Generalized Newtonian Flows with Directional Do-Nothing Boundary Conditions

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Abstract

Generalized Newtonian models have attracted considerable attention over the past few decades, as they provide an accurate description of many complex fluids, including blood, food products such as ketchup, yogurt, and sauces, polymeric liquids, suspensions, and slurries; see, for example, [5] for a mathematical approach to such problems.

In the context of Computational Fluid Dynamics, artificial boundaries, particularly outflow boundaries, are introduced in the mathematical model to truncate the physical domain and make numerical simulations feasible.

Here, we consider a mixed boundary value problem for the equations governing incompressible generalized Newtonian fluids. On the Neumann part of the boundary, we prescribe a Directional Do-Nothing (DDN) boundary condition, as in [1, 4, 3].

In line with recent studies on the Navier-Stokes equations [2, 4, 3], we investigate the well-posedness of the generalized Newtonian problem with DDN boundary conditions and complement our analysis with numerical experiments comparing the classical do-nothing and DDN boundary conditions for a family of power-law fluids. This is joint work with Pedro Nogueira (CEMAT, Instituto Superior Técnico, Universidade de Lisboa).

References

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