

Radioss CFD for ship hydrodynamics

Contents

- Introduction
- Research project
- Real-time ship simulations
- Radioss CFD simulations



Introduction



About

- ▶ Engineering agency, offering both consultancy and software for structural analysis (>25 employees)
- ▶ More than 12 years experience in CAE
- ▶ Active in BeNeLux, Germany and Ukraine
- ▶ Development of client specific software & customization of Femap & Hyperworks
- ▶ Partner of Siemens & Altair

Software sales

- ▶ Analysis software
- ▶ Training
- ▶ Support



Consultancy

- ▶ FE-analysis
- ▶ Product optimization
- ▶ Certification
- ▶ Outsourcing

FEMAP
VELOCITY SERIES

MSC SOFTWARE
SIMULATING REALITY

ANSYS
INCORPORATED

Altair
HyperWorks

Activities

Linear & Nonlinear Structural Analysis

- Strength & Stiffness assessments
- Nonlinear, buckling, modal, dynamic response analyses
- Fatigue & Failure analysis

Femap Customization

- Customized user interface
- Development of parametric modeling and analysis sequences

Design and Optimisation

- Optimisation with respect to use of material, loading conditions and structural stability

Conceptual designs

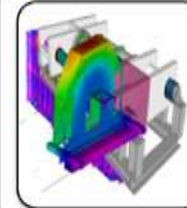
- Concept development for load carrying products and constructions
- Mechanical systems development

Consultancy and second opinion

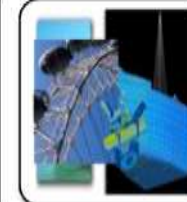
- Advice on equipment handling
- Evaluation of calculation procedures
- Analysis procedures according to engineering standards

Computational Fluid Dynamics

- Fluid Simulations
- FSI, Fluid Structure Interaction



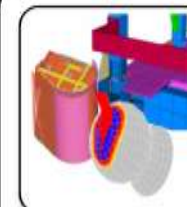
Machine building
Process industry



Civil Engineering
Offshore Maritime



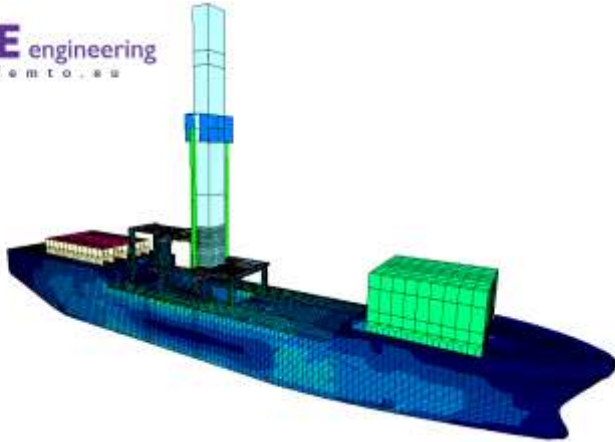
Packaging
Consumer products



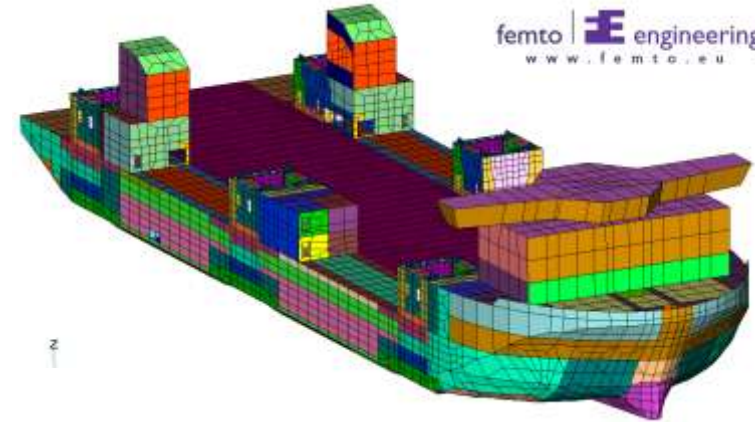
High-tech
Aerospace

Ship models

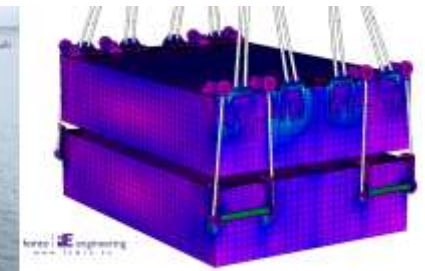
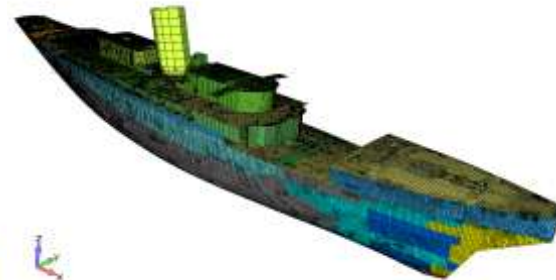
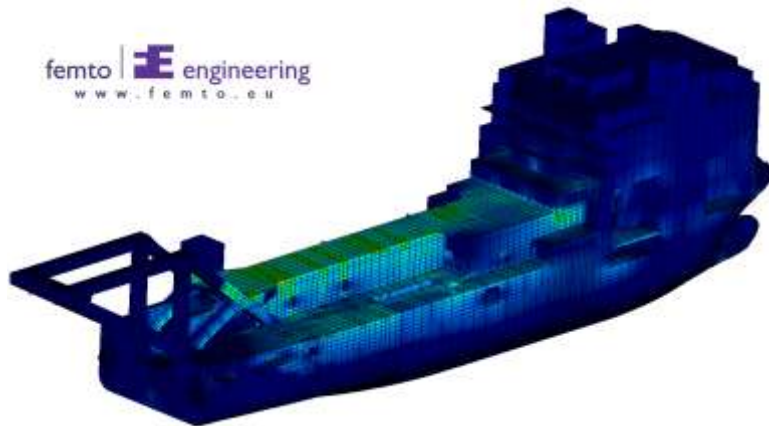
femto |  engineering
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Customers



- Leading in offshore
- More difficult simulation questions
- Cooperation with industry

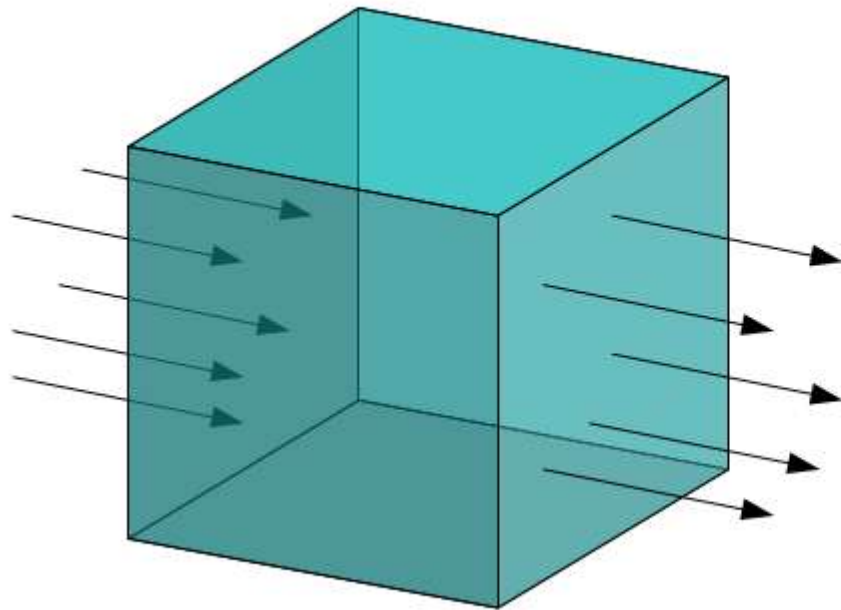
Real time ship simulations



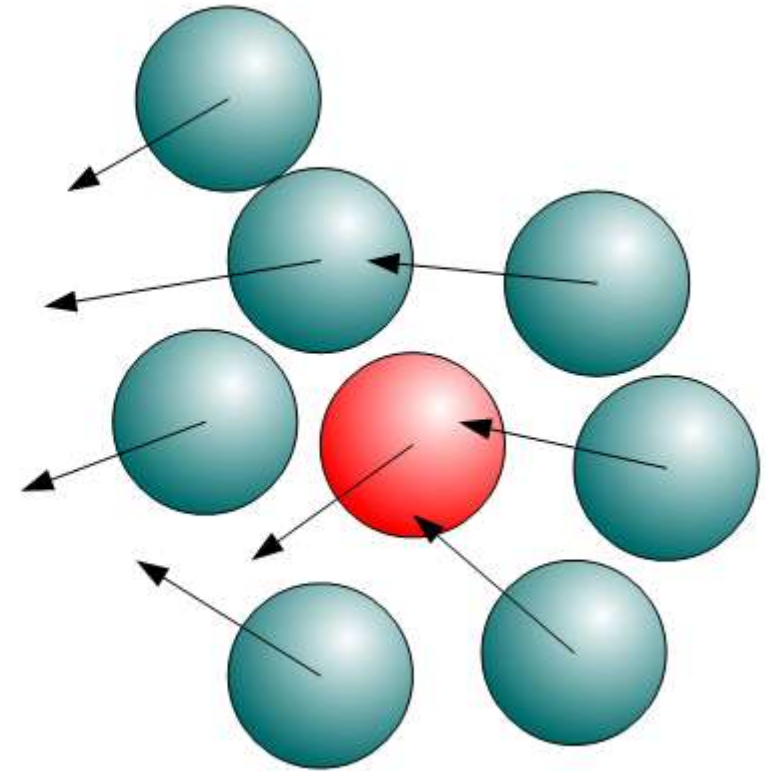
- Real time stress simulations (FEA)
- Real time Ship-Water interaction (ALE/SPH)
- Whom: TU Delft
- Why: risk reduction/teaching



Radioss CFD simulations



ALE



SPH

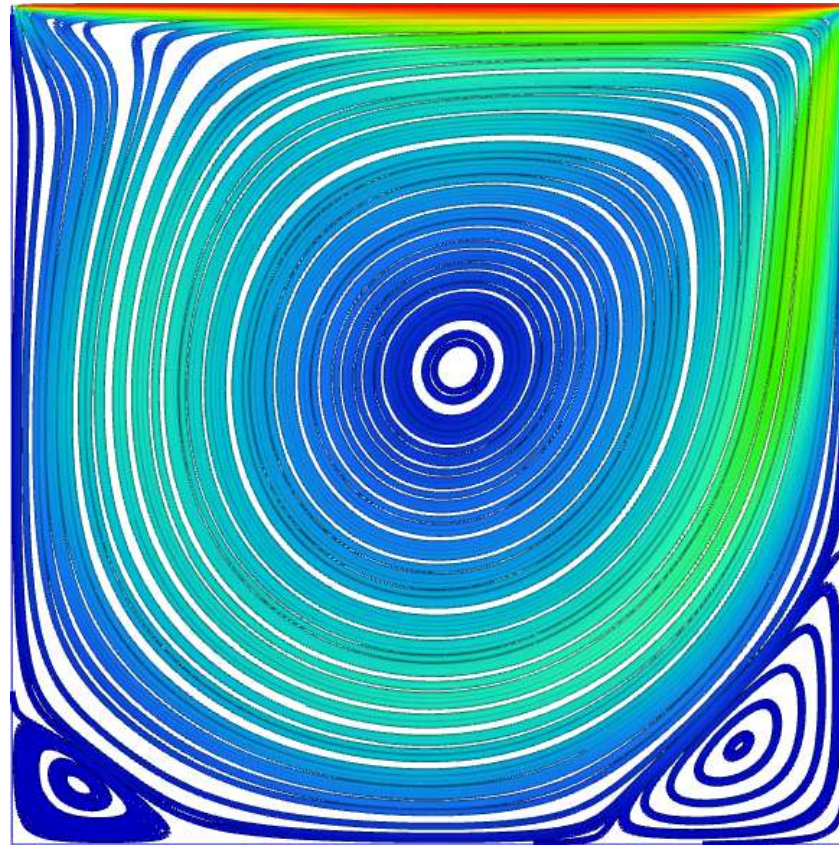
Simulation examples

2D

- Lid-driven cavity flow – ALE
- Von Kármán vortex street – ALE

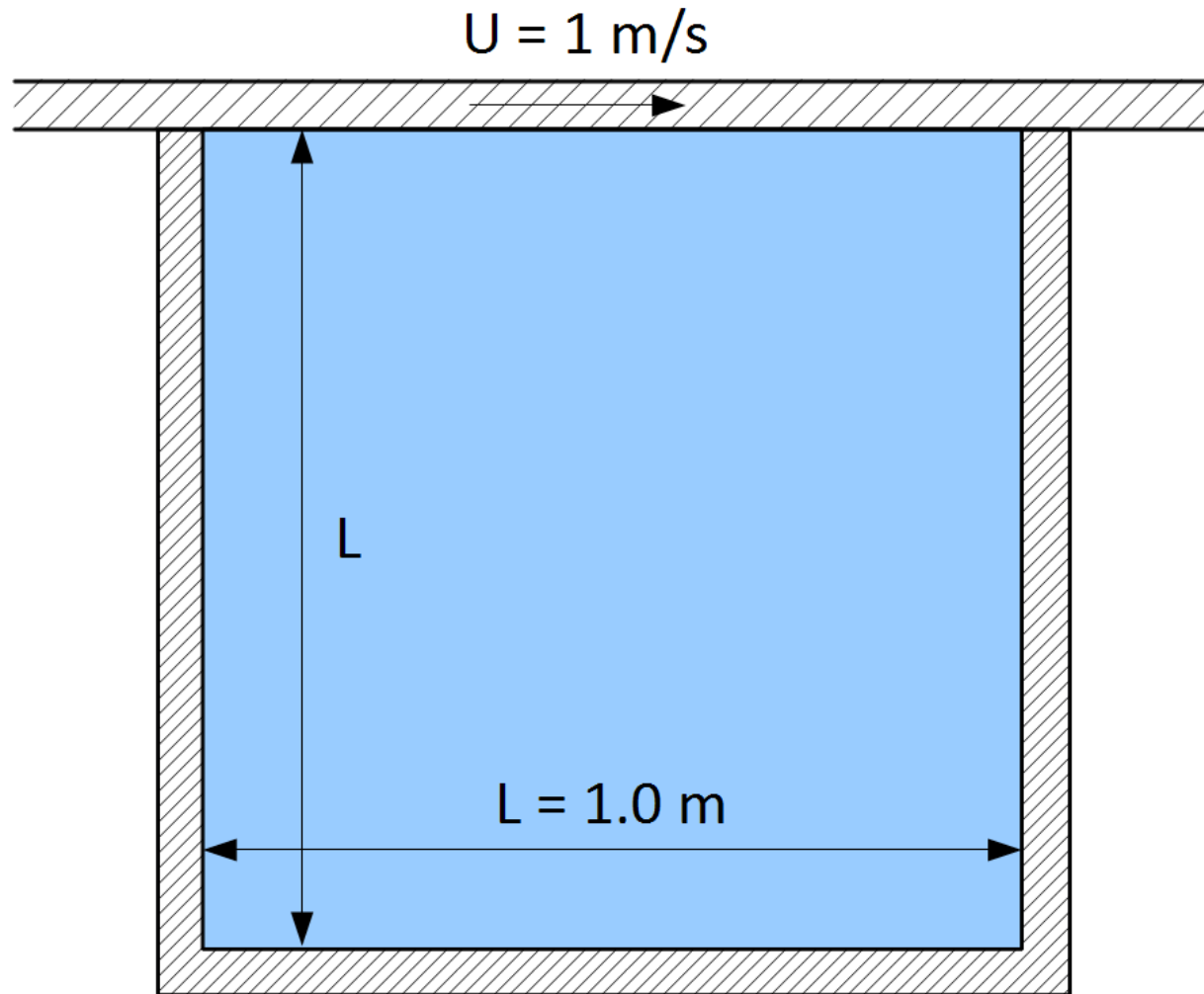
3D

- Dam break – SPH
- Ship in waves – SPH



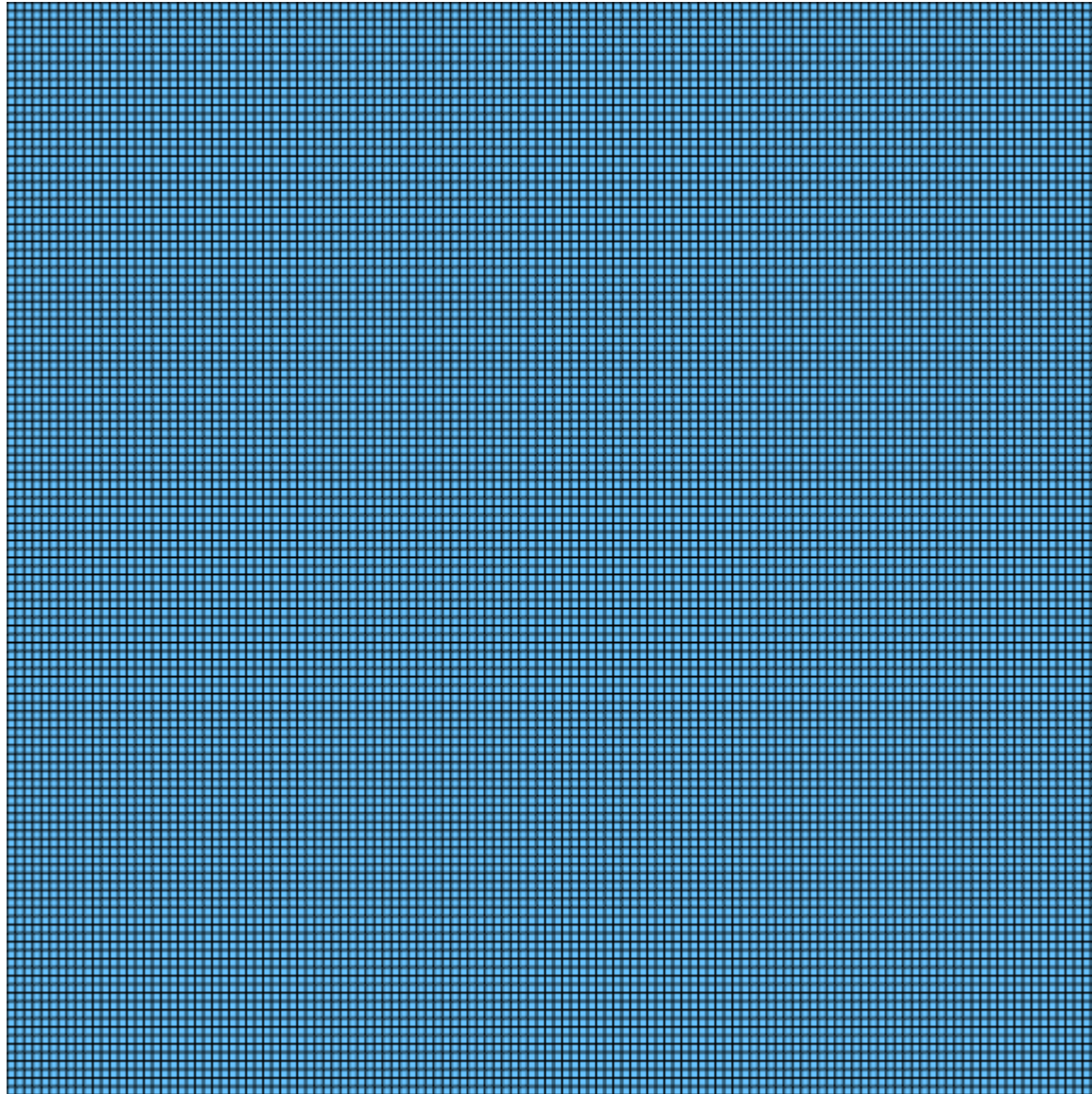
2D – Lid-driven cavity flow

Load case

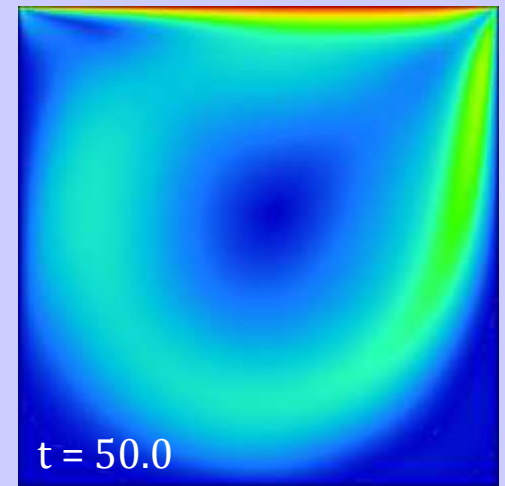
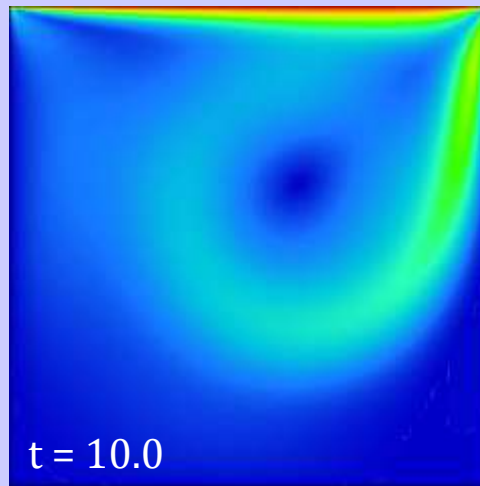
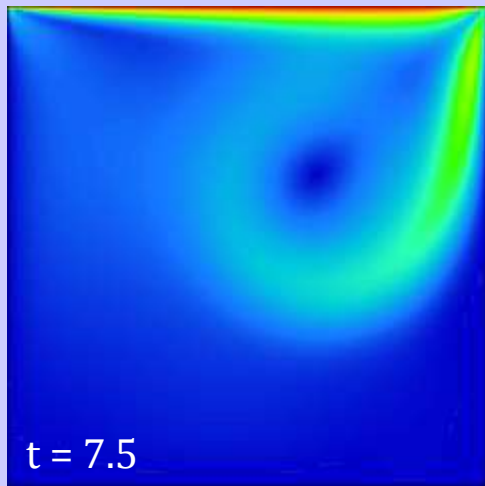
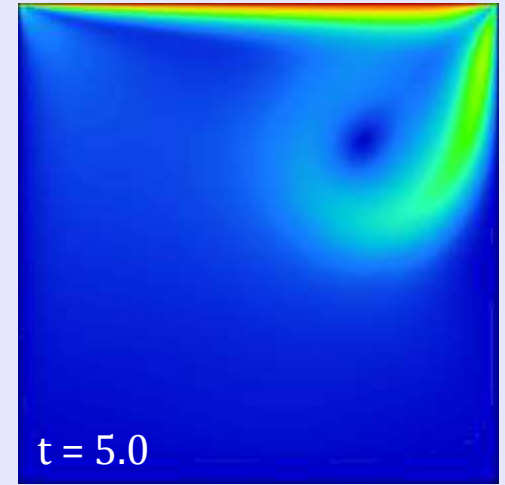
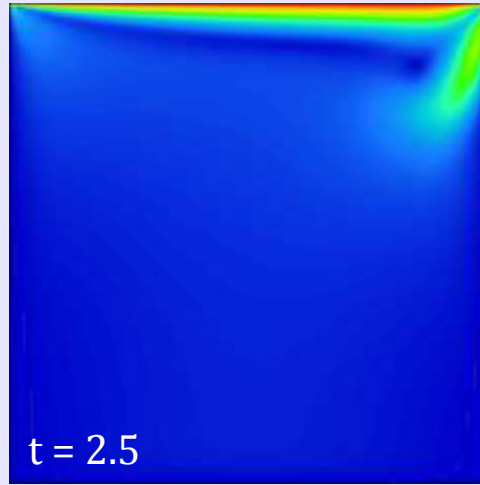
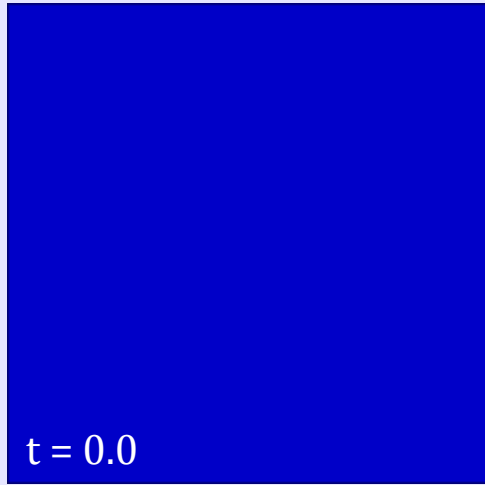


Model

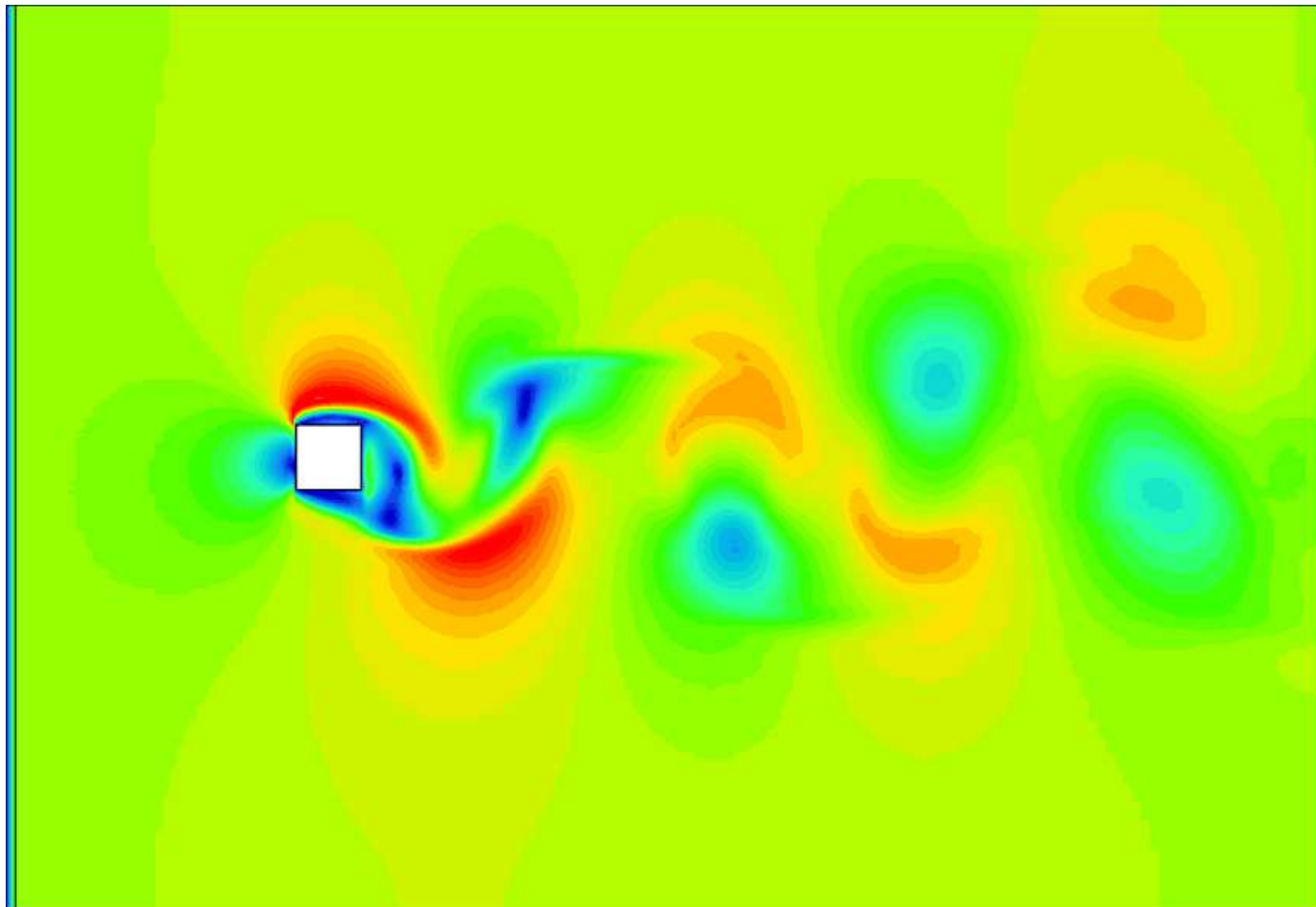
128 x 128
solid
elements



Results

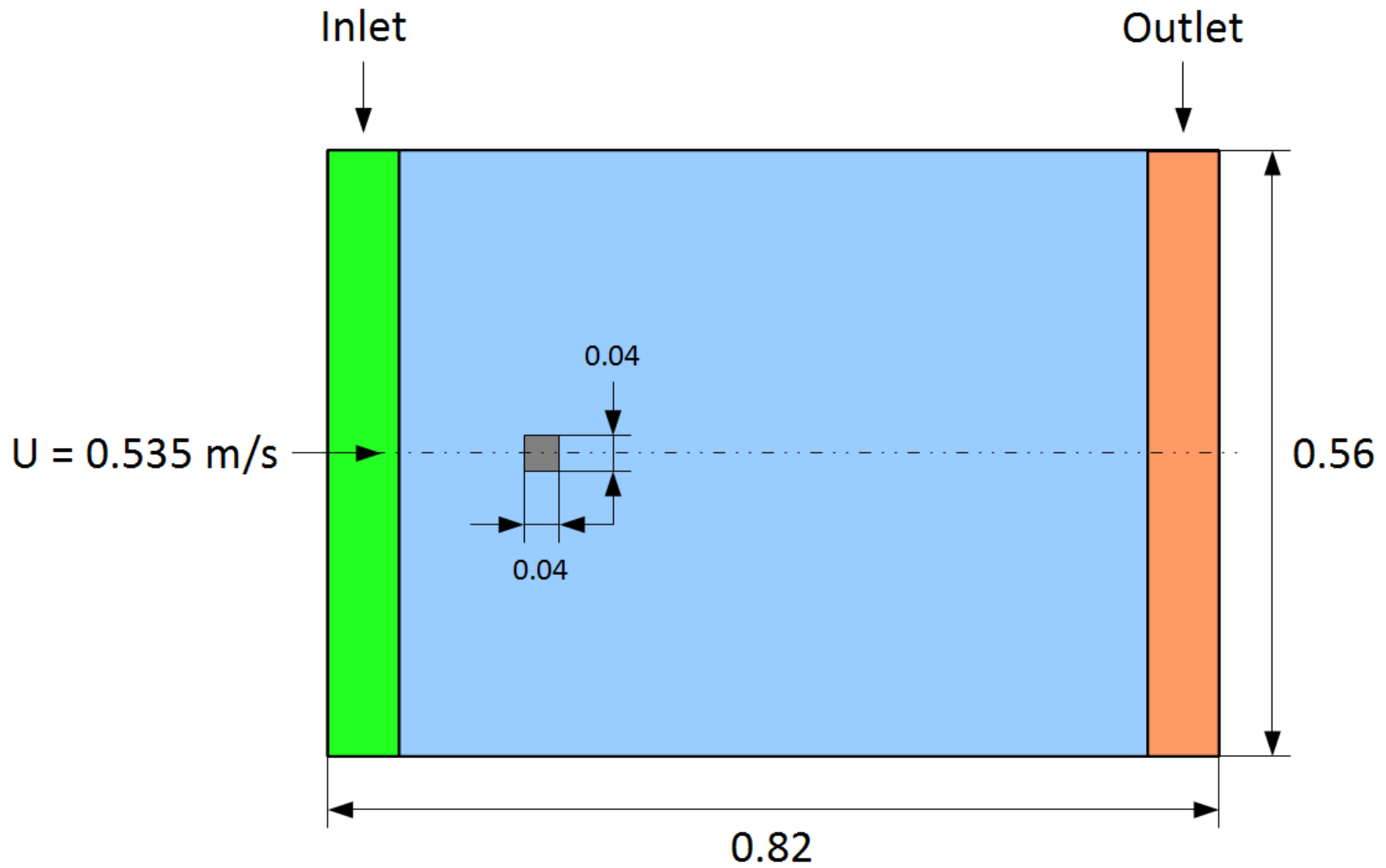


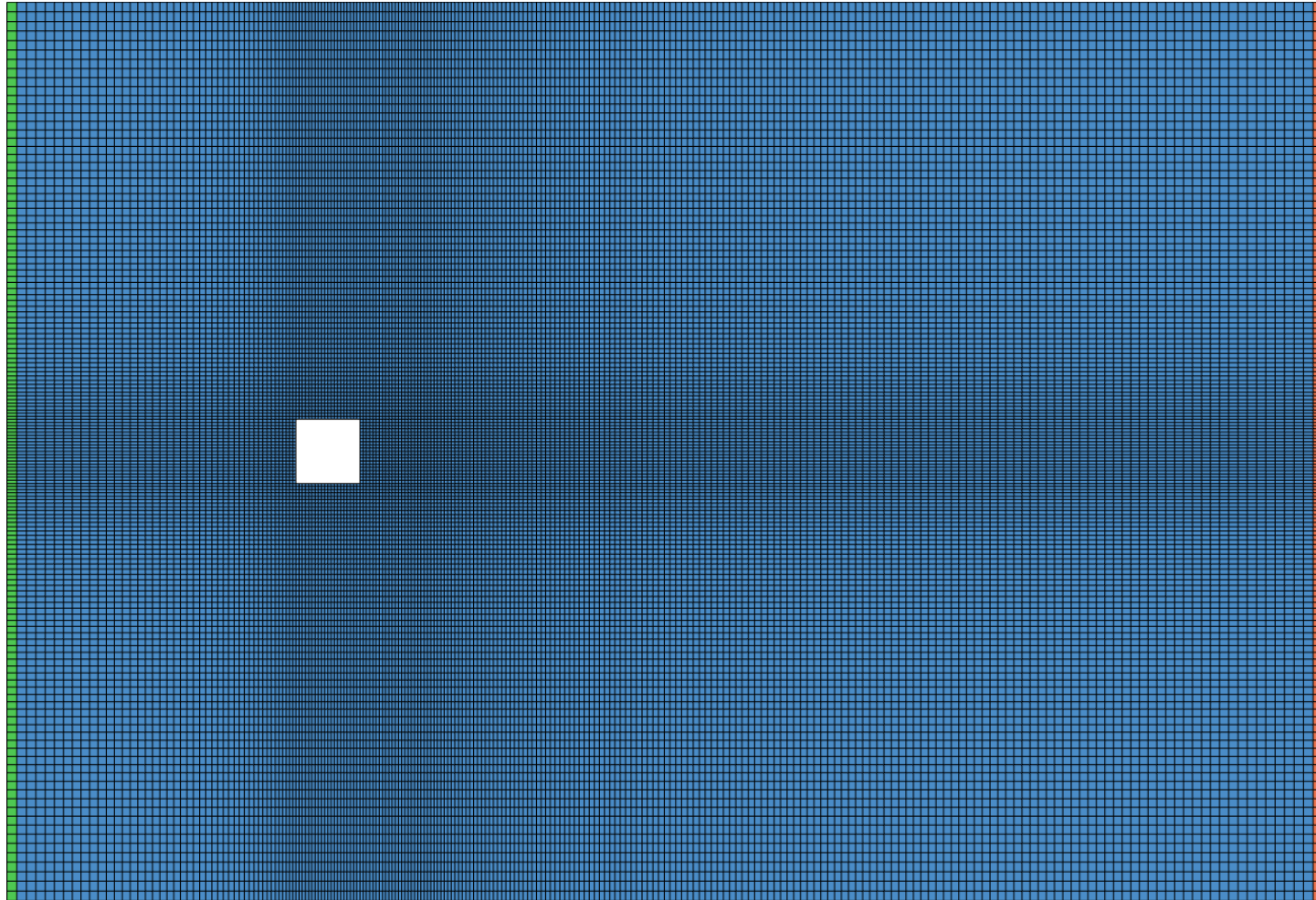
Movie



2D – Von Kármán vortex street

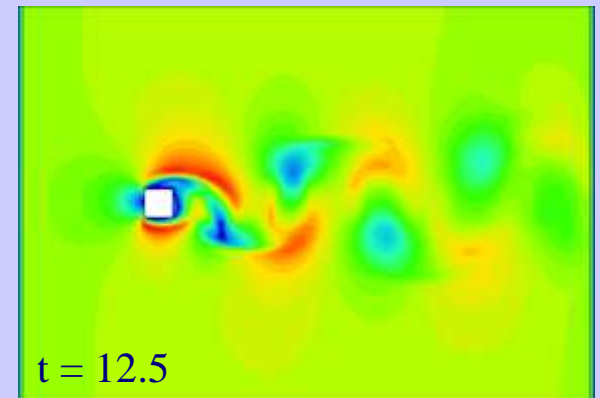
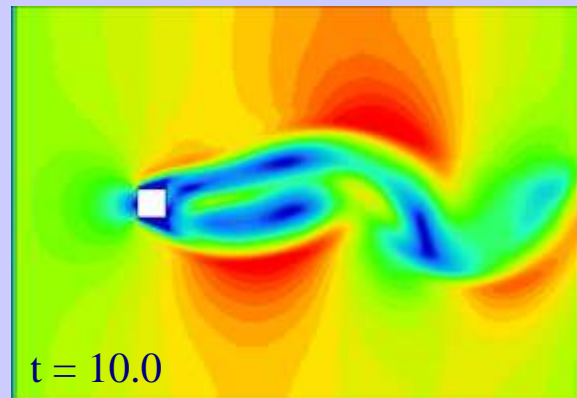
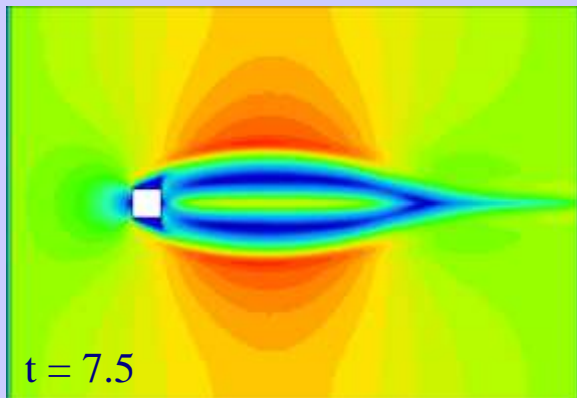
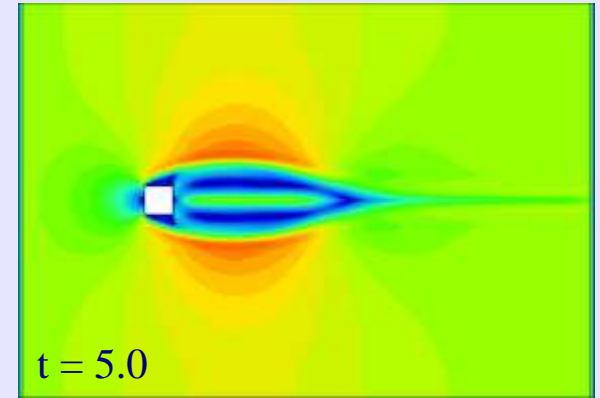
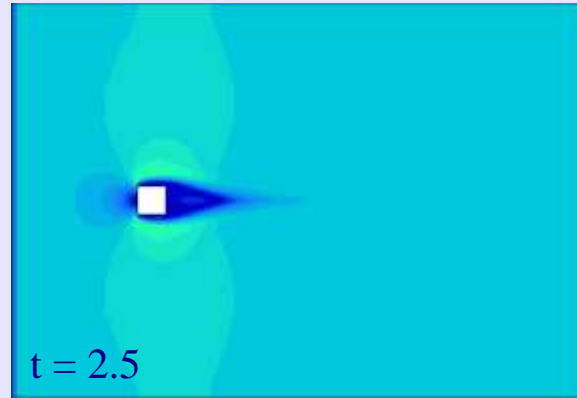
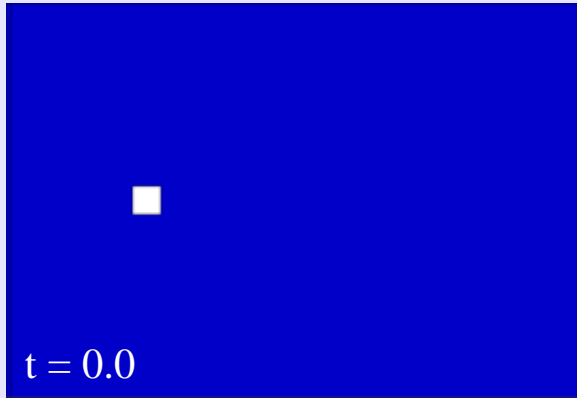
Load case

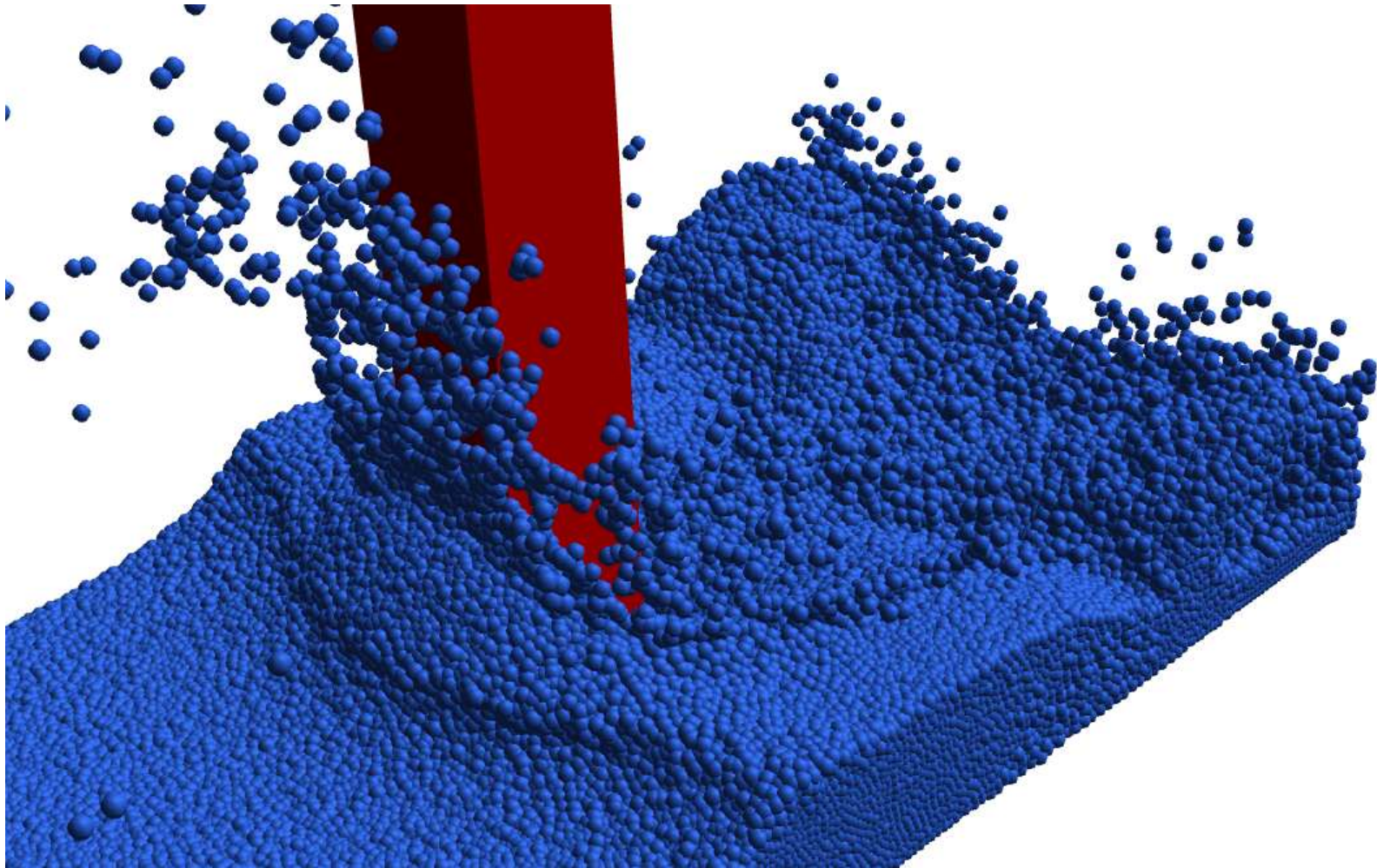




33,350 solid elements

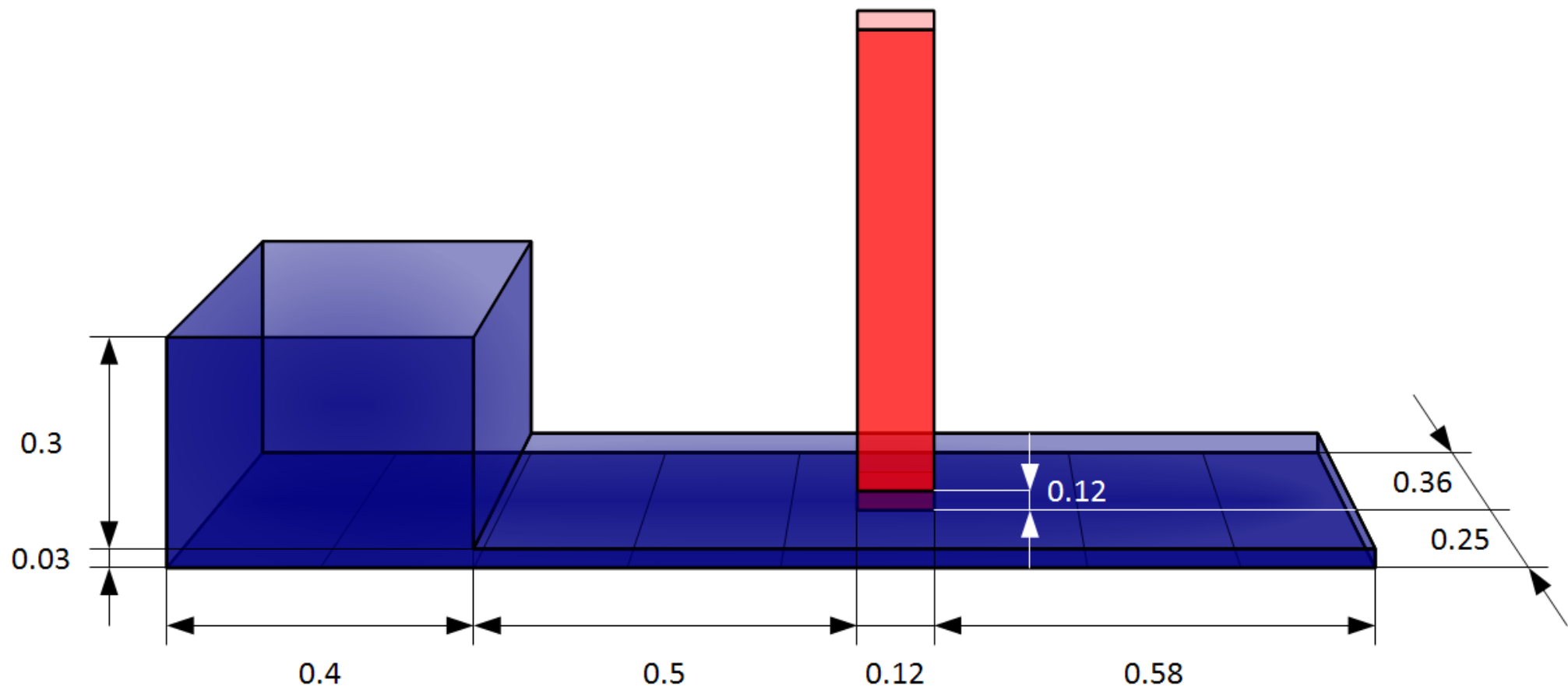
Results

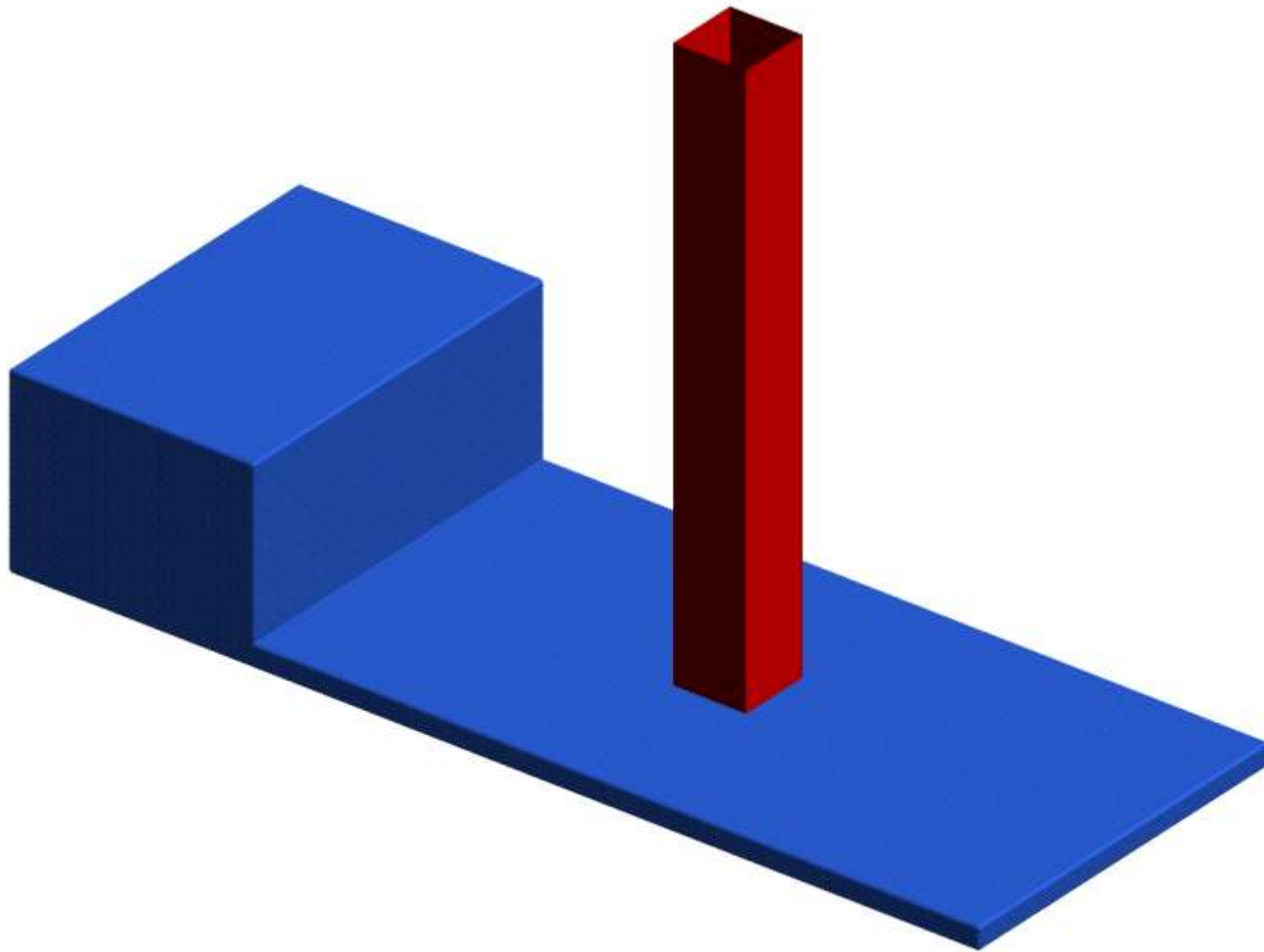




3D – Dam break

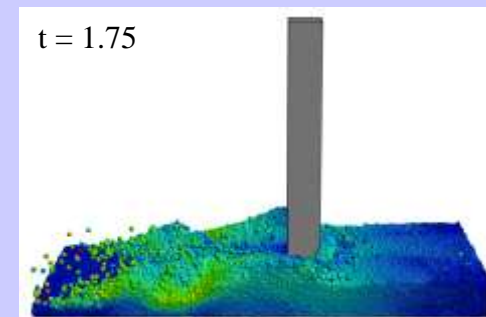
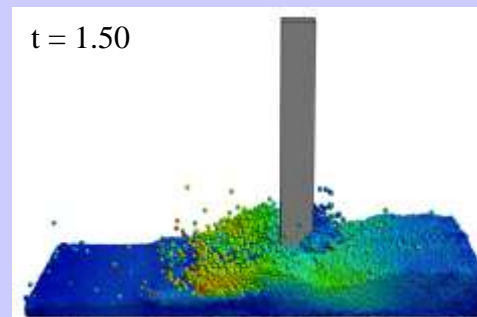
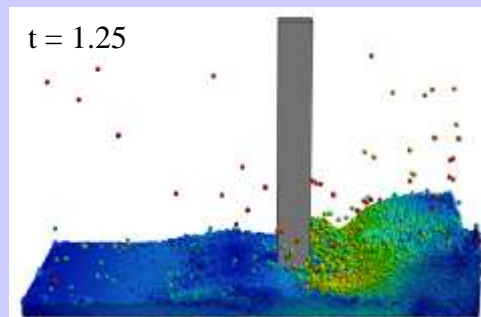
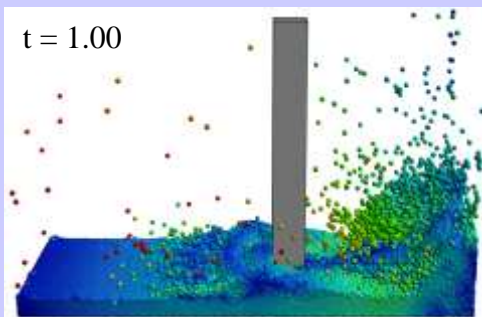
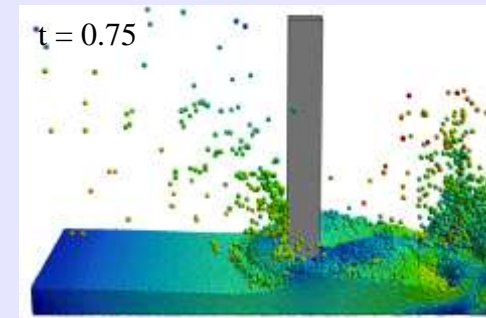
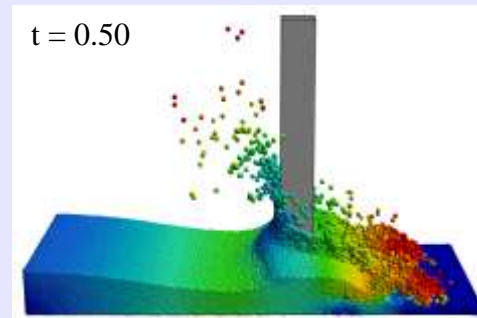
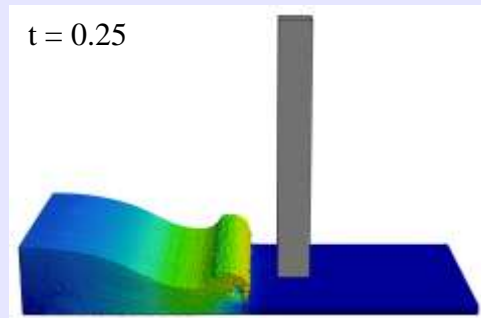
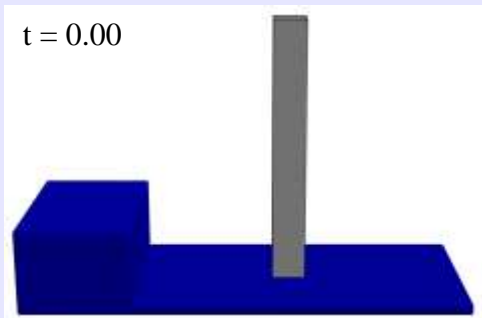
Load case



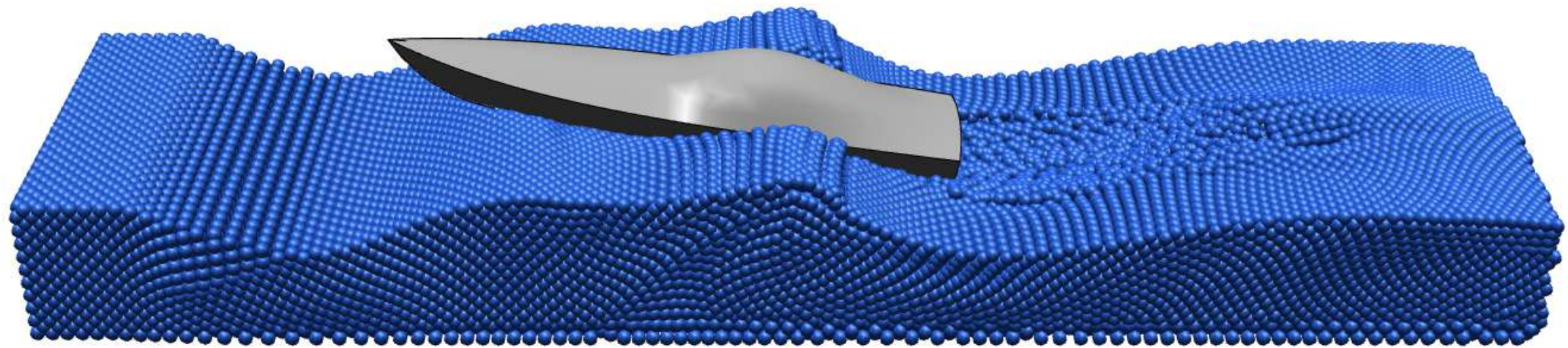


441,700 particles

Results

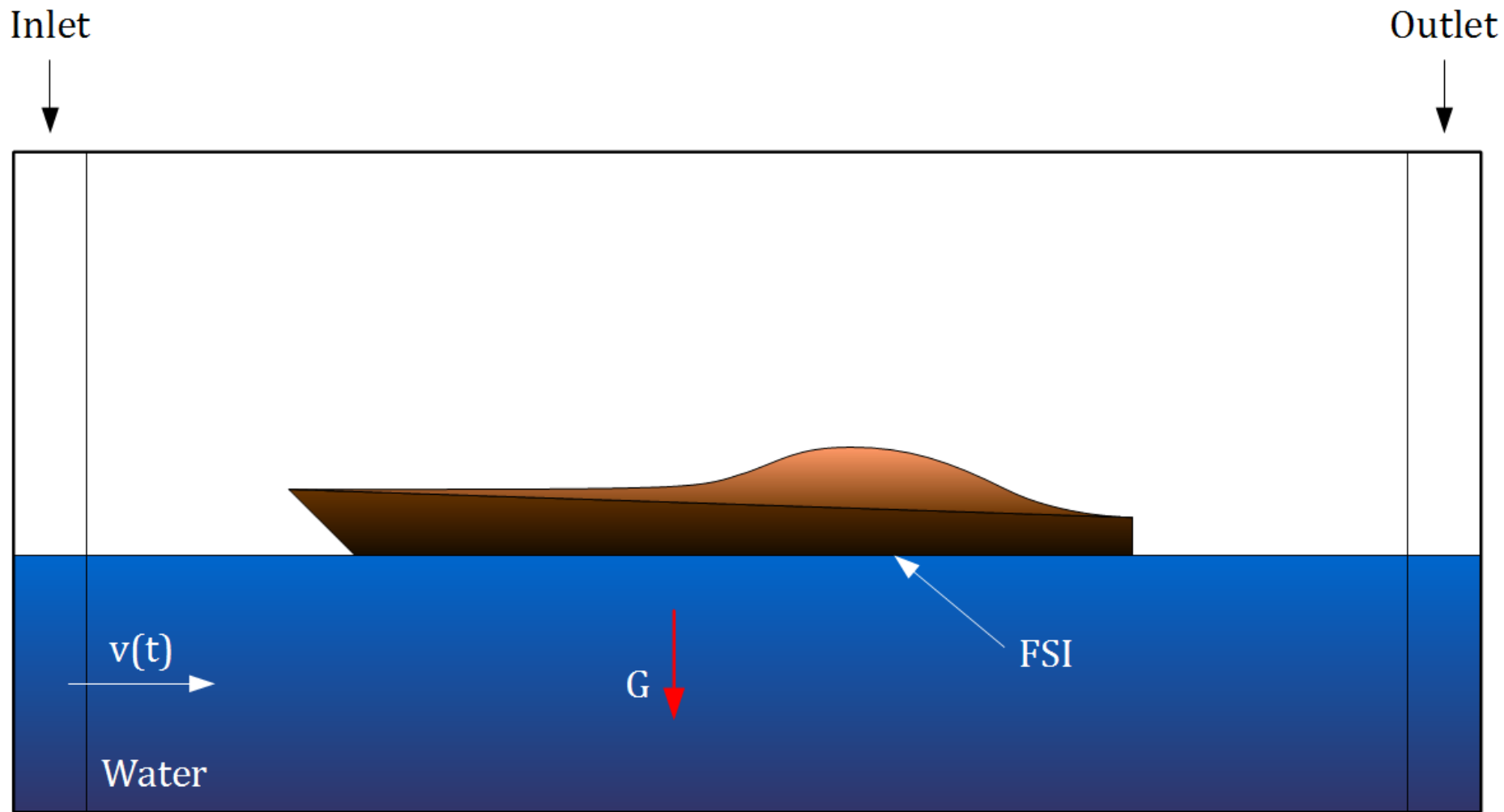


Movie

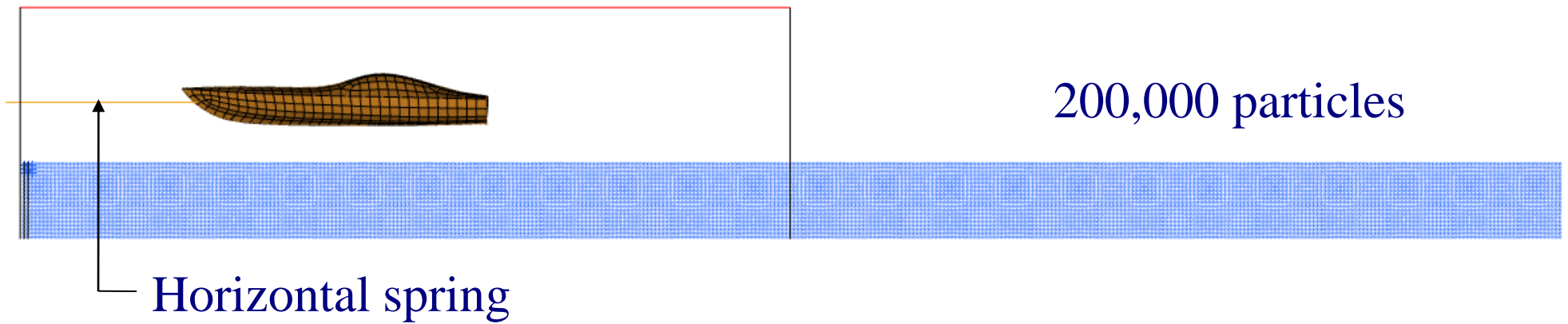
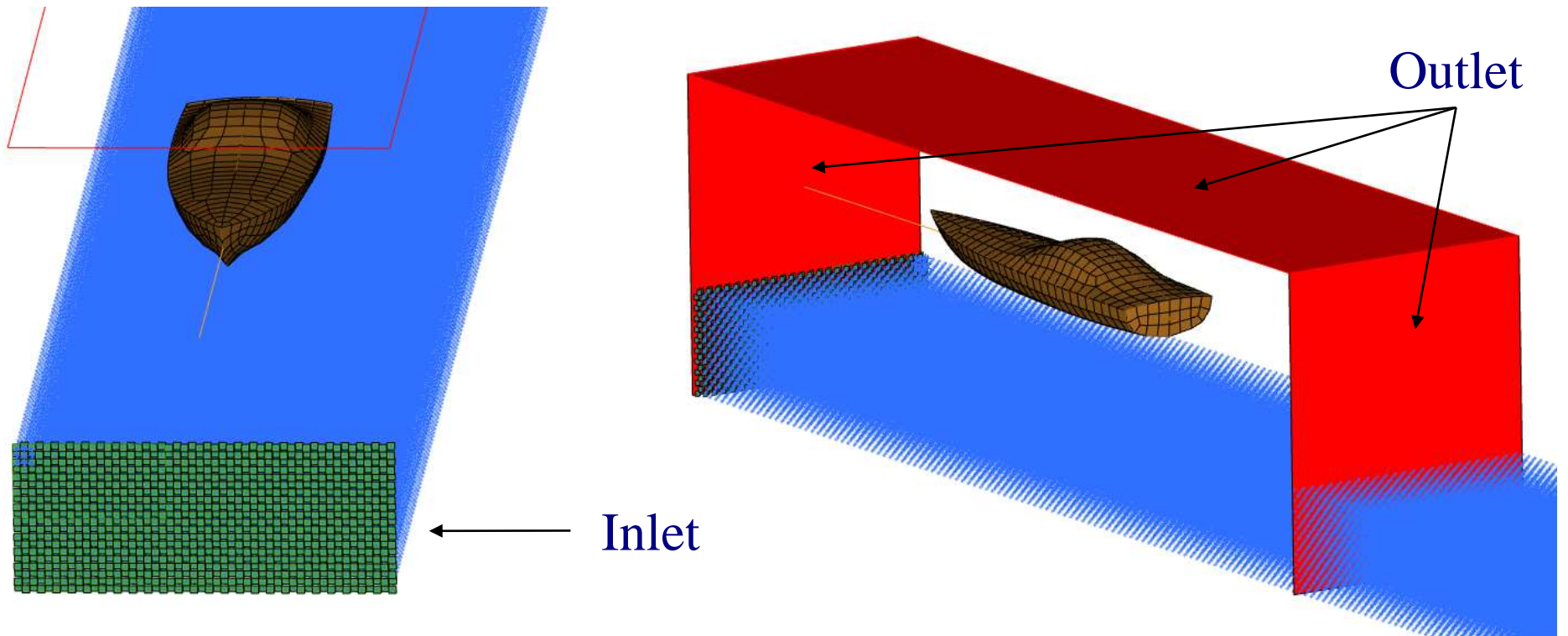


3D – Ship in waves

Load case

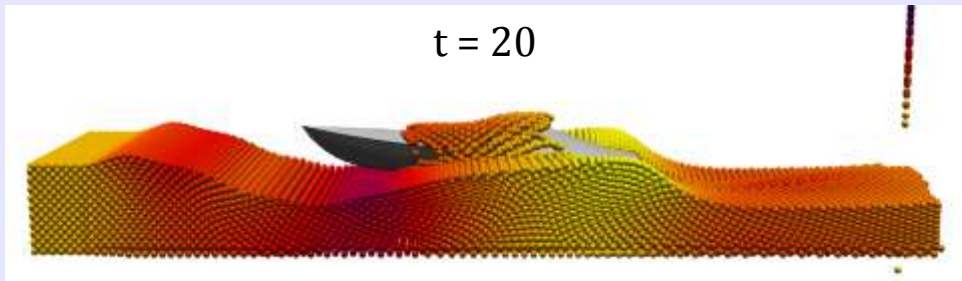


Model

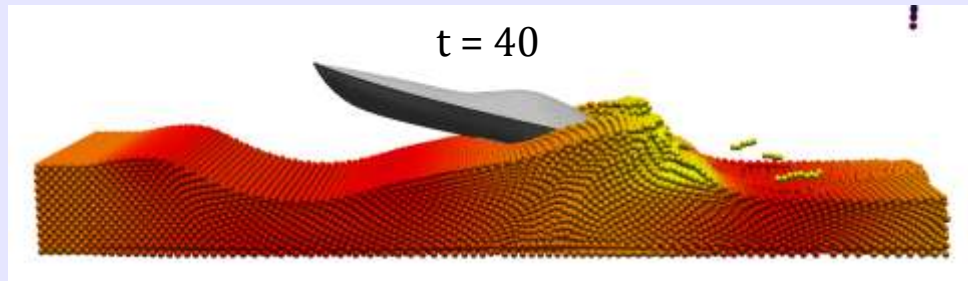


Results

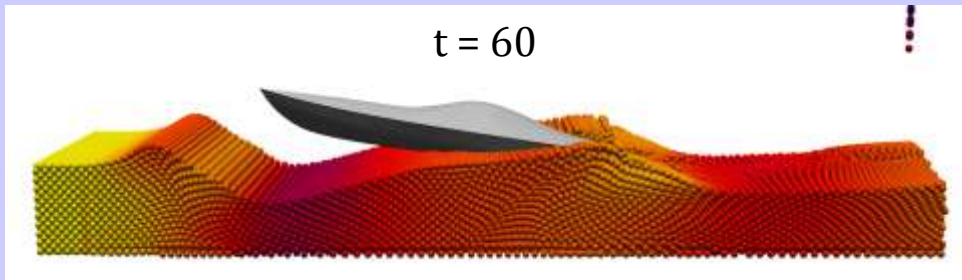
t = 20



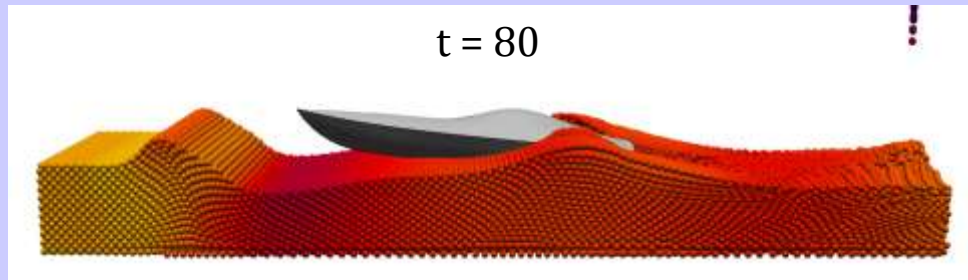
t = 40



t = 60



t = 80



Movie 1

Movie 2

Conclusions

ALE method

- Eulerian method using *solid elements*
- Used for many types of applications, both aerodynamics and hydrodynamics.

SPH method

- Lagrangian method using *particles*
- Optimized for simulating free-surface flows.

Simulations

- *2D – Lid-driven cavity flow*: Cavity flow simulation physically correct.
- *2D – Von Kármán vortex street*: Research on vortices still in progress.
- *3D – Dam break*: Comparison of results with benchmark proves physical correctness of our model.
- *3D – Ship in waves*: SPH method suitable for ship hydrodynamics.