Nonstationary Non-Newtonian Fluid Flow in a Thin Tube Structure

Borja Rukavina

Department of Mathematics, Faculty of Science, University of Zagreb, Croatia
RUBORJA@MATH.HR

Abstract

We consider the nonstationary non-Newtonian flow in a thin tube structure with a strain rate dependent viscosity. A thin tube structure is defined as a smoothened finite union of thin cylinders with diameters of order ε, where $\varepsilon > 0$ is a small parameter. In the described domain we observe a non-stationary Stokes system of equations where viscosity depends on the gradient of the solution, with a no-slip boundary condition, a homogeneous initial condition and a given velocity $\varepsilon \mathbf{g}$ on the inflow/outflow parts of the boundary.

We study the existence and uniqueness of a solution, its high order regularity, and derive a priori estimates. A new technical tool is introduced to prove the existence of a solution with high regularity for the non-Newtonian version of the Stokes equations, which may be useful for other non-linear problems. This is joint work with Grigory Panasenko, Igor Pažanin and Konstantinas Pileckas.