

Official RILEM EAC and TUDa Course
**Computational Methods for
 Building Physics and
 Construction Materials**

Date: April 8 – 12, 2019



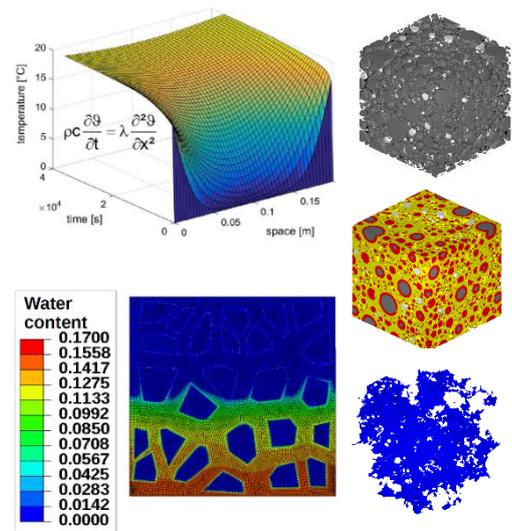
TECHNISCHE
 UNIVERSITÄT
 DARMSTADT

INSTITUT FÜR
 WERKSTOFFE
 IM BAUWESEN

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

Course description:

The course contains in-depth lecturing on different computational methods for differential equations, numerical solution strategies, explicit and implicit discretization, finite difference method, method of lines, boundary conditions and implementation of physical processes that frequently occur in construction materials. Emphasis will be on the meso-scale level and on transport processes that are active in porous construction materials such as concrete, geopolymers, insulation materials, etc. Typical problems that will be addressed in this course will be on modelling moisture and/or reactive transport in porous media, heat transport and effect of insulation, coupled moisture - heat systems, and cement hydration kinetics. The course will provide a full solution strategy approach, so from a physical problem, to schematization and discretization, to boundary conditions evaluation, 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/Matlab/FEM**
- **Coupled systems – heat and moisture flow, discretization and implementation in Octave/Matlab/FEM**
- **Particle structure formation and hydration kinetics of cementitious systems**

Preliminary course program:

CMBPCM	Time	Monday	Tuesday	Wednesday	Thursday	Friday
	8.00 - 9.00	Welcome, introduction and presenting RILEM				
Lectures	9.00 - 10.15	Introduction schematization and discretization	Transient discretization problem, explicit method in Excel	Transient discretization problems, boundary conditions evaluation	Transient multi-layer systems, implicit implementation in Octave/Matlab	Particle structure schematization and discretization
	10.15 - 10.45	Coffee break	Coffee break	Coffee break	Coffee break	Coffee break
	10.45 - 12.30	Steady state problem, explicit implementation in Excel	Transient discretization problem explicit method in Octave/Matlab	Transient discretization, implicit implementation in Octave/Matlab	Transient heat-moisture systems, implementation in Octave/Matlab/FEM	Kinetics modelling and implementation in Octave/Matlab
	12.30 - 13.30	Lunch	Lunch	Lunch	Lunch	Lunch
Demos	13.30 - 15.30	Demo on steady state Excel implementation	Demo on explicit transient implementations	Demo on implicit transient implementations Octave/Matlab	Demo on coupled heat - moisture systems Octave/FEM/WUFI	Demo on hydration and kinetics implementations
	15.30 - 16.00	Coffee break	Coffee break	Coffee break	Coffee break	Coffee break
Exercises	16.00 - 17.30	Exercises 1	Exercises 2	Exercises 3	Exercises 4	Exercises 5
	18.00	City walk	Free	Free	Dinner	Free

Objective:

Objective of the course is to train MSc, PhD and Postdoc students on how to solve common differential equations and what solution strategies can be applied to simulate physical problems in construction materials. After finishing this course, students will be able to use computational methods skills for their own research.

Venue:

The course venue will be at the Campus of the Technische Universität Darmstadt. Darmstadt is a "City of Science" which is situated in state of Hessen, near to Frankfurt. The University is one of Germany's leading TUs. The exact location will be announced as soon as possible.



Costs:

- PhDs and Postdocs 500 Euros
- MSc students from the TU Darmstadt: Free
- MSc students from other Universities: 150 Euros

This includes the course attendance, basic course materials (PDF copy of PPTs, etc), a course dinner, and coffee breaks and lunches during the whole course week. Accommodation is not included.

Accommodation:

For this course accommodation will not be arranged by the organizers. Hotels or Bed and Breakfast options can be found from regular websites.

Contact information:

TU Darmstadt MSc students can register via the TU Darmstadt TUCaN system.

Other MSc, PhD or PostDoc students can register via the following contact information:

Institute of Construction and Building Materials

Ms. A. Cevik

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Summary	Technische Universität Darmstadt	
Course	Campus Lichtwiese, TU Darmstadt	
Information	Address: Franziska-Braun-Straße 3, 64287 Darmstadt	
CP / ECTS:	6 / 6	
Faculty/ Institute:	Environmental and Civil Engineering / Institute of Construction and Building Materials	
Room:	The exact location will be announced asap	
Language:	English	