Official RILEM EAC and TUDa Course

Computational Methods for Building Physics and Construction Materials

ON-LINE !! April 4 – 8, 2022

Teachers: Prof. Dr. ir. E.A.B. Koenders, Dr. chem.-Ing. N. Ukrainczyk
Dr. A. Caggiano, Dr.-Ing. Ch. Mankel

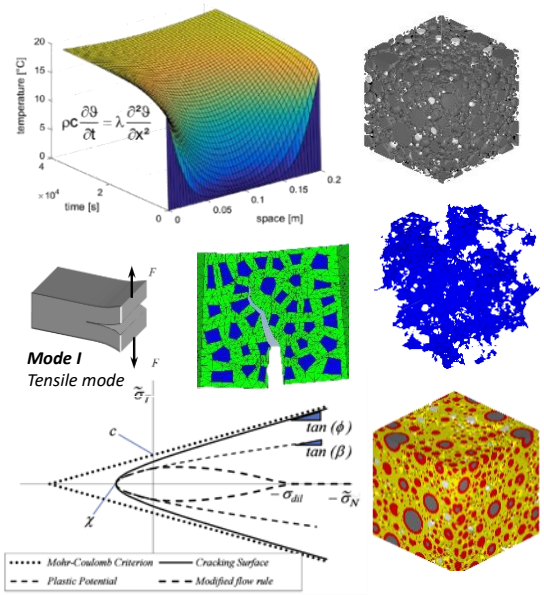
TECHNISCHE UNIVERSITÄT DARMSTADT
INSTITUT FÜR WERKSTOFFE IM BAUWESEN

unite! University Network for Innovation, Technology and Engineering

The course will be online via **ZOOM** – Sign in to receive the link

Course description:

The course contains detailed lecturing on computational methods for 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 and finite element methods applied to transport processes, active in porous construction materials such as concrete, insulation materials, etc. Typical problems that will be addressed in this course are thermal, moisture and/or reactive transport modelling, chloride ingress modelling, coupled moisture - heat systems, cement hydration kinetics and particle structure generation. The course provides a full solution strategy, starting from a physical problem, to schematization and discretization, to boundary conditions evaluation, implementation and a computational solution.



Key topics:

- Steady state problems – discretization and implementation in Excel
- Transient problems – explicit & implicit heat and moisture flow – implementation in Octave/FEM
- Coupled systems – heat and moisture flow, discretization and implementation in Octave/FEM
- Particle structure formation and hydration kinetics of cementitious systems
- Demonstrations and exercises with realistic examples

Updated online course program:

		04. Apr 22	05. Apr 22	06. Apr 22	07. Apr 22	08. Apr 22
CMBPCM	Time	Monday	Tuesday	Wednesday	Thursday	Friday
	8.45 - 9.00	Welcome - introduction RILEM and UNITE!				
Lectures	9.00 - 10.15	Introduction schematization and discretization	Transient implicit implementation in Octave	Advanced time integrators and coupled systems	Particle structure schematization for cement microstructures	FEM - Basic theory for heat diffusion
	10.15 - 10.45	Coffee break	Coffee break	Coffee break	Coffee break	Coffee break
	10.45 - 12.30	Transient discretization problem, explicit method in Excel	Implementation of boundary conditions and multi-layer systems in Octave	Transient heat-moisture systems, implementation in Octave	Cement hydration kinetics theory	FEM - Elements, shape functions and matrices
	12.30 - 13.30	Lunch break	Lunch break	Lunch break	Lunch break	Lunch break
Demos	13.30 - 15.30	Demo on explicit transient implementations	Demo on implicit transient implementations	Demo on coupled heat - moisture systems Octave	Demo on cement hydration in Octave	Demo on FEM - implementations in Octave
	15.30 - 16.00	Coffee break	Coffee break	Coffee break	Coffee break	Coffee break
Examples	16.00 - 17.30	Example: Chloride diffusion explicit excel	Example: Heat diffusion in a multi-layer wall in Octave	Example: Heat-moisture problem in WUFI	Example: Cement hydration in Hymostruc	Example: FEM in Abaqus

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 problems in construction materials. After finishing this course, students will be able to use computational methods for their own research.

Venue:

The course will be offered via the online platform ZOOM.
A ZOOM-link will be sent shortly before every course day.

Fee:

Participant	Whole week registration [€]	Per day registration [€]
MSc students from the TU Darmstadt or UNITE! partners	free	free
MSc students from other Universities	75	25
PhD students and/or Postdocs	300	100
Professors or representatives from the industry	600	200

Note: The fees already include RILEM discount.

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

Enrollment information:

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:

Institute of Construction and Building Materials
Ms. A. Cevik
E-Mail: info@wib.tu-darmstadt.de
Tel: +49-6151-16-22210

Extra information:

Non TU Darmstadt students may also opt for doing the exam. After succesful 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.

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:	ZOOM – Virtual Room
Language:	English

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