SECOND YEAR INTERNSHIP (2 months):
MODELING AND SIMULATION OF SUPERCAVITATING FLOWS

Context:
This study is a part of a collaboration between laboratories LEGI (Laboratoire desEcoulements Géophysiques et Industriels), ILM (Institut Lumière Matière) and Pprime. Themain objective is the investigation of supercaviting flows by using micro geometries suchas micro-metric size objects placed in a channel [1]. Vehicles operating at high speeds in water are typically accompanied by high levelsof skin friction drag and cavitation. Cavitation, however, instead of being an unwantedaccompaniment to high speed underwater travel, can actually be employed to reduce skinfriction drag and provide order-of-magnitude increases in speed compared to thoseachieved with conventional, fully-wetted undersea vehicles [2].

Fig. 1 High-speed vehicle in supercavitation regime [2].

This work consists in performing numerical simulations of supercavitatingconfigurations and by comparing results with the experimental data obtained at LEGI andILM. Different geometries will be investigated such as, round, rectangle, beveled 2Dobjects or hydrofoils. Simulations will be performed with the 1-fluid RANS compressible code CaviFlow validated in various cavitation cases [3-4] or with ANSYS Fluent comercial code. The mass transfer is modelled through a sourceterm appearing explicitely in a void ratio transport equation. A special focus will be done onthe performance and heat transfers.

Work schedule:
Preparaton of simulations: geometries, meshes and initial conditions.- Run simulations at different operating points and check the influence of parameters.- Perform analysis of results and comparaison with the experimental data.- Estimation of heat transfers.

Expected skills: Fluid Mechanics (hydro/aero), CFD, Compressible Numerical Methods

Contract details: - 2 months internship - As the study is funded by a DGA grant, only European citizens may apply to that offer.

Organization:
The internship will be located in Poitiers or in Grenoble under the supervision of EricGoncalves and Damien Colombet in collaboration with Gilles Ledoux and Frédéric Ayela.

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References:
[1] Qiu, X., Cherief, W., Colombet, D., & Ayela, F. (2017). A simple process to achievemicrochannels geometries able to produce hydrodynamic cavitation. Journal ofMicromechanics and Microengineering, 27(4).

[2] Kunz, Lindau, Billet, Stinebring (2001). Multiphase CFD modeling of developed andsupercavitating flows.Lectures series VKI, Bruxelles.

[3] Goncalves and Charriere (2014). Modelling for isothermal cavitation with a four-equation model. Int. Journal of Multiphase Flow, vol. 59.

[4] Goncalves and Zeidan, (2017). Numerical study of turbulent cavitating flows in thermalregime. Int. Journal of Numerical Methods for Heat & Fluid Flow, vol. 27.