

Research Topic for the Arts et Métiers ParisTech - CSC PhD Program

Subfield: Mechanical Engineering / Fluid Mechanics

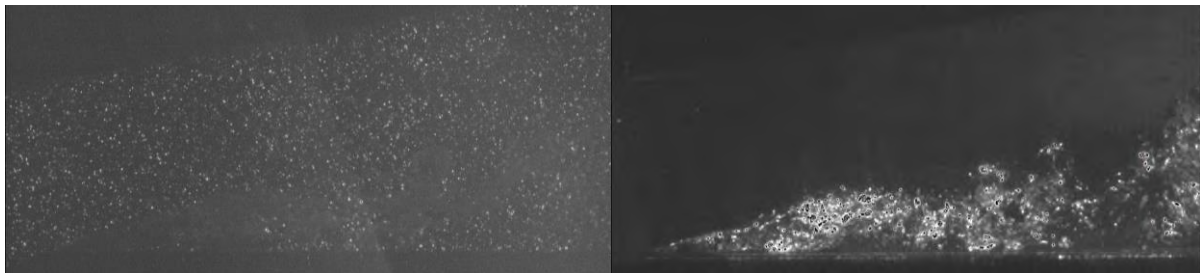
ParisTech School: Arts et Metiers

Title: Analysis of the dynamics of cavitating flows by high speed stereo PIV

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Short description of possible research topics for a PhD:

Velocity measurements with PIV (Particle Image Velocimetry) systems within cavitating flows encounter strong difficulties, which are mainly due to the opacity of the cavitation areas and the spurious reflections of the incident light on the vapor bubbles. Most of the previous works have been focused on specific low void fraction areas like the wake of sheet cavities. However, following the pioneering work of Dular (2004), PIV coupled with a LIF (Laser Induced Fluorescence) technique has been successfully performed at Arts et Metiers in the last years, and both the liquid and the vapour velocity fields have been obtained. The objective of the present work is to extend these investigations to high speed stereo measurements, in order to obtain simultaneously and at high frequency the 3 components of the velocity in the gaseous and liquid phases. Various configurations of sheet and cloud cavitation will be investigated, in order to analyse the mechanisms that drive the instabilities, and especially clarify the role played by the re-entrant jet and the shock wave instability recently emphasized by S. Ceccio and co-workers.



LIF PIV measurements (a) image of particles, (b) image of bubbles

Required background of the student: fluid mechanics

A list of 5 (max.) representative publications of the group: (Related to the research topic)

- 1) Coutier-Delgosha O., Stutz B., Vabre A., Legoupil S. (2007), Analysis of the cavitating flow structure by experimental and numerical investigations, *J. of Fluid Mech.* 578, 171-222.
- 2) Dular M., Khelifa I., Fuzier S., Coutier-Delgosha O., Adama Maiga M. (2012), Scale effects on unsteady cloud cavitation, *Experiments in Fluids* 53/5, 1233-1250.
- 3) Fuzier S., Coudert S., Coutier-Delgosha O. (2013), Two phase velocity measurements using LIF-PIV inside the cavitation sheet generated in a venturi, Proceedings of the Int. Conf. on Multiphase Flow, Jeju, Korea, May 26-31, 2013.
- 4) Coutier-Delgosha O., Khelifa I., Fuzier S., Fezzaa K. (2015), Analysis of cavitating flows by X-ray imaging and optical techniques, Proceedings of the 9th Int. Conf. of Cavitation, (CAV 2015), Lausanne, Switzerland, December 06-09, 2015.
- 5) Ganesh H., Makiharju S., Steven C. (2016), Bubbly shock propagation as a mechanism for sheet-to-cloud transition of partial cavities, *J. of Fluid Mech.* 802, 37-78.

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