VPF8 - Viscoplastic Fluids: from Theory to Application 2019
Oral presentation abstract

Title: Flow of a yield stress-fluid over cavity and viscoplastic boundary layers: following the quest

Authors:
Paul VIGNEAUX, UMPA, ENS de Lyon, France
Guillaume CHAMBON, IRSTEA Grenoble, France
Arthur MARLY, UMPA, ENS de Lyon, France
Li-Hua LUU, IRSTEA Aix, France
Pierre PHILIPPE, IRSTEA Aix, France

Contact author's email: paul.vigneaux -at- math.cnrs.fr

Abstract:

We consider channel flows of a viscoplastic fluid over a rectangular cavity filled by the same material and present a detailed cross-comparison of experimental and numerical results based on the Herschel-Bulkley model, extending the results of [1]. In the configurations studied, the characteristic viscoplastic number *Hb* is moderate and we study (analytically, numerically and experimentally) how the structure of the yielded viscoplastic boundary layer (captured between the dead zone in the cavity and the plug zone at the centre of the channel) is modified compared to the asymptotic situation $Hb \to \infty$ studied for instance in [2]. Interestingly, in these moderate *Hb* configurations, one finds that the Oldroyd' scaling of the boundary layer thickness (see [2, 3]) remains valid, provided an adaptation of the definition of *Hb.*

References:

[1] Flow of a yield-stress fluid over a cavity: experimental and numerical investigation of a viscoplastic boundary layer. Journal of Non-Newtonian Fluid Mechanics (2018) Vol. 261, pp 38-49. P. Vigneaux, G. Chambon, A. Marly, L.-H. Luu and P. Philippe.

[2] Viscoplastic boundary layers, Journal of Fluid Mechanics 813 (2017) 929–954. N. J. Balmforth, R. V. Craster, D. R. Hewitt, S. Hormozi, A. Maleki.

[3] Two-dimensional plastic flow of a Bingham solid. A plastic boundary-layer theory for slow motion, Proc. Cambridge Phil. Soc. 43 (1947) 383–395. J. G. Oldroyd.

Acknowledgements:

This work has been partially supported by **CNRS** through the interdisciplinary program **InFIniti** in 2017 and 2018.