

Comparison of Viscosity Models for the Simulation of Non-Newtonian Flow in Lid-Driven Cavity

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Synopsis

This research migration project investigates transient simulations of the two-dimensional lid-driven cavity for non-Newtonian fluids using the open-source computational fluid dynamics (CFD) software OpenFOAM. The `nonNewtonianIcoFoam` solver, for incompressible, laminar, generalized Newtonian flow, is employed to assess the efficacy of four viscosity models: Power-law, Carreau, Carreau–Yasuda, and Casson. The velocity fields are validated against benchmark data from the literature using normalised velocity profiles along the cavity centerline. Simulations at $Re = 100$ and $Re = 400$ show that increasing the Reynolds number sharpens near-wall gradients and shifts the velocity peaks toward the walls. The migration uses reference datasets from Li *et al.* (Power-law) [1], Kim and Reddy (Carreau; Carreau–Yasuda) [2], and Neofytou (Casson) [3].

Keywords: Non-Newtonian fluids; Power-law fluids; Carreau model; Carreau–Yasuda model; Casson model; Lid-driven cavity; OpenFOAM.

References

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