OIST SEMINAR

Date: February 10, 2017 (Fri)
Time: 3:00 pm – 4:00 pm
Venue: D015 (Lab1, Level D)
Speaker: Professor Guillermo ARTANA
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Some aspects of flows in soap films

Abstract

Soap film flows involve complex phenomena in which surface tension forces play an important role. A 2D (or quasi 2D) analog of the observed flow dynamics can however be found in configurations where no interfacial forces exist. In this talk we address three problems that are of interest when analyzing this kind of flows. The first one concerns establishing to which extent the results obtained with soap film flows can give useful information of a more general 2D fluid flow (or quasi 2D flow). This kind of problem has been previously considered by J.M. Chomaz1. This author found that the experimental conditions under which both dynamics can be linked are quite restrictive: we revisit these results establishing less restrictive conditions2. The second one is related to developments of experimental techniques that can be used with these flows for velocimetry purposes. Soap film flows are known to produce remarkable flow visualizations but quantitative analysis extracted from the images has not been fully explored. We present and discuss results using two different techniques of visualization (interferometry and Schlieren) whose images are post processed with classical correlation techniques (Particle Image Velocimetry) or with a dense motion estimator. Finally, we consider the eulerian time spectrum of 2D turbulent soap film flows focusing our study on the characteristics of the associated spatial structures. The development of energy cascade concepts requires a schematic "eddy" with a single wave number associated, however distinctions between real eddies and waves exist3. We perform an analysis with the *Chronos-Koopman* spectral technique4 that enables to circumvent some of the limitations of the classical Fourier analysis. The use of this approach produces power spectra with slopes compatible with the enstrophy and energy cascades, giving access to the associated spatial modes that show definite wavenumber structures. We analyze possible coupling of these structures and conclude about the validity of Taylor hypothesis and on intermittency of the flow.

1. J. M. CHOMAZ, The dynamics of a viscous soap film with soluble surfactant, *J. Fluid Mech*. 442, 387409 (2001)

2. M.I. AULIEL, F. CASTRO HEBRERO, R. SOSA, G. ARTANA, Gravity driven soap film dynamics in subcritical regimes, *Physical Review E*, 92 (4),0043009, (2015).

3. H. TENNEKES AND J.L. LUMLEY, A first course in Turbulence, *MIT Press*, 1972

4. A. CAMMILLERI, F. GUENIAT, J. CARLIER, L. PASTUR, E. MEMIN, F. LUSSEYRAN, G. ARTANA, POD-spectral decomposition for fluid flow analysis and model reduction, *Theoret and Comp Fluid Dynamics*, 27(6), 787-815, (2013).

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