

Turbulent/non-turbulent interfaces in Newtonian and viscoelastic fluids

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This presentation describes some of the results obtained in the PRACE project access “INTERFACE - Turbulent/non-turbulent interfaces in Newtonian and viscoelastic fluids” (2016143345). The goal of this project was to study turbulent/non-turbulent interfaces (TNTI) and regions of strong inhomogeneity in the fluid motions of Newtonian and viscoelastic fluids. Such interfaces abound in nature and engineering applications, and govern key processes in science and engineering with consequences for combustion, pollutant emissions, and the environment. This is typically a system with a huge number of degrees of freedom, governed by the Navier-Stokes equations. In order to properly simulate this system by solving the governing equations without any approximation, a massive numerical simulation is usually required. These direct numerical simulations (DNS) are equivalent to an experiment, since one of these simulations in some sense contains it itself all the answers for the scientist.

One important and long-standing question regarding these interfaces concerns their thickness. Thanks to the new simulations carried out in Marenostrum IV we were able to attain the highest Reynolds numbers in existence and we have been therefore able to solve this important question [2]. Many more results concern the TNTIs from viscoelastic fluids which are presently being finished for publication. We were able to understand why viscoelastic fluids spread much slower than Newtonian fluids which has important engineering consequences [3]. None of the results briefly described above could possibly be obtained without access to Tier-0 resources.

The work surpassed our expectations regarding the number and magnitude of the data generated, which will be continue to be explored in the near future by our research team and other collaborators, by allowing the development of better predictive tools with positive impacts in the environment.

References

[1] INTERFACE - Turbulent/non-turbulent interfaces in Newtonian and viscoelastic fluids. PRACE (2016143345). Final Report. C. B. da Silva. 2018.

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[3] T. Silva, M. Zecchetto and C. B. da Silva, The scaling of the turbulent/non-turbulent interface at high Reynolds numbers. *J. Fluid Mechanics*, 843, 156-179, 2018.