CEMRACS '08

Modelling and Numerical Simulation of Complex Fluids
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Numerical simulation of vesicles and comparison with experimental data

Project proposed by

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Complex fluids exhibit several puzzling behaviors that critically depend on the underlying structures that compose the fluids. Indeed, many complex fluids are made of microscopic entities (such as rigid or soft particles, biological cells, macromolecules, etc...) which are suspended in a liquid, and whose individual and collective behaviors strongly impact on the overall rheological properties of the fluid at the global scale.

Typical examples of complex fluids are suspensions (rigid particles suspended in a Newtonian fluid), emulsions (droplets suspended in a Newtonian fluid), or blood (red blood cells suspended in the plasma). Complex fluids are the rule in the industrial and biological worlds, conferring thus to this topic an important interest in various domains ranging from the fundamental to the technological level.

A significant challenge in complex fluids lies in the understanding of the

- fluid/structure interaction at the individual level ;
- space-time organization of the entities (i.e. their collective behaviors, like jamming, formation of bands...) composing the complex fluid.

In this work, we plan to simulate Vesicles under conned and extended flows using several numerical methods and improving existent codes. Theses results would be very interesting for rheological studies. The final goal is to interpret the experimental data and to guide new experimental developments, such as to conceive of new microfluidics devices for cell sorting out, a task of much current interest in the lab-on-chip technologies.

This project is part of the ANR project MOSICOB : "Modélisation et simulation de fluides complexes biomimétiques" involving LSP (GRENOBLE), Laboratoire de Mathematiques (ORSAY) and Institut Elie Cartan (NANCY).