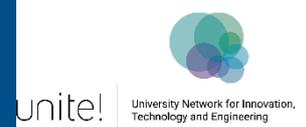


Official RILEM EAC and TUDa Course

Computational Methods for Building Physics and Construction Materials

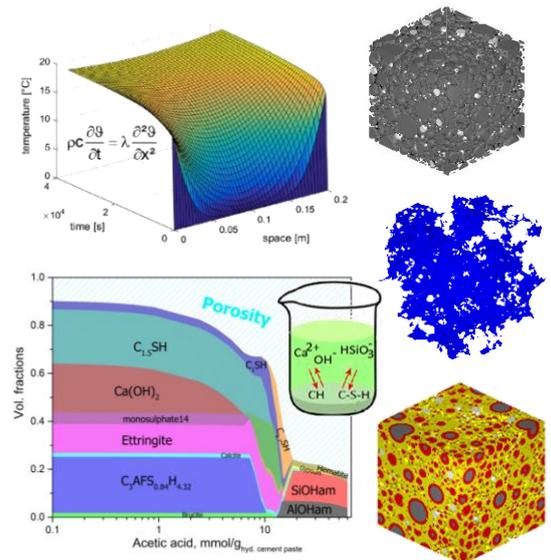
Hybrid!! July 3 – 7, 2023

Teachers: Prof. Dr. ir. E.A.B. Koenders, Dr. chem.-Ing. N. Ukrainczyk
 Prof. Dr.-Ing. Th. Matschei (RWTH Aachen), Dr.-Ing. C. Mankel
 M.Sc. M. Löher, Dr.-Ing. F. Georget (RWTH Aachen)



Course description:

The course contains detailed lecturing on computational methods covering differential equations, numerical solution strategies, explicit and implicit discretization, Method of Lines, boundary conditions and implementation of physical processes that frequently occur in construction materials. Emphasis will be on the Finite Difference Method applied to transport processes in porous construction materials, such as concrete and insulation materials, and on hydration modelling. Typical problems that will be addressed in this course are thermal, moisture and reactive transport modelling, multi-layer systems, coupled moisture - heat systems, cement particle structure, hydration kinetics and thermodynamic modelling, and the first steps towards high performance computing. The course provides a full solution strategy, starting from a physical problem, to schematization and discretization, to boundary conditions evaluation, implementation and to a computational solution.



Key topics:

- Steady state problems – discretization and implementation in Excel
- Transient problems – explicit & implicit heat and moisture flow – implementation in Octave
- Coupled and multi-layer systems for heat and moisture flow, discretization and implementation in Octave
- Particle structure formation and hydration kinetics of cementitious systems
- Thermodynamic modelling of cement hydration with GEM-Selektor
- Demonstrations and exercises with examples for all topics

Course program:

		03. Jul 23	04. Jul 23	05. Jul 23	06. Jul 23	07. Jul 23
		Monday	Tuesday	Wednesday	Thursday	Friday
CMBPCM	Time					
	8.45 - 9.00	Welcome - introduction RILEM and UNITE!				
Lectures	9.00 - 10.15	V1 Introduction schematization and discretization	V5 Transient implicit implementation in Octave	V9 Advanced time integrators and coupled systems	V13 Particle structure schematization for cement microstructures	V17 Thermodynamic (TD) modelling of cement hydration
	10.15 - 10.45	Coffee break	Coffee break	Coffee break	Coffee break	Coffee break
	10.45 - 12.30	V2 Transient discretization problem, explicit method in Excel	V6 Implementation of boundary conditions and multi-layer systems in Octave	V10 Transient heat-moisture systems, implementation in Octave	V14 Cement hydration kinetics theory	V18 Demo + Exercise: GEM-Selektor for TD hydration modelling
	12.30 - 13.30	Lunch break	Lunch break	Lunch break	Lunch break	Lunch break
Demos	13.30 - 15.30	V3 Demo on Octave and explicit transient implementations	V7 Demo on implicit transient implementations	V11 Demo on coupled heat moisture systems Octave/WUFI	V15 Demo hydration in Octave and Hymostruc	V19 High Performance Computing
	15.30 - 16.00	Coffee break	Coffee break	Coffee break	Coffee break	Coffee break
Exercise	16.00 - 17.30	V4 Exercise: Chloride diffusion explicit excel/Octave	V8 Exercise: Heat diffusion in a multi-layer wall in Octave	V12 Exercise: Heat-moisture problem in Octave/WUFI	V16 Exercise: Cement hydration in Octave/Hymostruc	V20 Demo + Exercise: High Performance Computing

Objective:

Main objective of the course is to train MSc, PhD and Postdoc students, who are beginners or have no modelling experience, on how to solve partial differential equations and to become familiar with numerical solution strategies for common physical/chemical problems in construction materials. After finishing this course, students will be able to use computational methods for their own research and build their own basic computational models.

Venue:

The course will be provided in a hybrid format, where the actual course will take place at the TU Darmstadt and the online streaming will be offered via the platform ZOOM. A ZOOM-link will be sent shortly before every course day.



Registration fee:

Participant situation	Whole week [€]		Per day [€]	
	Online	TU Darmstadt	Online	TU Darmstadt
MSc students from the TU Darmstadt or UNITE! partners	free	free	free	free
MSc students from other Universities	75	150	30	50
PhD students and/or Postdocs	300	500	100	150
Professors or representatives from the industry	600	1000	200	300

Note: The fees already include RILEM discount.

The fee includes online course attendance, basic course materials like a PDF-copy of all PPTs, Octave, programming codes used during lectures and exercises, useful links to freeware, etc. Recordings of the full course will also be made available for the participants via an online streaming platform until three weeks after the course.

Exam:

Non TU Darmstadt students may also opt for doing the exam. After successful passing the exam, a formal document confirming the 6 ECTS will be provided by TU Darmstadt. This document can be used for your graduate school.

Enrollment:

TU Darmstadt MSc students can enroll via the TU Darmstadt TUCaN system. Other MSc-, PhD-students, PostDocs, Professors, UNITE! partners, or representatives from the industry, can enroll via the following contact information:

Enrollment website: Click [here](#)
A new enrollment system will be launched soon!

Contact information:

Institute of Construction and Building Materials

Ms. A. Cevik

E-Mail: info@wib.tu-darmstadt.de

Tel: +49-6151-16-22210

Summary Course Information

Technische Universität Darmstadt
Institute of Construction and Building Materials
Campus Lichtwiese, TU Darmstadt
Address: Franziska-Braun-Straße 3, 64287 Darmstadt

CP / ECTS: 6 / 6

Exam: An exam will be provided

Room: Will be announced soon

Language: English

