University of Natural Resources and Life Sciences, Vienna
Department of Water, Atmosphere and Environment

Computational Methods in Hydrodynamics for Water Resources Management

Michael Tritthart and Daniel Wildt

SWARM Summer School
15 – 26 November 2021
Program

15th November 2021

Outline I

University of Natural Resources
and Life Sciences, Vienna
Department of Water, Atmosphere
and Environment

Concept and Intended Learning Outcomes
Summer School

Venue and access to the online sessions

Program
Week 1: Numerical solution of problems in hydrodynamics
Week 2: CFD with OpenFOAM

Teaching Materials

Concept and Intended Learning Outcomes: Summer School

The attendees of the summer school will acquire the following knowledge and abilities:

- ▶ mathematical formulation of hydrodynamic problems using differential equations
- ▶ discretization of differential equations for the numerical solution
- ▶ implementation of models for the numerical solution of simple hydrodynamic problems
- ▶ use of open-source code for the solution of more complex computational fluid dynamics models

Venue and access to the online sessions

University of Natural Resources
and Life Sciences, Vienna
Department of Water, Atmosphere
and Environment

The following link can be used to access the Zoom sessions:
`https://bokuvienna.zoom.us/j/98798606663?pwd=ckJmM1hmaGFERUlVL251YW9pOHlKQT09`
Meeting ID: 987 9860 6663
Passcode: 859380
Some individual sessions may be held in other Zoom-meetings.

Program: Week 1: Numerical solution of problems in hydrodynamics

University of Natural Resources and Life Sciences, Vienna
Department of Water, Atmosphere and Environment

Monday, 15th November 2021

- ▶ 10:00–12:00 (Michael Tritthart and Daniel Wildt): Welcome session
    - ▶ Presentation of University, Department and Institute
    - ▶ Program of the Summer School
- ▶ 13:00–17:00 (Daniel Wildt): Introduction to unsteady problems in hydrodynamics
    - ▶ Balancing of the water levels of two tanks connected through a pipe
    - ▶ Heat and mass transport in free-surface waterbodies

Program: Week 1: Numerical solution of problems in hydrodynamics

University of Natural Resources
and Life Sciences, Vienna
Department of Water, Atmosphere
and Environment

Tuesday, 16th November 2021

▶ 09:00-13:00 (Daniel Wildt): Ordinary differential equations

 ▶ Water surface estimation in non-uniform flow
 ▶ Retention

▶ afternoon: Self-organised learning

Program: Week 1: Numerical solution of problems in hydrodynamics

Wednesday, 17th November 2021

- ▶ 09:30-12:00 (Michael Tritthart): Theory on computer-based river modelling
  Join Zoom Meeting: `https://bokuvienna.zoom.us/j/96857851294?pwd=dm5vZzl4c3BLRVB2bXc2QmV1MHhEZz09`
  Meeting-ID: 968 5785 1294
  Passcode: 322112

- ▶ 15:00-18:00 (Daniel Wildt): Partial Differential Equations – Development of a flood wave

Program: Week 1: Numerical solution of problems in hydrodynamics

University of Natural Resources and Life Sciences, Vienna
Department of Water, Atmosphere and Environment

Thursday, 18th November 2021

▶ 10:00-12:00 (Daniel Wildt): 1D models, error estimation
Join Zoom Meeting:
`https://bokuvienna.zoom.us/j/97026800256?pwd=`
`emw2K0ZkTEt0RjM4ZDZHcm1heklTQT09`
Meeting ID: 970 2680 0256
Passcode: 444712

   ▶ Set-up of a 1D model of a channel system using the Excel worksheets UNDA
   ▶ Error estimation in physical lab experiments

▶ 14:00-16:00 Hydraulic lab tour

Program: Week 1: Numerical solution of problems in hydrodynamics

University of Natural Resources and Life Sciences, Vienna
Department of Water, Atmosphere and Environment

Friday, 19th November 2021

- ▶ 09:00-12:00 (Daniel Wildt): Unsteady pipe flow (hydraulic surge)
- ▶ 18:00-20:00 (Daniel Wildt): get-together with the IAHR Young Professional Network Vienna

Program: Week 2: CFD with Open-FOAM

University of Natural Resources and Life Sciences, Vienna
Department of Water, Atmosphere and Environment

Monday, 22nd November 2021

- ▶ 09:30-12:00 (Michael Tritthart): Introduction to Linux operating systems and the Unix command line
- ▶ afternoon: Self-organised learning

Tuesday, 23rd November 2021

- ▶ 09:00-13:00 (Daniel Wildt): Introduction to OpenFOAM
- ▶ afternoon: Self-organised learning

Program: Week 2: CFD with Open-FOAM

University of Natural Resources and Life Sciences, Vienna
Department of Water, Atmosphere and Environment

Wednesday, 24th November 2021

- ▶ 09:00-13:00 (Daniel Wildt):
  "An Introduction to OpenFOAM: A User View" presentation by Prof. Hrojve Jasak at the University of Ghent (May 2016) Part I

- ▶ afternoon: Group project assignment and work on group projects

Thursday, 25th November 2021

- ▶ 09:00-13:00 (Daniel Wildt)
  "An Introduction to OpenFOAM: A User View" presentation by Prof. Hrojve Jasak at the University of Ghent (May 2016) Part II

- ▶ afternoon: self organized learning, group project work

Program: Week 2: CFD with Open-FOAM

Friday, 26th November 2021

► 09:00-13:00 (Daniel Wildt): Summary
  ► Project Presentation
  ► Recap of the summer school and feedback meeting

Teaching Materials:

Participants will be supplied with various teaching materials in digital form:

▶ handouts

▶ MS Excel worksheets

▶ literature list and weblinks (see section **??**)

▶ OpenFOAM test cases

The materials will be shared with the participants via the BOKUlearn E-Learning platform:
`https://learn.boku.ac.at/user/index.php?id=44340`.

University of Natural Resources and Life Science, Vienna

Department of Water, Atmosphere and Environment
Institut of Hydraulic Engineering and River Research

Michael Tritthart and Daniel Wildt, MSc

Muthgasse 107, A - 1190 Wien
Tel.: 01-47654-81935
daniel.wildt@boku.ac.at
http://www.wau.boku.ac.at/iwa/