Simulations of viscoelastic fluids flows using a modified log-conformation transformation

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Abstract

One of the most challenging problems in the non-Newtonian fluid mechanics is the so called High-Weissenberg-Number-Problem (HWNP). In the context of fighting this phenomena in numerical simulations of viscoelastic fluids flows, the log-conformation transformation (LCT), introduced by *Fattal & Kupferman* in [1, 2], became a commonly used and very valuable tool. Despite of its success, this approach also has some drawbacks. One of them being the singular behavior of the log-conformation transformation at low Weissenberg number regime. In order to overcome this problem a modified LCT was recently introduced by *Saramito* in [3]. This new version of the LCT uses an alternative definition of the conformation tensor, leading to a non-singular version of the LCT. Thanks to this modified LCT, the numerical simulation of viscoelastic fluids flows is more robust, starting from low-Weissenberg number (close to Newtonian) regime, while keeping its advantages in overcoming the HWNP.

The aim of the presentation is to show how this modified LCT approach is theoretically developed and numerically implemented. The numerical results obtained using a Open-FOAM implementation of the new modified LCT approach will be presented showing the robustness of this approach in a wide range of Weissenberg numbers.

References

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