PhD Opening

"Model Order Reduction for Interfacial Flows"

Fluid flows involving interfaces between different materials, or between different phases of a same material, are of paramount importance in many fields of science and engineering. Numerical simulation is often the only way for industrial companies to understand, predict and control these flows.

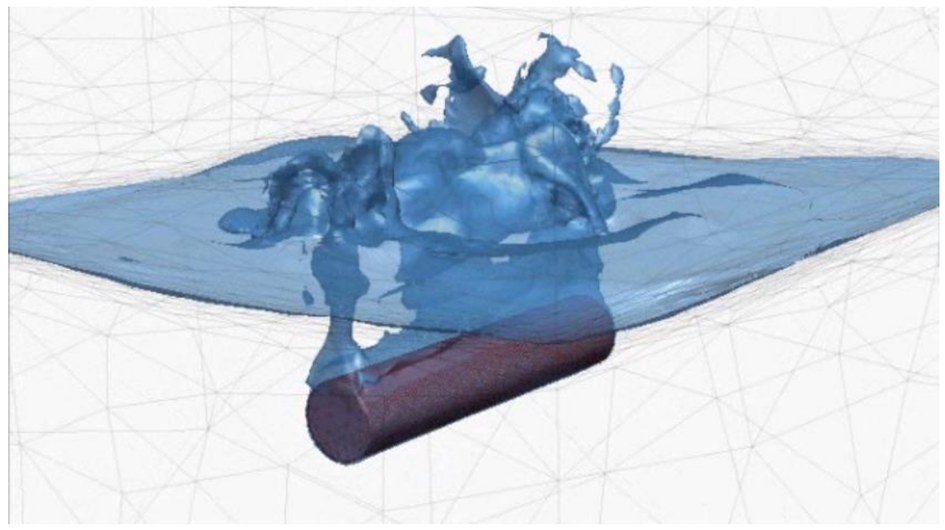

Image credit: M. Khalloufi, CEMEF

Numerous numerical methods based on Finite Elements and Finite Volumes have been devised for the simulation of interfacial flows in the last decades. Many of them rely on local mesh refinement in the vicinity of the interface to compensate their inherent lack of accuracy. Because the interface evolves in time, the mesh has to be periodically adapted to follow it. This results in simulations that are computationally extremely intensive.

On the other hand, an alternative known as Model Order Reduction (MOR) is gaining interest. It aims to approximate a large-scale system with a reduced model that is much less computationally demanding. Applied to flow problems in industrial processes and products, such a fast prediction capability opens new possibilities for engineers. Up to now, however, little research has focused on developing MOR procedures that suit the type of mesh-adaptive simulation required for flows involving interfaces.

The goal of the PhD work, in the framework of the ANR project ROMINA, is to develop MOR techniques for mesh-adaptive, complex-physics simulation of interfacial flows. It will build on methods originating in two research labs of MINES ParisTech. The large-scale multi-phase problems will be solved through the Finite-Element CFD solvers of CEMEF. The MOR procedures will be based on the hyper-reduction techniques invented at the Centre des Matériaux. The new methods will be tested on academic test cases and assessed on cases that reflect industrial applications. The results are expected to be published in scientific journals and presented in international conferences.

Partners

- MINES ParisTech – CEMEF
- MINES ParisTech – MAT
- Agence Nationale de la Recherche (ANR)

Contacts

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Links

CEMEF

Centre des Matériaux

Candidate Profile & Offer

The successful candidate will hold a M.Sc. degree in Applied Mathematics, Mechanics or a related discipline, **with excellent academic record**. A solid background in numerical methods (in particular Finite Element methods), C++ programming skills and motivation to learn are required. The PhD will take place in CEMEF, an internationally-recognised research laboratory of MINES ParisTech located in Sophia-Antipolis, on the French Riviera. It offers a dynamic research environment, exhaustive training opportunities and a strong link with the industry. The PhD student will receive a 3-year fellowship, starting preferably in October 2017.