Unité Mécanique Lille UML J. Boussinesq

Université de Lille 1 Sciences et Technologies

Sujet de stage de Master 2

Laboratoire : Unité de Mécanique de Lille – J. Boussinesq ULR 7512

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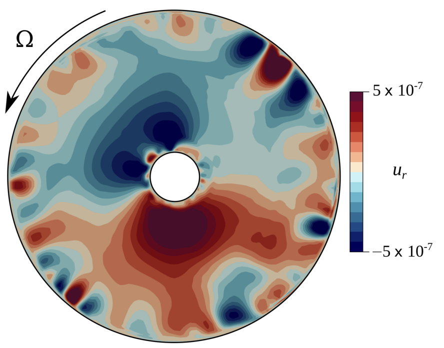
Collaborateurs : V. Bertola (Univ. Liverpool)

Stage rémunéré : ☑Oui ☐ non

Elastic turbulence in Taylor Couette flow

Présentation du sujet : One of the most remarkable effects of highly viscous polymer solutions that has been recently observed in experiments is the development of an *elastic turbulence* regime in the limit of strong elasticity. The flow of polymer solution in this regime displays irregularities typical of turbulent flows even at low velocity and high viscosity (i.e., for vanishing Reynolds number). As a consequence of turbulent motion at small scales, elastic turbulence can reveal as an efficient technique for mixing in very low Reynolds flows (e.g., in microchannels). Despite its great technological interest, elastic turbulence is still only partially understood from a fundamental point of view.

During this internship, we will build on the results obtained in a previous internship that demonstrated the numerical reproducibility of elastic turbulence in a 2D Taylor-Couette system (fig. 1), in order to extend the simulations to a 3D geometry that could be compared with the experimental setup of V. Bertola. The analysis will focus on the turbulent statistical properties that represent the most comparable indicators between numerical simulations and experimental measurements.



$Re = \frac{\Omega R_{out}^2}{\nu_s} = 10^{-4}$, $Wi = \Omega\lambda = 106.8$, $\Gamma = R_{in}/R_{out} = 0.15$

Figure 1: Velocity fluctuations generated by developed elastic turbulence in a 2D Taylor-Couette setup.

This project is conceived as a continuation of a Master 2 internship funded by Fédération Lilloise de Mécanique in 2020/2021. Within the framework of the international collaboration with experimental researchers and theoreticians, a CSC funding has been secured, allowing to inscribe this project within a solid long-term research environment.

Mots-clés : Fluid mechanics, Turbulence, Complex fluids, Numerical simulation.

Prérequis : Education in Fluid mechanics, Physics, Applied Mathematics. Good knowledge of fluid mechanics and an interest for numerical methods. Good knowledge of oral and written English is required. Knowing a programming language (Python, C, Fortran) would be a plus.