

EMC 2024

Welcome to Aalto



EMC

Resourcing a sustainable future



Contents

- **Program**
- **Intro students and staff**
- **Aalto University**
- **EMC Curriculum**
- **Courses at Aalto ENG**
- **Research and facilities**

Agenda today

- 10:00** Welcome & introductions of students and personnel - Mikael Rinne
- 10:30** Greetings from the industry- André van Wageninen, Rupert Resources
- 11:00** Break
- 11:15** Mining, studies and research at Aalto ENG - Mikael Rinne
- 11:30** Geology studies and research - Jussi Leveinen
- 11:45** Integrated Project Communication & Field Experience courses - Mikael Rinne, Jaana Suviniitty
- 12:00** Lunch together (table reserved at Kvarkki restaurant, Otakaari 3)
- 13:30** Mineral Processing studies at Aalto CHEM - Rodrigo Serna
- 13:45** Federation of European Mining Programmes (FEMP) - John Vaassen
- 14:00** Metallurgy studies and research - Marko Kekkonen
- 14:15** Greetings from Aachen and Leoben
- 14:30** Break
- 14:45** Greetings from the industry - Panu Oikkonen (Normet)
- 15:00** Practical information about studies in EMC - Stefano De Luca, Aino Roms, Pekka Tolvanen
- 16:00** Group picture



Excursion to Sandvik Tampere

Wed 28.8.2024

- 1) **Note: Departure at 7:45 in front of Rakentajanaukio 4!**
- 2) **Note: Take your passports or IDs with you!**

Agenda EMC visit to Sandvik Tampere 28th of August 2024, “Future of mining”

10:30 – 10:45 *Auditorium* Welcome and Ice breaking (Mentimeter quiz) Sara-Leena and Martyna (coffee and snack)

10:45 – 11:00 *Auditorium* Sandvik Group and SMR presentation (Martyna)

11:00 – 11:35 *Auditorium* Surface Mining and Drilling presentation (Tuomo Pirinen)

11:35 – 12:00 *Auditorium* Test Mine presentation and Safety Info (Sara-Leena)

12:00 – 12:40 *Masuni* Lunch

12:40 – 13:00 Going to Test Mine Visitor Center, getting geared up (Sara-Leena and Martyna)

13:00 – 14:00 *Test Mine* Walk down & Amelia demo (Amelia demo between 13:10 – 13:40 Liisa & Henri) and walk back up (Sara-Leena and Martyna)

14:00 – 14:10 *Visitor Center* getting the gear off (Martyna and Sara-Leena)

14:10 – 15:10 *Optimine showroom* [Digital mining technologies presentation](#) (Vitus & Charlotte)

15:10 – 15:35 *Optimine showroom* Electrification in mining presentation (Tommi)

15:35 – 16:00 *Digital Mine* Q&A and wrap up and snacks (Sara-Leena & Martyna)

Back to campus about 18:30

Weekly schedule

[Planning your studies |
Aalto University](https://www.aalto.fi/en/programmes/european-mining-course/planning-your-studies)

<https://www.aalto.fi/en/programmes/european-mining-course/planning-your-studies>



Student Guide ^

[Programmes](#)

European Mining Course

[Programme main page](#) v

Planning your studies

Weekly schedule

Here you can view and download the weekly schedule of your studies at Aalto in autumn term 2024.



Week 36

Day	Monday 2024-09-02	Tuesday 2024-09-03	Wednesday 2024-09-04	Thursday 2024-09-05	Friday 2024-09-06	
8 :00		Rakentajanaukio 4, R5 Lecture	Otakaari 1, A215 Lecture		Otakaari 1, Y430 Exercise	
:15		Rock Mechanics	Engineering principles for metallurgical processes		Fundamentals of Minerals Engineering and Recycling	
:30						
:45						
9 :00						
:15						
:30			Otakaari 1, U135a Lecture	Otakaari 1, U142 Lecture	Rakentajanaukio 4, R2 Lecture	
:45			Fundamentals of Minerals Engineering and recycling	Fundamentals of Minerals Engineering and recycling	Rock Mechanics	
10 :00						
:15						
:30						
:45						
11 :00						
:15						
:30						
:45						
12 :00			Rakentajanaukio 4, R5 Lecture		Vuorimiehentie 2, C100 Lecture	
:15			Rock Mechanics		Engineering principles for metallurgical processes	
:30						
:45						
13 :00		Opening ceremony of the academic year				
:15		(no teaching in afternoon)				
:30						
:45						
14 :00						
:15						
:30						
:45						
15 :00						
:15						
:30		Aalto Party				
:45		15:30-19:30				
16 :00						
:15		Alvar Aalto park				
:30						
:45						

EMC staff at Aalto

prof. Mikael Rinne,
Rock Mechanics



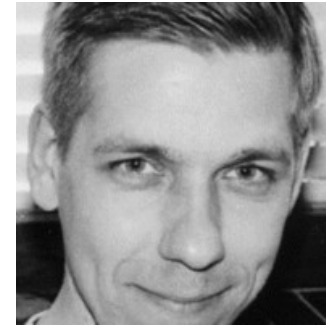
prof. Rodrigo Serna
Guerrero
Minerals Processing



prof. Jussi Leveinen,
Engineering Geology



Lecturer Marko Kekkonen
Metallurgy



Mateusz Janiszewski
University Lecturer
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Otto Hedström,
Laboratory Manager



Stefano De Luca,
Coordinator, School of
Engineering
stefano.deluca@aalto.fi
jointmasters-eng@aalto.fi



Pekka Tolvanen
Planning Officer, School of
Chemical Engineering
pekka.m.tolvanen@aalto.fi



EMC staff

Aachen

prof. Berndt Lottermoser



M.Sc. Yannick Feldmann,
Coordinator



Leoben

Prof. Nikolaus Sifferlinger



Prof. Michael Tost



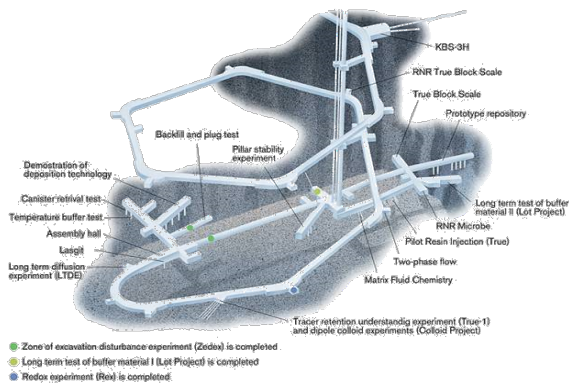
Birgit Knoll, Coordinator



Mikael Rinne

- 1988 DI (MSc), Aalto Univ. (TKK)
- 1987-2008 Consulting and research (Companies in Finland and Sweden)
- 1996-2000 PhD studies at KTH, Sweden
- 2006 – 2008 PhD studies at TKK/Aalto, Finland
- Since 2008 - professor at TKK/ Aalto Univ.

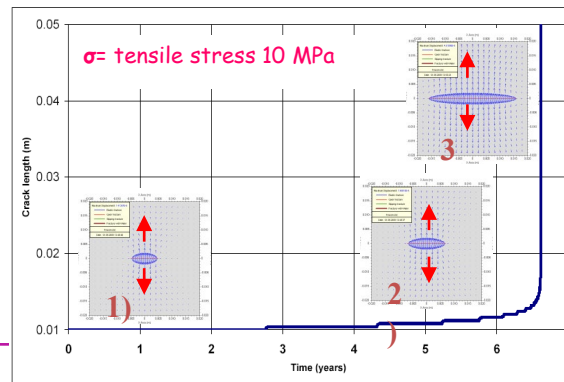
Research on radioactive waste disposal Sweden and Finland (1997-2008)



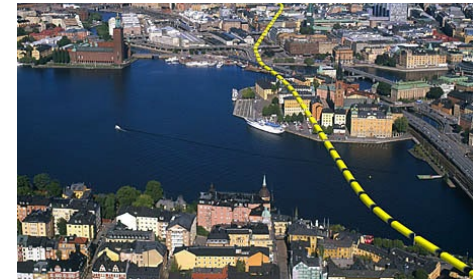
Preliminary design of E18 Muurla-Lohjanharju tunnels (1991-1993)



Doctoral thesis “Time dependent failure model of rock” (2004-2008)



Auditing design of Citybanan railway under Stockholm (2005-2007)



Auditing the geological database of Angouran zink mine, Iran (2001)





Aalto University
School of Engineering

Aalto University

A merger of leading Finnish universities in 2010

Helsinki University of Technology (TKK)

Helsinki School of Economics (HSE)

University of Art and Design Helsinki (TaHK)

A community of:

- 90,000 alumni
- 16,000 students
- 4,400 faculty & staff
- with 390 professors



Art, Business, Science and Technology



**Civil Engineering,
Geoen지니어ing, Mining**

**Mineral processing,
metallurgy, recycling**

School of...

Economics

Art and Design

Engineering

Chemical Engineering

Science

Electrical Engineering



Aalto University
School of Engineering

EMC courses

<https://www.aalto.fi/en/programmes/european-mining-course>

EMC courses at Aalto

1st semester at Aalto University (autumn 2024)

Code	Name	ECTS	Period
CHEM-E6140	Fundamentals of Minerals Engineering and Recycling	5	I
GEO-E2030	Rock Mechanics	5	I
GEO-E3010	Economic Geology and Mineral Economics	5	II
GEO-E3050	Field Experience and Project in Hard Rock Mining	2	II
LC-1317	Integrated Project Communication for MSc Students (o, w) *	3	II
CHEM-E6111**	Engineering Principles for Metallurgical Processes	5	I
CHEM-E6160	Fundamentals of Pyrometallurgy	5	II
Total		30	

EMC courses at Aachen

2nd semester at RWTH Aachen (spring/summer 2025)

Code	Name	ECTS
51.00034	Mine Waste	5
51.00023	Feasibility Studies of Mining Projects	5
51.00035	Mine Design and Simulation	5
51.00008	Mine Ventilation	5
51.49767	Reserve Modelling and Estimation	5
51.00031	Case Study: Mining Project	5
Total		30

EMC courses at Leoben

3rd semester at MU Leoben (autumn/winter 2025)

Code	Name	ECTS
200.111	Continuous Mining Methods and Conveying Technologies in Surface and Underground Mining	3
200.051	Open Pit Mining	4
200.193	Mineral Economics	3
200.147	Occupational and Process Safety	3
200.098	Sustainable development: History of thought, basic concepts and current applications	6
200.044	Underground Mining	4
Optional courses (select 7 ECTS)		
200.149	Artisanal and Small-scale Mining in Development Countries	3
200.059	Excavation Engineering	3
200.148	Marine Mining	2
200.140	Mining in Austria, the European Union and Worldwide	1
200.114	Seminar in Mining Engineering and Mineral Economics	2
Total		30

EMC master's thesis

Main university to supervise:

- **Aalto ENG / CHEM**
- **Aachen**
- **Leoben**

NOTE:

- **You need to follow the instruction for the masters thesis in all three universities**
- **You need have a co-supervisor in all three universities**
- **Your thesis must be approved in all three universities**

<https://www.aalto.fi/en/programmes/european-mining-course/thesis>

Welcome!



Photo by Tuuli Sotamaa
Aalto University



Aalto University
School of Engineering

Mining, studies and research at Aalto ENG

<https://www.aalto.fi/en/programmes/european-mining-course>

Courses at Aalto school of Engineering (ENG)

Rock Mechanics, period I

- Rock and rock mass as material
- Rock stress and its measurements
- Failure mechanisms
- Laboratory and field testing of rock properties.

Field Experience and Project in Hard Rock Mining, period II

- Visits to operating mines & mining equipment manufacturers
- Operation processes are studied and compared
- Students prepare and present reports on selected subjects.
- Integrated Project Communication for MSc Students

Economic Geology & Mineral Economics, period II

- Main rock forming minerals
- Main petrographic characteristics of rocks
- Plate tectonics, ore formation, ore deposits in a genetic system
- Optical properties of the main ore mineral types
- Industrial minerals and their application.



Aalto University
School of Engineering

Research

Research team: Mineral Based Materials and Mechanics

- 6 full-time professors
 - 2 part-time professors (POP)
 - 3 staff scientist
 - 3 lecturers
 - 5 postdocs
 - 11 doctoral researchers
 - 14 part-time teachers/assistants
 - 2 project employees
 - 6 research assistants
 - 9 visitors
- Σ 61 persons (8.3.2023).



Mikael Rinne
Rock Mechanics



Leena Korkiala-Tanttu
Geotechnical Engineering



Augusto Cannone Falchetto, Pavement technology



Jussi Leveinen
Engineering Geology



Wojciech Solowski
Geotechnical Engineering



Jouni Punkki
Concrete technology



Topias Siren
Rock Engineering

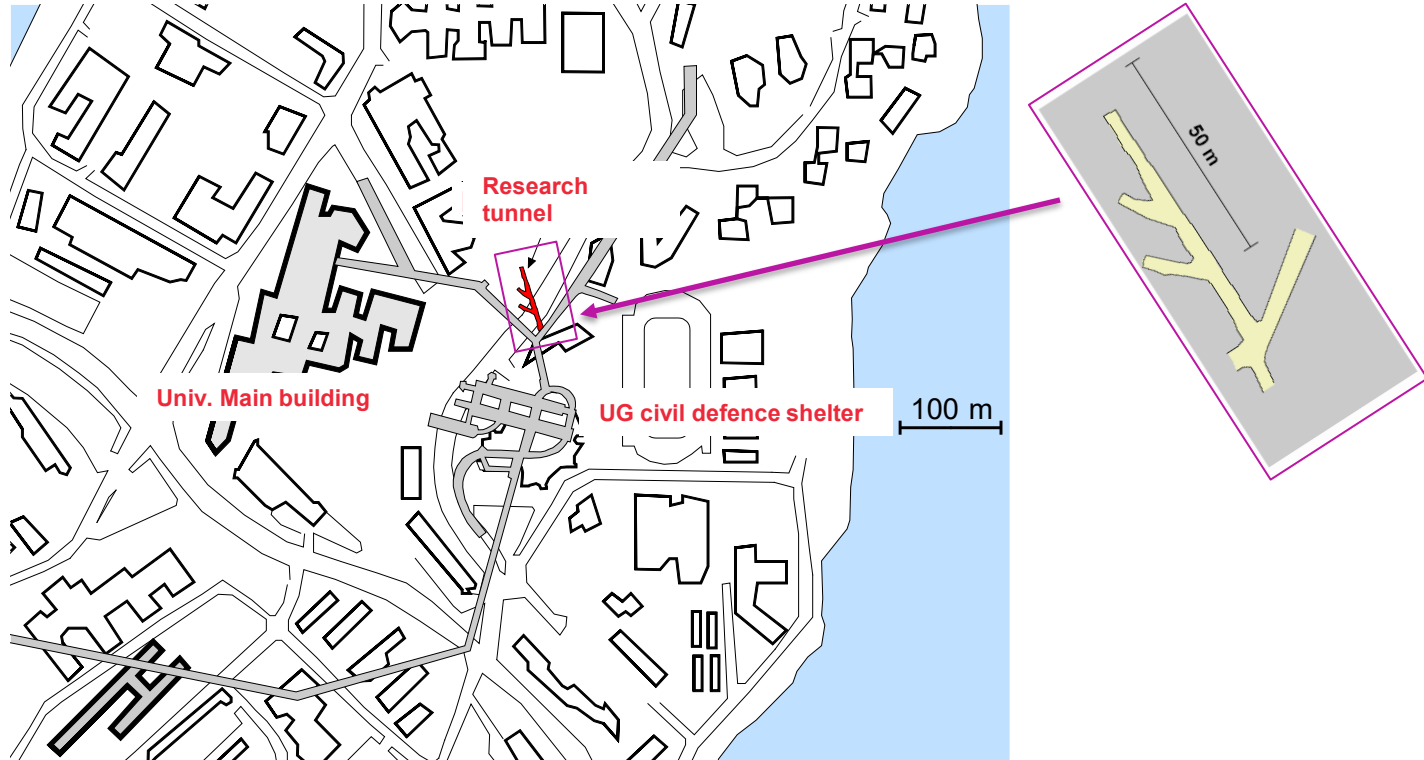


Nina Raitanen
Highway Engineering

Relevant fields of expertise



Research tunnel



Research tunnel

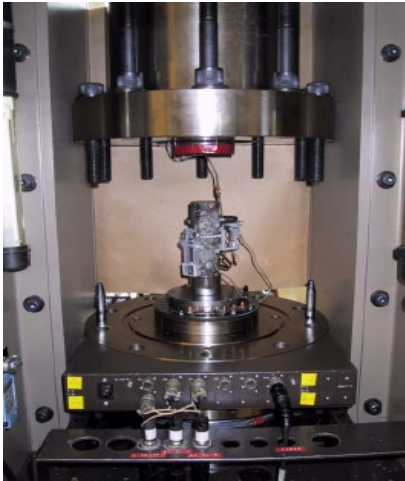
- Drilling, bolting, hauling & loading exercises
- Exercises in geological and geophysical investigations



Rock laboratory

- testing and research

Pressure apparatus MTS 815 for material testing



- Strength and deformation properties of rock, backfill, concrete etc.
 - Nuclear waste disposal
 - Tunnelling projects
 - Mine projects
- Drillability properties of rock
- Frictional properties of rock joints
- Point load strength of rock
- Tilt table device etc



Welcome and info 27.8.2024

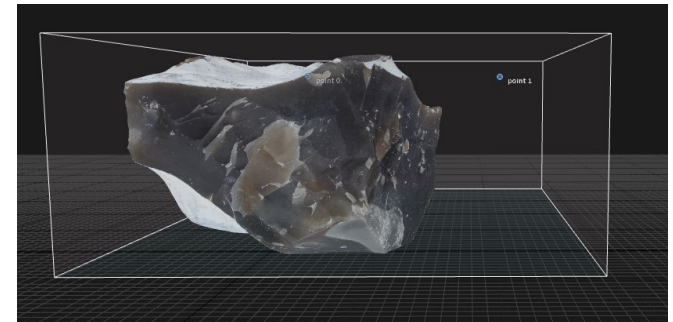
Recent and ongoing research

- **On-line monitoring and risk management in deep mining (Mishra)**
- **Seasonal underground storage of solar thermal energy in hard crystalline rocks (Janiszewski)**
- **Dust distribution from open-pits (Sitkiä)**
- **Geophysical and Geochemical methods for stope design (GAGS, Kiuru)**
Prediction of geotechnical and geochemical conditions for safe and profitable operations.
- **Mechanical Properties of Rock Joints –KARMO / RAKKA (Uotinen, Torkan)**
Photogrammetry and 3D printing technology to study scale-dependency of fracture surface properties and hydro-mechanical properties

AALTO and Virtual Reality based education

Three VR projects: MIEDU, VUTE & KAVI and EDUROCK.

- High-resolution VR stations
- Creation of online VR training environments
- Analysis of effect on mapping (20 students + 11 staff)
- Development of virtual rock collection for education is ongoing



A”

Aalto University
School of Engineering

Mechanical properties of rock joints using photogrammetry

Projects: KARMO, RAKKA, MIRKA.



Dust emission caused by drilling and crushing in rock aggregate and dimensional stone quarries

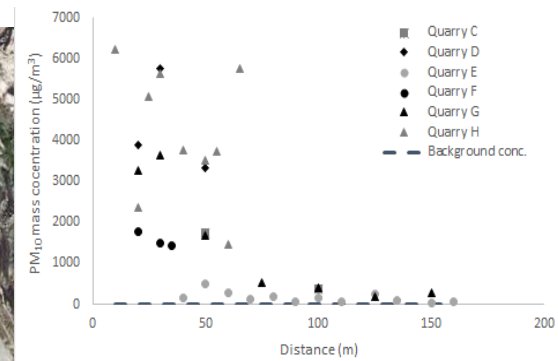


Measurement at downwind distances 40 m and 50 m from the crusher (Sairanen et al 2017)



Predicted concentration contours ($50 \mu\text{g PM}_{10}/\text{m}^3$) according to three models (M. Sairanen, unpublished).

Measured PM₁₀ concentration at downwind direction in quarries C, D, E, F, G and H (Sairanen et al 2017)



Recent and ongoing master's thesis

- **Jonas Heinzler:** Comparison of the blast performance of Ammonium Nitrate/Fuel Oil and emulsion explosives with emphasis on the production of blast fumes in underground salt mining conditions
- **Tamer Gökdemir:** Quantification of deformation trends in a sublevel caving mine using mobile 3D laser scanning
- **Till Guttman:** Influence of mine planning and design on the hydroelectric potential in the Peruvian mining industry
- **Matti Islander:** Improving slope stability through presplit blasting at an open pit mine
- **Sami Naumer:** Numerical modelling of microwave-assisted weakening of rock strength
- **Hannah Weinbach:** Applications of geophysical measuring methods for the exploration and securing of old mine workings near the surface using the example of the former lignite mine
- **Mikko Aarnio:** Effect of shock wave collision on blast induced vibrations in hard rock
- **Eva Hoojdonk:** A visual assessment tool for mine development
- **Pieter de Vries:** A multi-criteria decision-making comparative study for subsurface hydrogen storage
- **Duco van Wassenaar:** The reprocessing of historic mine tailings
- **Sean Klerkx:** Development of an Explosive Energy Distribution Optimization System
- **Richard Meij:** Development of a new smart evacuation modelling technique for underground mines using Mathematical Programming
- **Jasper Krjin:** Breaching behavior of mining face slope during dredge mining operation in tailings
- **Christopher Kühlbach:** Industrial Internet of Things implementation of a discontinuous extraction process from loading to dumping on the example of a diabase quarry

Thank you!