

Figure 1 – SedFOAM two-phase flow simulation of scour around a vertical cylinder (a), and downstream of an apron (b, [Z. Cheng Phd Thesis]).

Laboratory : LEGI, CNRS-UMR5519, Grenoble-INP, UGA Location : Grenoble (Saint-Martin d'Hères campus) Profil : Master 2 internship or Projet de Fin d'Etude (PFE) Duration : 5 months

The scour phenomenon around river or coastal structures is a very major issue for civil engineering that can have disastrous human and financial consequences. The state of the art for scour modeling is based on empirical approaches that has limited predictive capabilities. In general, engineers deal with the scour issue using expensive physical models. The classical morphodynamic numerical models are based on empirical formulas that rely on steady and uniform flow assumptions. These models are shown to be insufficient to accurately predict scour in real configurations.

Over the past two decades, a significant research effort have been dedicated to modeling sediment transport using the multiphase approach. Recently, an open-source multi-dimensional turbulence-averaged two-phase sediment transport model, sedFOAM¹, is being jointly developed by researchers from LEGI in Grenoble and from the Center For Applied Coastal Research at the University of Delaware (USA). SedFOAM is developed under the open-source CFD toolbox OpenFOAM². This model has been validated on different configurations and the goal of this internship is to further apply the model to the scour phenomenon.

During this internship, the successful applicant will work on the scour around a circular seabed pipeline³. In particular, he or she will investigate the role of the flow in the porous medium beneath the pipeline in initiation of scour as well as the erosion induced by the vortex-shedding in the lee of the cylinder.

Desired skills

- Experience with Linux/Unix system.
- Experience in programming with Python/Matlab.
- Academic background in fluid mechanic, hydraulic and/or sediment transport.
- Good level in english.

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¹Cheng, Z. and Hsu, T.-J.: A Multi-dimensional Two-Phase Eulerian Model for Sediment Transport-TwoPhaseEulerSedFoam, Research report CACR-14-08, Center for Applied Coastal Research - University of Delaware, 2014.

²http://openfoam.org/

³Lee, C. H., Low, Y. M., and Chiew, Y. M. Multi-dimensional rheology-based two-phase model for sediment transport and applications to sheet flow and pipeline scour. Physics of Fluids, 2016 ; 28(5) 053305.