**Title of the thesis: Analysis, Control and Simulation of Non-Newtonian Fluids**

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**Summary:**

A non-newtonian fluid is a fluid with a viscosity depending on the constraints acting on the fluid. Typical examples of such fluids are the polymers, the ketchup, the paint, the blood [2]. More exactly, depending on the shear rate, the fluid behaves as a solid or as a liquid. From a mathematical point of view, this translates into the addition of another nonlinear term in the Navier-Stokes equation. This nonlinearity complexifies even more the mathematical analysis and several problems concerning these equations remain widely open.

A control system is a dynamical system on which we can act using a control aiming to drive the state of the system to a prescribed target state in a given time. The controllability of nonlinear systems, of finite or infinite dimension, is a very active research area. The first works related to the control theory published more than sixty years ago studied linear systems of differential equations, and more recently, a rich literature treats the topic of the controllability of linear and non-linear partial differential equations. The methods employed for the controllability of nonlinear partial differential equations (linearization, return method, etc.) are, in general, inspired by the ideas appearing in the finite dimensional case.

The objective of this thesis is to study the controllability of models describing the behavior of non-newtonian fluids. A bibliographic research will be necessary in the beginning in order to assimilate both the non-newtonian fluid models and the classical methods in nonlinear control theory [1]. The expected results of this thesis are at the same time theoretic (existence, uniqueness, qualitative properties of the solutions and controllability) and numeric (convergence of numerical schemes, numerical simulations for the direct problems and for the approximation of the controls).

**Requirements:** A good knowledge in the analysis of partial differential equations and in their numerical approximation will be appreciated.

**References:**
