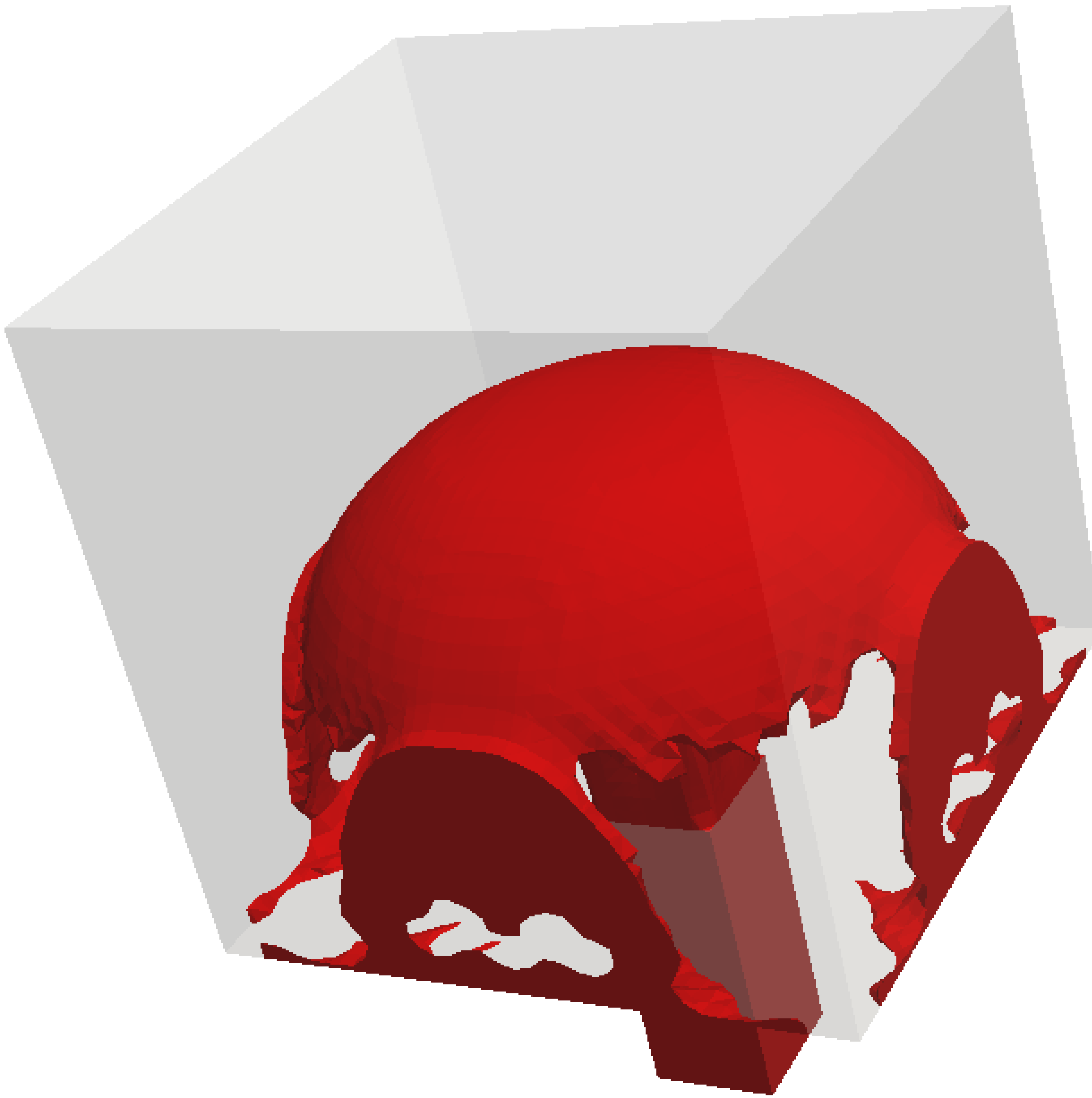
Multiphase (VOF) simulation project

József Nagy

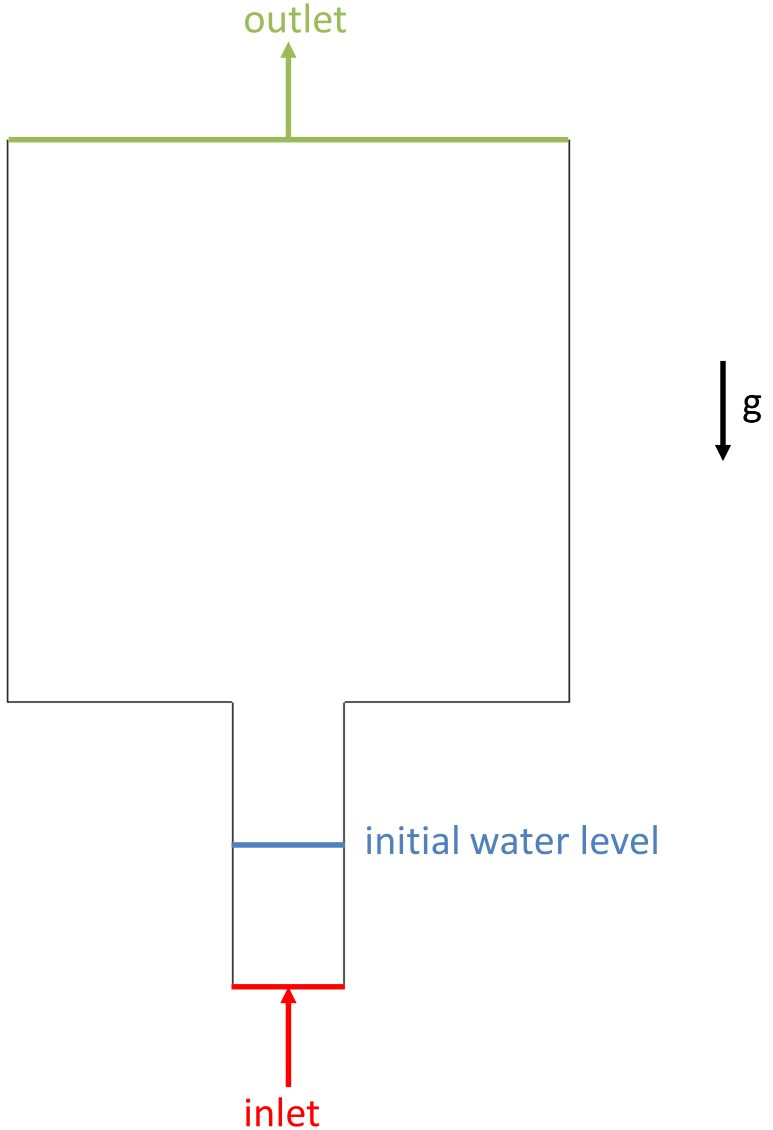
Workshop
Vienna, Austria



Goals

- Utilize knowledge from multiphase and meshing tutorial
  - snappyHexMesh
  - multiple phases (gas-liquid)
  - Volume of Fluid
- Case setup
- Initial values (BC)
- Simulate flow of the dam break case (2D)
  - coarse
  - refined
  - Dynamic mesh
- Postprocessing

Geometry



Solver

interFoam:

’ Solver for 2 incompressible, isothermal immiscible fluids using a VOF (volume of fluid) phase-fraction based interface capturing approach’

- incompressible

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- multi phase

Solver

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’ Solver for 2 incompressible, isothermal immiscible fluids using a VOF (volume of fluid) phase-fraction based interface capturing approach’

- incompressible
- transient
- laminar and turbulent
- multi phase
- immiscible

Solver

interFoam:

’ Solver for 2 incompressible, isothermal immiscible fluids using a VOF (volume of fluid) phase-fraction based interface capturing approach’

- incompressible
- transient
- laminar and turbulent
- multi phase
- immiscible
- VOF

Solver

interFoam:

’ Solver for 2 incompressible, isothermal immiscible fluids using a VOF (volume of fluid) phase-fraction based interface capturing approach’

- incompressible
- transient
- laminar and turbulent
- multi phase
- immiscible
- VOF
- isothermal

Solver

interDyMFoam:

’ Solver for 2 incompressible, isothermal immiscible fluids using a VOF (volume of fluid) phase-fraction based interface capturing approach, with optional mesh motion and mesh topology changes including adaptive re-meshing.’

- incompressible
- transient
- laminar and turbulent
- multi phase (VOF)
- immiscible, isothermal
- dynamic mesh refinement

Theory

- incompressible
- transient
- laminar and turbulent
- multi phase
- immiscible
- VOF
- isothermal

Continuity equation:

$$\boxed{\nabla \cdot \boldsymbol{u} = 0}$$

Momentum equations:

$$\frac{\partial \rho \boldsymbol{u}}{\partial t} + \nabla \cdot (\rho \boldsymbol{u}\boldsymbol{u}) = -\nabla p + \nabla \boxed{\cdot\, \rho \nu}[2S] + F$$

Volume of Fluid:

$$\rho = \alpha \rho_l + (1 - \alpha)\rho_g$$

$$\frac{\partial \alpha}{\partial t} + \nabla \cdot (\alpha \boldsymbol{u}) + \nabla \cdot (\alpha (1 - \alpha) \boldsymbol{u}_r) = 0$$

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- **PISO-loop**

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Courant number (CFL)

$$Co = \frac{U \cdot dx}{dt}$$

- *Co* should be less than or equal to 0
- *U* – velocity is given by the simulation
- *dx* – characteristic cell length is given by the mesh
- *dt* – time step
- To guarantee the condition $Co \leq 1$ the time *dt* step is the only quantity, which can be changed – adjustable time step