

Numerical Simulation of Non-Newtonian Fluid Flow across a Sinusoidal Microchannel

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Abstract

Flow of non-Newtonian fluids through sinusoidal microchannels is studied in the current work. The work aims to simulate different flow features such as velocity profile, pressure gradient, viscosity profile in flow of non-Newtonian fluid through a sinusoidal microchannel. The work is motivated by the growing interest in designing efficient microfluidic devices that can handle complex fluids, such as biological fluids, polymer solutions, and suspensions (Nguyen & Nguyen, 2012). Understanding the flow characteristics of such fluids in microchannels provides valuable insights into optimizing microchannel design for specific applications. The geometry under consideration is adopted based on Mondal et al. 2019 (Figure 1) and the fluid system used for the simulation study are presented in Table 1

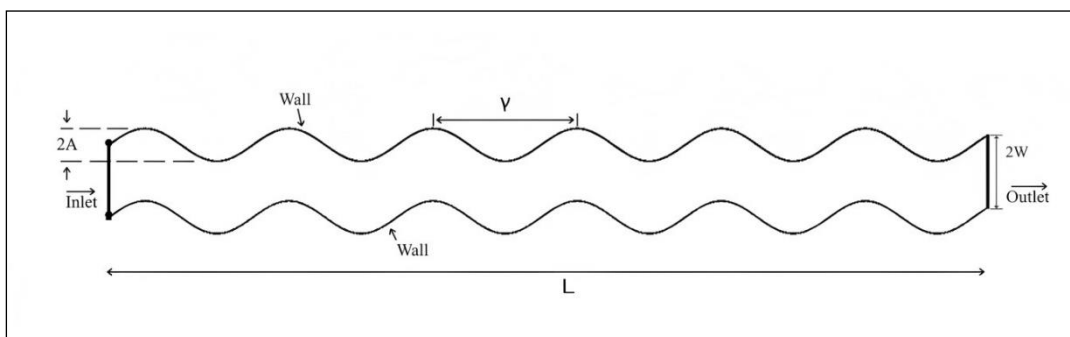


Figure 1: Schematic Sketch of the geometry

Table 1: Details of non-Newtonian Fluids

Fluid	Density (kg/m³)	K (Pa.sⁿ)	n (-)
Blood	1060	0.004	0.90
Cellulose	1006	0.025	0.82
Xanthan Gum	1143	0.55	0.39
Crude Oil	970	2.8811	0.9305
Printer Ink	1220	3.783	0.7925

References

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Nguyen Q-H and Nguye N-D (2012) Incompressible Non-Newtonian Fluid Flows. In *Continuum Mechanics - Progress in Fundamentals and Engineering Applications*, Eds. Gan Y. X., 47 - 71