

# Sur l'influence des polymères sur certains critères d'identification de vortex

et

## On the influence of polymers on some vortex identification criteria

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### Résumé :

Vortex dynamics is a matter of great interest to the scientific community. Supplies to the understanding of the creation and evolution of such structures may help to better comprehend several complex turbulent phenomena. Flow visualization contributes a lot to such comprehension, as well as post-processing computational fluid dynamics (CFD). However, there is not a widely accepted definition to a vortex available in the literature. Nonetheless, the interest on analysing vortex structures in viscoelastic fluid flows is growing due to some important phenomena associated to such flows, as, for instance, polymer induced drag reduction. The literature presents some ideas on how the presence of polymers diluted in a Newtonian fluid may affect the vortex dynamics. Nevertheless, such observations result from the application of some flow classification criteria to identify vortex regions. Most of such criteria were derived for Newtonian fluids and, therefore, some of them may need some special care or a particular interpretation when applied to viscoelastic fluid flows. We present here an evaluation of the influence of polymers on some flow classification criteria. In a first moment, the original equation of the  $\lambda_2$  criterion by Jeong and Hussain (JFM, 1995) is considered to turbulent channel flows of a Newtonian fluid. By means of statistics (plane averages and joint probability distribution), each term of such equation is explored to evaluate if it opposes or corroborates the identification of a vortex. Moreover, the  $Q$  criterion (Hunt *et al.*, CTR-S88, 1988) is related to the  $\lambda_2$  criterion. Finally, these criteria are applied to viscoelastic fluid flows. The presence of polymers changes the stresses in the flow and, consequently, the role of each term of the former equation to the criteria. The effect of rheological parameters on the characterization of the flow are explored and discussed.