RESEARCH MASTER INTERNSHIP

Département Aérodynamique, Energétique et Propulsion

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INTERNSHIP DESCRIPTION

Domain : Hydrodynamics, Mixing

Title **NON-MODAL STABILITY ANALYSIS OF THE MIXING-LAYER**

Mixing promotion downstream jet-type injectors is a key point of the energetic and environmental performance of combustion chambers. In this frame we deal with fundamental issues related to the mixing of density-contrasted fuel/oxydizer couples. Many experiments (including those performed in our lab) demonstrated thet the light jet exhibit a secondary instability yielding spectacular side ejections. This flow structure enhances mixing but its internal mechanism is still a matter of conjecture. We want to shed some light on this conjecture and propose a control strategy based on this instability.

During J. Fontane's thesis we have already performed a modal analysis of inhomogeneous mixing layers. The results have been published in a first rank journal (Fontane & Joly 2008) and were selected by the American Physical Society to be included in the 2008 edition of Gallery of Fluid Motion (Fontane, Joly & Reinaud 2008).

The purpose of this project is to develop a non-modal approach of the instability of the mixing layer but starting with the simpler situation when the density is uniform. The unsteadiness of the base flow invites to adopt a direct-adjoint method which does not have the drawbacks of the modal approach. This master internship has a theroretical core and demands the writing of the linearized direct and adjoint equations. This preliminary stage is not difficult but will suit someone with a good apetite for mathematical aspects of fluid mechanics. The applicant will benefit from an additionnal supervision by J. Fontane and will access high performance computers.

This project is a preliminary for a PhD aiming at a generalisation to the more complex inhomogeneous case.

Fontane, J. & Joly, L. 2008 The stability of the variable-density Kelvin-Helmholtz billow. J. Fluid Mech. 612, pp. 237-260.

Fontane, J., Joly, L. & Reinaud, J. 2008 Fractal Kelvin-Helmholtz break-ups. Phys. Fluids, Gallery of Fluid Motion, 20, 091109.

90 % Theoretical Research	10 % Applied Research	0 % Experimental Research

Possibility to go on a Ph.D.: o Yes o

APPLICANT PROFILE

Knowledge and required level:

Fluid Mechanics, Hydrodynamic Stability (notions as in lectures of the M2R)
Langages/Systèmes : Matlab

Applications should be sent by e-mail to the supervisor.