



**Engineering Mechanics
Graduate course ' Multi-scale and Micromechanics'
November 2022**

Time frame:

Module 1: Wednesday November 2nd – Friday November 4th
Module 2: Tuesday November 8th – Thursday November 10th

Local organizing committee (LOC)

Hans van Dommelen
Marc Geers
Johan Hoefnagels
Varvara Kouznetsova
Marc van Maris
Ron Peerlings

Secretary: Alice van Litsenburg

Lecturers team

Can Ayas	Delft University of Technology
Issam Doghri	Université Catholique de Louvain
Hans van Dommelen	Eindhoven University of Technology
Marc Geers	Eindhoven University of Technology
Johan Hoefnagels	Eindhoven University of Technology
Markus Hütter	Eindhoven University of Technology
Varvara Kouznetsova	Eindhoven University of Technology
Regina Luttgé	Eindhoven University of Technology
Francesco Maresca	Groningen University
Thomas Pardoën	Université Catholique de Louvain
Ron Peerlings	Eindhoven University of Technology
Ondrej Rokos	Eindhoven University of Technology
Yoeri van de Burgt	Eindhoven University of Technology
Olaf van der Sluis	Eindhoven University of Technology
Ye Wang	Eindhoven University of Technology

Daily time schedule

Lecture period I	: 09.00-10.00 (not on the first day of each module)
Short coffee break	: 10.00-10.15
Lecture period II	: 10.15-11.15
Short coffee break	: 11.15-11.30
Lecture period III	: 11.30-12.30
Lunch break	: 12.30-13.30
Lecture period IV	: 13.30-14.30
Training session:	14.45-17.30

Module 1: November 2nd – November 4th 2022

Multi-scale & crystal plasticity

- Homogenization: closed-form, computational and asymptotic schemes
- Coarse graining
- Micromechanics of crystalline materials.

Wednesday November 2 nd	AM	10.15-11.15	Multi-scale and Micromechanics: Introduction, Overview, Mathematical background	Marc Geers
		11.30-12.30	Homogenization concepts	Varvara Kouznetsova
	PM	13.30-14.30	Thermodynamics perspective on coarse graining	Markus Hütter
		14.30-15.30	Thermodynamics perspective on coarse graining	Markus Hütter
		15.30-17.30	Informal poster session – Challenges in multi-scale and micromechanics	Lecturers team
Thursday November 3 th	AM	09.00-10.00	Asymptotic homogenization	Ron Peerlings
		10.15-11.15	Crystal plasticity	Hans van Dommelen
		11.30-12.30	Discrete dislocation mechanics	Can Ayas
	PM	13.30-14.30	Discrete dislocation mechanics	Can Ayas
		14.45-17.30	Crystal plasticity: training session	Hans van Dommelen & co
Friday November 4 th	AM	09.00-10.00	Computational homogenization: theoretical aspects	Varvara Kouznetsova
		10.15-11.15	Computational homogenization: numerical solution	Varvara Kouznetsova
		11.30-12.30	Mean-field homogenization of elastic/inelastic materials	Issam Doghri
	PM	13.30-14.30	Mean-field homogenization of elastic/inelastic materials	Issam Doghri
		14.45-17.30	Training session on computational homogenization	Varvara Kouznetsova & co

Module 2: November 8th – November 10th 2022

Micromechanics

- Thin films – Interfaces
- Experimental micromechanics
- Ductile damage
- Atomistic modelling
- Microstructure evolution and phase field models
- Micro- and nanofabrication methods

Tuesday November 8 th	AM	10.15-11.15	Microstructural evolution & phase field models	Marc Geers
		11.30-12.30	Microstructural evolution & phase field models	Marc Geers
		13.30-17.30	MicroFab session	Regina Luttge, Yoeri van de Burgt, Ye Wang
Wednesday November 9 th	AM	09.00-10.00	Experimental micromechanics	Johan Hoefnagels
		10.15-11.15	Microscopy	Johan Hoefnagels
		11.30-12.30	Atomistic modelling: computational methods	Francesco Maresca
	PM	13.30-14.30	Atomistic modelling: application to dislocations	Francesco Maresca
		14.45-17.30	Multi-scale lab: observing and testing across length scales	Johan Hoefnagels Marc van Maris
Thursday November 10 th	AM	09.00-10.00	Mechanics and adhesion of thin films	Olaf van der Sluis
		10.15-11.15	Mechanics and adhesion of thin films	Olaf van der Sluis
		11.30-12.30	Homogenization of mechanical metamaterials	Ondrej Rokos
	PM	13.30-14.30	Ductile damage micromechanics	Thomas Pardoën
		14.45-15.45	Ductile damage micromechanics	Thomas Pardoën
		15.45-16.30	Course evaluation & closure	van Dommelen/Geers