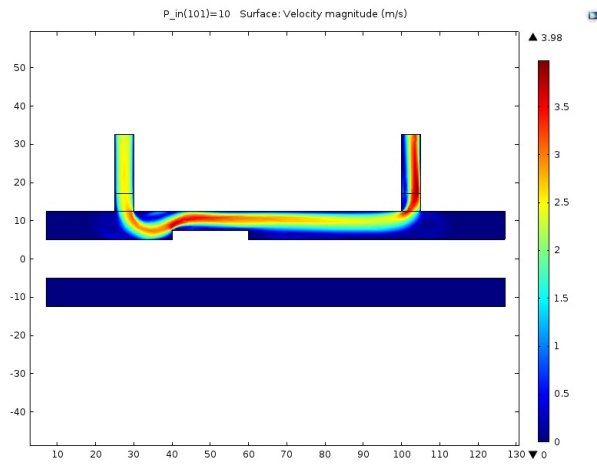


Figure 1: Boundary Layer Effect.

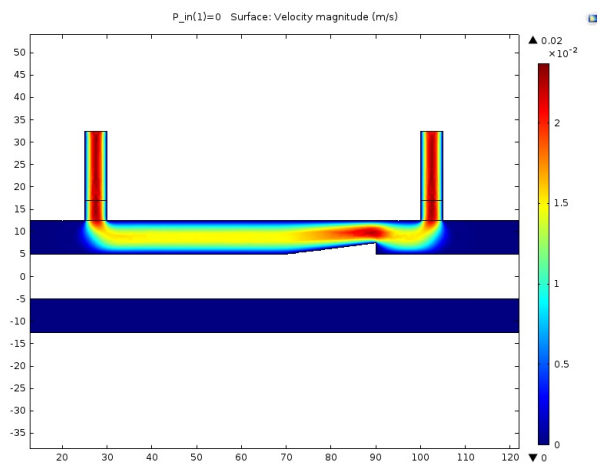


Figure 2: Flow Variation with Obtrusion.

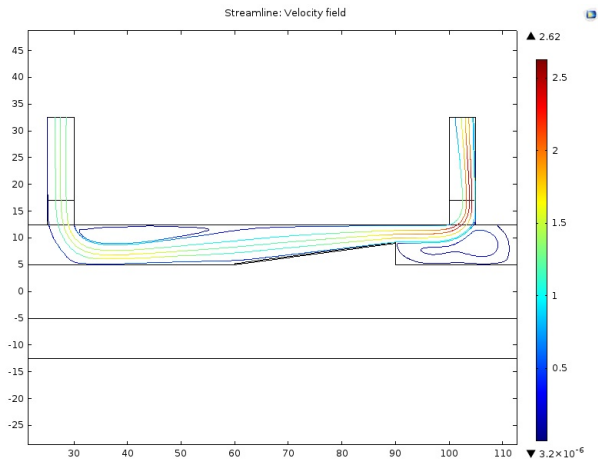


Figure 3: Pre-flow and Postflow Vortex.

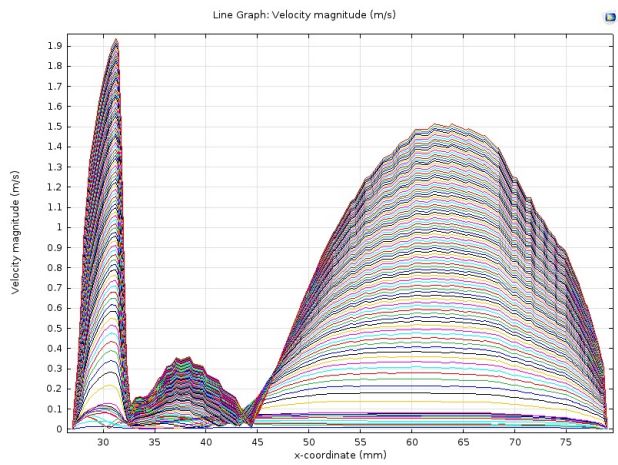


Figure 4: Velocity Profile for Various Inflow Velocities.