FEM multigrid techniques for viscoelastic flow

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ABSTRACT

Similar to high Re number flows which require special discretization and solution techniques to treat the multiscale behaviour, viscoelastic fluids are very difficult to simulate for high Weissenberg (We) numbers ("elastic turbulence"). While many researchers believe that the key tools are appropriate stabilization techniques for the tensor-valued convection-reaction equation for the extra stress, we explain the concept of log conformation representation (LCR) which exploits the fact that the conformation tensor is positive definite and shows exponential behaviour. Together with appropriate FEM techniques and monolithic Newton-multigrid solvers for the resulting fully implicit approaches, significantly higher We numbers seem to be reachable than compared with the standard formulation, at least for Oldroyd-B and Giesekus models. We demonstrate this behaviour for several flow configurations with benchmarking character.

REFERENCES

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