Chair for Computation in Engineering
Department of Geo, Civil and Environmental Engineering
Technical University of Munich

Modeling: ★★☆☆☆
Mathematics: ★★☆☆☆
Programming: ★★★☆☆
Science: ★★☆☆☆

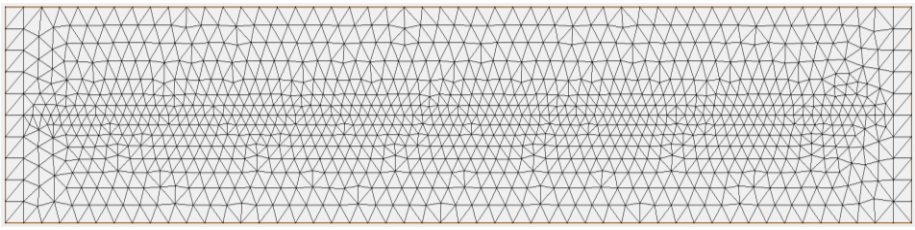
Software Lab:

Flexible pre-processors for fluid simulations

General Overviews

Flexible pre-processors are required to generate meshes for fluid simulations within finite volume's framework, especially for complex domains. Having such pre-processors is an advantage for users to simulate fluids in many real-life applications. In this project, water simulations are chosen using an in-house code NUFSAW2D, which employ an edge-based cell-centred finite volume method to solve the 2D shallow water equations. Like common finite volume codes, NUFSAW2D requires meshes as a spatial discretisation of a domain. Currently, it has a function automatically enabling simple rectangular meshes generation and another function that can understand a (simple) format from another mesh generator, e.g. in .2dm format. To be a more comprehensive tool, an interface that can understand other meshing formats and can support the edge-based data structure in NUFSAW2D is thus of main interest in this project.

unstructured mesh – e.g. created in .2dm format



provide an interface to understand the format and to support the edge-based data structure in NUFSAW2D with an efficiently parallelised algorithm.

→ **RUN NUFSAW2D**

Tasks

- You should provide an interface (as a source code) to support an input for NUFSAW2D, either as an input file (.txt file) or directly written inside the source code.
- The interface should support parallel programming (at least written with OpenMP).
- You **DO NOT** need to understand deeply the numerical method used in NUFSAW2D; however, the edge-based data structure for the common partial differential equations (PDEs) with finite volume method is a **MUST**.
- No restriction in programming language; however, Fortran 90 is preferable.

Supervisor

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References

[1] B. M. Ginting, A Two-dimensional Artificial Viscosity Technique for Modelling Discontinuity in Shallow Water Flows, Applied Mathematical Modelling, Vol. 45C, 2017, pp. 653-683.

[2] B. M. Ginting, R.-P. Mundani, Artificial Viscosity Technique: A Riemann-solver-free method for 2D Urban Flood Modelling on Complex Topography, in Advances in Hydroinformatics - SimHydro 2017 - Choosing The Right Model in Applied Hydraulics, Springer Water, 2018.