Chair of Hydraulic and Water Resources Engineering
TUM School of Engineering and Design
Technical University of Munich

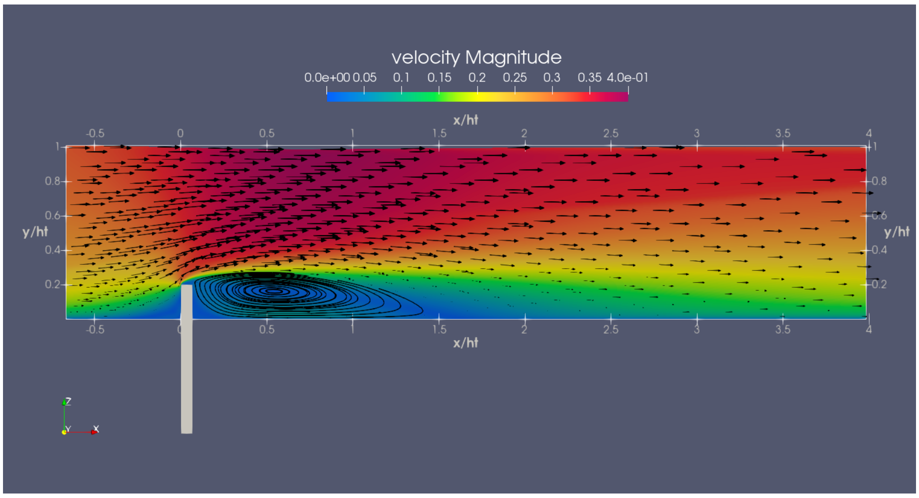
Master's Thesis

November 7, 2025

Topic: Numerical Modeling of Scour Downstream of Submerged Weir using sedFoam

Background:

The evolution of scour downstream of submerged weirs is primarily driven by longitudinal vortices resulting from flow separation. In recent times, Computational Fluid Dynamics (CFD) modeling has proven to be a time and cost-effective alternative to physical modeling for understanding and predicting scour around hydraulic structures. Most common CFD sediment transport models are based on bed shear stress and Exner's equation. However, these approaches often underestimate scour development, particularly under clear-water conditions. This study aims instead to explore **sedFoam**, a two-phase Eulerian–Eulerian model. Unlike traditional approaches, sedFoam resolves both water and sediment as interacting fluid phases, thus making it a two-phase flow model. The research aims to investigate the advantages and disadvantages of sedFoam for simulating flow and scour around submerged weirs. Specifically, the work will evaluate how well the solver captures fluid–sediment interactions and scour formation, while also assessing its computational cost and modeling complexity.



Flow around submerged weir

Pre-requisites:

- Prior knowledge of Fluid Mechanics and CFD
- Experience with OpenFOAM is highly preferred
- Comfort with scientific computing and data analysis tools (Python, MATLAB, or similar)

Contact:

If you are interested in the Master's Thesis topic, please write a **short email to rabs.ranjit@tum.de with your current grade report.**

References:

1. Chauchat, Julien, et al. "SedFoam-2.0: a 3-D two-phase flow numerical model for sediment transport." Geoscientific Model Development 10.12 (2017): 4367-4392.

2. Zhang, Wen, et al. "Characteristics of the flow field within a developing scour hole at a submerged weir." Journal of Hydraulic Research 60.2 (2022): 283-294.