A numerical study of the Oldroyd-B fluid in the natural stress formulation

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Due to the emerging field of microfluidics, simulations in contractions, expansions, cross-channels and T-channels have been explored by many re- searchers in the last years. The physical understanding of peculiar phenomena observed in these types of geometries, as viscoelastic instabilities or different types of flow transitions, is the main motivation for the developing of stable and accurate numerical strategies. However, two obstacles have plagued the numerical community in the solution of viscoelastic flows in the presence of geometric singularities: the high Weissenberg number problem (HWNP) and the accurate computation of the non-Newtonian stress tensor around sharp corners. The former has been bypassed using stabilization methods while the latter remains a challenging issue in non-Newtonian fluid mechanics. In this talk, we will present a numerical study of the natural stress formulation (NSF) which is an alternative decomposition of the conformation tensor. According to our numerical results, the NSF has demonstrated to be very accurate in comparison with the Cartesian formulation for solving problems with sharp corners.