

LMS | ACTIVITY REPORT 2022

Courses taught

BA, MA and Doctoral level at EPFL

The column "Credits / Coeff." indicates Coefficient for first-year students (BA1-2), Credits for the others

Spring semester 2022

Teacher(s)	Code	Course title	Section-Semester	Credits / Coeff.	Student number
Laloui, Lyesse (LMS); Fernandez Andrino, Juan (SAR-ENS); Nguyen, Richard (SAR-ENS); Molinas, Margaux (EML)	PENS-211	Terra Epidermis	ENAC-BA4	4	23
Laloui, Lyesse (LMS)	CIVIL-444	Energy geostructures	GC-MA2, GC-MA4	4	5
Ferrari, Alessio (LMS)	CIVIL-530	Slope stability	GC-MA2, GC-MA4	3	6

Fall semester 2022

Teacher(s)	Code	Course title	Section-Semester	Credits / Coeff.	Student number
Terzis, Dimitrios (LMS)	CIVIL-424	Innovation for construction and the environment	GC-MA1, GC-MA3	3	30

Additional teaching

Teacher(s)	Course title	Section-Semester	Credits	Student number	Institution where taught (if not EPFL)	Additional information on external institution(s)
Ferrari, Alessio (LMS)	A Resilient Future: Science and Technology for Disaster Risk Reduction	EPFLx - edX Course				Silvia Hostettler, Cooperation & Development Center, EPFL
Nussbaum, Christophe (SGC-ENS)	Engineering geology for geo-energy.	Civil Engineering, master 2	3			Federal Office of Topography, swisstopo.

Teacher(s)	Course title	Section-Semester	Credits	Student number	Institution where taught (if not EPFL)	Additional information on external institution(s)
Tuttolomondo, Angelica (LMS)	Lecturer ???					

Postdoc works (completed in 2022 or ongoing)

Advisee	Research topic	Starting (month/year)	End, if known (month/year)	Supervisor(s)	Institution(s) involved (if not EPFL)	Additional information on external institution(s) involved
Bosch Llufrü, Jose Antonio (LMS)	Bio-chemo-hydro-mechanical modelling of microbially induced cementation in soils.	06/2021		Laloui, Lyesse (LMS)		
Burns, Eric Wasson						
Houhou, Roba (LMS)	Desiccation Cracking of biocemented clays.	05/2021	08/2022	Laloui, Lyesse (LMS)		
Perolo, Pascal	Projet « 532520 », « CLIMACT », « The unseen processes of Enhanced Weathering ».	11/2022	12/2022	Laloui, Lyesse (LMS)	Université de Lausanne (UNIL), CH (Swiss Universities and Research Centers)	
Ravera, Elena (LMS)	Energy geostructures.	12/2021		Laloui, Lyesse (LMS)		
Stavropoulou, Eleni (LMS)	Impact of CO ₂ on the sealing capacity of caprock representative shale	09/2019		Laloui, Lyesse (LMS)		
Terzis, Dimitrios (LMS)	Bio-cementation.	09/2019		Laloui, Lyesse (LMS)		
Tuttolomondo, Angelica (LMS)	Scale effects in Opalinus Clay. New insights in the analysis and prediction of the mechanical behavior of compacted expansive clays as engineered barriers. In-situ stress estimation methodologies. Cavitation in undrained processes. She is now PhD supervisor and lecturer.	03/2021	08/2022	Laloui, Lyesse (LMS)		

EPFL PhD theses (completed in 2022 or ongoing)

Advisee	Thesis title	Doctoral Program	Enrolment date	Estimated completion year	Advisor	Co-advisor	Other(s)	Institution(s) involved (if not EPFL)	Additional information on external institution involvement
Babiy, Svetlana (LMS)	New insights for chemo-hydro-mechanical modelling of engineered geotechnical barriers	EDCE	01.02.2022		Laloui, Lyesse (LMS)	-			
Elmaloglou, Ariadni (LMS)	Influence of pore-scale heterogeneity on the precipitation patterns in Microbially Induced Calcite Precipitation (MICP)	EDME	01.09.2018	2023	Laloui, Lyesse (LMS)	Terzis, Dimitrios (LMS)			
Fuselier, Héloïse (LMS)	Thermo-hydro-mechanical behaviour of the Callovo-Oxfordian claystone under thermal changes	EDME	01.04.2020		Laloui, Lyesse (LMS)	Ferrari, Alessio (LMS)			
Harran, Ray (LMS)	Mechanical performance and upscaling of bio-improved soils	EDME	01.10.2018	2022	Laloui, Lyesse (LMS)	Terzis, Dimitrios (LMS)			
Kim, Jinwoo (LMS)	Swelling and shrinkage of partially saturated gas shales: from laboratory tests to an effective stress framework	EDME	01.12.2018	2022	Laloui, Lyesse (LMS)	Ferrari, Alessio (LMS)			
Kim, Taeheon (LMS)	INVESTIGATION OF THE EFFECT OF MINERAL DISSOLUTION ON THE GEOMECHANICAL BEHAVIOUR OF GEOMATERIALS	EDME	01.10.2018	2022	Laloui, Lyesse (LMS)	Ferrari, Alessio (LMS)			
Lee, Yoonsung (EDCE)		EDCE	01.05.2022	2022	Laloui, Lyesse (LMS)	-			Did not finished

Advisee	Thesis title	Doctoral Program	Enrolment date	Estimated completion year	Advisor	Co-advisor	Other(s)	Institution(s) involved (if not EPFL)	Additional information on external institution(s) involved
Llabjani, Qazim (LMS)	Gas-Induced Impacts on the Barrier Integrity of Deep Geological Repository of Radioactive Wastes	EDME	01.12.2020		Laloui, Lyesse (LMS)	Ferrari, Alessio (LMS)			
Wang, You	NUMERICAL AND EXPERIMENTAL STUDY ON CYCLIC BEHAVIORS OF MICP-TREATED SOILS	EDME	01.06.2021	2022	Laloui, Lyesse (LMS)	-			Did not finished
Wojnarowicz, Matthias (LMS)	Performance assessment of FEM models to simulate THM effects in the rock around the FE-tunnel	EDME	16.03.2020		Laloui, Lyesse (LMS)	Madaschi, Aldo			

External PhD students who will receive their PhD diploma from another university (completed in 2022 or ongoing)

Advisee	Thesis title	Doctoral Program	Completion year	Advisor(s)	Co-advisor(s)	Other(s)	Institution(s) involved (if not EPFL)	Additional information on external institution(s) involved
Lu, Xingbang (LMS)	The constitutive model for under-consolidated soft clay and hydromechanical analysis of deep excavation in under-consolidated clayey deposit.		2024	Laloui, Lyesse (LMS)			Tongji University, CN (World Universities and Research Centers)	

Advisee	Thesis title	Doctoral Program	Completion year	Advisor(s)	Co-advisor(s)	Other(s)	Institution(s) involved (if not EPFL)	Additional information on external institution(s) involved
Vespo, Vincenzo Sergio (LMS)	Geomechanical effects of CO2 injection on caprock.		2023	Ferrari, Alessio (LMS)			Polytechnic University of Turin, IT (European Universities and Research Centers)	

Master diploma projects in Civil Engineering, Environmental Engineering and other programs (started in spring or fall 2022)

Advisee(s)	Project title	Section-Semester	Advisor(s)	Co-advisor(s)	Institution(s) involved (if not EPFL)	Additional information on external institution(s) involved
Schaufelberger, Annik Julia (LMS)	Influence of convective heat transfer on the storage performance of an energy tunnel	GC-PME	Laloui, Lyesse (LMS)			
Siwar, Othmane (GC-PMH)	Calcul inverse des caractéristiques structurelles des chaussées routières à partir de mesures de déflexion mesurées avec des véhicules d'auscultation à grand rendement	GC-PMH	Laloui, Lyesse (LMS)			
Tomcik, Christopher (GC-PME)	Conception intégrée d'un système de captage et de valorisation de la chaleur fatale à basse température en milieu souterrain	GC-PME	Laloui, Lyesse (LMS)			

Master diploma projects in Architecture (completed in spring 2022, retrieved from Infoscience)

Empty category

Prestudies of master projects in Civil Engineering (completed in fall

2022)

Advisee(s)	Project title	Section-Semester	Tutors(s)	Other advisor(s)	Institution(s) involved (if not EPFL)	Additional information on external institution(s) involved
Gouin, Judith Hélène (GC-MA3)	Etude géotechnique de la section Casernes-Blécherette du M3	GC-MA3	Laloui, Lyesse (LMS)			
Siwar, Othmane (GC-PMH)	Calcul inverse des caractéristiques structurelles des chaussées routières à partir de mesures de déflexion mesurées avec des véhicules d'auscultation à grand rendement	GC-PMH	Laloui, Lyesse (LMS)			

Theoretical statements of master projects in Architecture (completed in January 2022, retrieved from Infoscience)

Empty category

Semester projects (completed in 2022)

Advisee(s)	Project title	Section-Semester	Tutor(s)	Other advisor(s)	Institution(s) involved (if not EPFL)	Additional information on external institution(s) involved
Burgaud, Alexandre (GC-MA1)	Laboratoire GC: Hydro-mechanical characterisation of the bentonite/steel interface in the context of radioactive waste storage	GC-MA1	Ferrari, Alessio (LMS)			
Gouin, Judith Hélène (GC-MA3)	Projet de construction: Modeling a tunnel excavation in an anisotropic material, an assessment for nuclear waste repositories	GC-MA2	Laloui, Lyesse (LMS)			
Montarnal, Odile Gabrielle (GC-MA1)	Laboratoire GC: Geomechanics for radioactive waste storage: Impact of temperature on the host-rock	GC-MA1	Laloui, Lyesse (LMS)			

Advisee(s)	Project title	Section-Semester	Tutor(s)	Other advisor(s)	Institution(s) involved (if not EPFL)	Additional information on external institution(s) involved
Naftalski, Jean Vincent Daniel (GC-MA3)	Projet de construction: Modeling a tunnel excavation in a elasto-plastic material: an assessment for nuclear waste repositories	GC-MA4	Laloui, Lyesse (LMS)			

Other supervisions

Advisee	Type of supervision	Work topic	Starting (month/year)	End, if known (month/year)	Supervisor(s)	Institution(s) involved (if not EPFL)	Additional information on external institution(s) involved
Birbaum, Julien (LMS)	Apprenticeship	Apprentice, laborant en physique.	08/2022		Dubey, Patrick (LMS); Laloui, Lyesse (LMS)		
Gros, Léna Ollivia Emma	Internship	?	06/2022	09/2022	Laloui, Lyesse (LMS)	Université de Lorraine, FR (European Universities and Research Centers)	
Loubane, Hamza	Internship	Coupled geochemical and geomechanical analysis of basalts during injection of dissolved CO2.	02/2022	06/2022	Laloui, Lyesse (LMS); Stavropoulou, Eleni (LMS)	Université Grenoble Alpes, FR (European Universities and Research Centers)	
Peltier, Margaux Marie Valérie (LMS)	Others	Scientific assistant / Development of geothermal-inspired technologies for existing built environments	01/2019	12/2022	Laloui, Lyesse (LMS)		

Advisee	Type of supervision	Work topic	Starting (month/year)	End, if known (month/year)	Supervisor(s)	Institution(s) involved (if not EPFL)	Additional information on external institution(s) involved
Romanens, Natacha (LMS)	Apprenticeship	Apprentice, laborant en physique	08/2019		Laloui, Lyesse (LMS); Dubey, Patrick (LMS)		
Thoumyre, Charles	Others	Construction & Environmental Biocementation in Real World Application.	02/2021	01/2022	Laloui, Lyesse (LMS)		

COVID impacts on your activities

Empty category

Funded research projects

Title	Principal Investigator (PI)	Co-PI(s)	EPFL coordinator	Funding organisation; Program	Granted amount (CHF)	Starting date	Duration (Months)	Status	in
Assessing and exploiting the interaction between ventilation and geothermal systems in energy tunnels	LALOUI Lyesse	Ten Bosch Sofie	LALOUI Lyesse	Off. Conf.; Innosuisse	62,591 out of 62,591	01.01.2022	12	Completed	
The unseen processes of enhanced weathering.	LALOUI Lyesse		LALOUI Lyesse	Divers; CLIMACT	40,790 out of 49,833	01.11.2021	12	Completed	
Phase 27 - Experimental assessment of shale properties for safe geological CO2 storage	LALOUI Lyesse		LALOUI Lyesse	Non lucr.; Mont Terri	10,000 out of 10,000	01.08.2021	12	Completed	
Enerdrape : Transforming underground parking into heat exchangers	Peltier Margaux Marie Valérie	Peltier Margaux Marie Valérie	LALOUI Lyesse	FNS; BRIDGE	178,912 out of 178,912	01.11.2020	19	Completed	
Construction & Environmental Biocementation in REal World Applications	LALOUI Lyesse		LALOUI Lyesse	H2020; Excellent Science	162,150 out of 162,150	01.02.2021	18	Completed	
BEACON - Bentonite Mechanical Evolution	Ferrari Alessio	LALOUI Lyesse	Ferrari Alessio	Autres EU; Euratom	268,193 out of 4,131,368	01.06.2017	60	Completed	

Title	Principal Investigator (PI)	Co-PI(s)	EPFL coordinator	Funding organisation; Program	Granted amount (CHF)	Starting date	Duration (Months)	Status	in
THM-model validation in the context of the FE modelling Task Force	Lyesse LALOU			; NAGRA National Cooperative for the Disposal of Radioactive Waste	180,000 out of 180,000	01.01.2019	36	Industrial contract	
Geomechanical behavior of Opalinus Clay: time-dependent, scale effects and constitutive model validation	Lyesse LALOU			; NAGRA National Cooperative for the Disposal of Radioactive Waste	300,000 out of 300,000	01.11.2019	32	Industrial contract	
Support in geomechanical test analysis: planning, evaluation and synthesis of tests from cores of deep boreholes	Lyesse LALOU			; NAGRA National Cooperative for the Disposal of Radioactive Waste	117,000 out of 117,000	01.05.2020	24	Industrial contract	
Extension of research activities within the FE-M Task Force	Lyesse LALOU			; NAGRA National Cooperative for the Disposal of Radioactive Waste	50,000 out of 50,000	01.07.2021	18	Industrial contract	
Extension of research activities of the LMS/EPFL activities for studying hydraulic and 2-phase flow behaviour of NUMO cores	Lyesse LALOU			; NAGRA National Cooperative for the Disposal of Radioactive Waste	30,000 out of 30,000	01.10.2021	3	Industrial contract	

Title	Principal Investigator (PI)	Co-PI(s)	EPFL coordinator	Funding organisation; Program	Granted amount (CHF)	Starting date	Duration (Months)	Status	in
Extension of Opalinus Clay constitutive model (eADP) to viscoplastic and non-isothermal conditions	Lyesse LALOU			; NAGRA National Cooperative for the Disposal of Radioactive Waste	90,000 out of 90,000	15.03.2022	18	Industrial contract	
Second extension of research activities within the FE-M Task Force	Lyesse LALOU			; NAGRA National Cooperative for the Disposal of Radioactive Waste	50,000 out of 50,000	01.03.2022	8	Industrial contract	
2nd tranche of research activities within the FE-M Task Force	Lyesse LALOU			; Nagra	50,000 out of 50,000	01.11.2022	12	Industrial contract	
Hydro-mechanical behaviour and 2-phase flow behavior of crushed Opalinus Clay	Lyesse LALOU			; NAGRA National Cooperative for the Disposal of Radioactive Waste	40,000 out of 40,000	01.12.2022	6	Industrial contract	
Express: a high-speed metro for a sustainable mobility in the Alpes	Jaboyedoff Michel		LALOU Lyesse	Divers; CLIMACT	24,383 out of 48,992	01.10.2022	12	Ongoing	
CS-C Experiment, Phase 28: Experimental assessment of shale properties for safe geological CO2 storage	LALOU Lyesse	Stavropoulou Eleni	LALOU Lyesse	Non lucr.; Mont Terri	10,000 out of 10,000	01.08.2022	12	Ongoing	

Title	Principal Investigator (PI)	Co-PI(s)	EPFL coordinator	Funding organisation; Program	Granted amount (CHF)	Starting date	Duration (Months)	Status	in
Demonstration and upscaling of carbon dioxide storage solutions for a net-zero Switzerland: DemoUpStorage	LALOUI Lyesse	Stavropoulou Eleni	LALOUI Lyesse	Off. Conf.; Divers Confédération	90,000 out of 497,710	01.08.2022	24	Ongoing	
New insights in the analysis and prediction of the mechanical behavior of compacted expansive clays as engineered barriers	LALOUI Lyesse		LALOUI Lyesse	FNS; FNS-Project Funding	672,139 out of 672,139	01.11.2021	48	Ongoing	
European Joint Programme on Radioactive Waste Management	GARCIA Marie	LALOUI Lyesse	Ferrari Alessio	H2020; Other	273,862 out of 35,142,221	01.06.2019	60	Ongoing	
Comportement Thermo-Hydro-Mechanique du Callovo-Oxfordien sous chargement thermique	LALOUI Lyesse		LALOUI Lyesse	INT Governmental; ANDRA	307,500 out of 307,500	01.08.2019	48	Ongoing	
BIOGEOS - Bio-mediated Geo-material Strengthening for engineering applications	LALOUI Lyesse		LALOUI Lyesse	H2020; Excellent Science	2,991,544 out of 2,991,544	01.11.2018	66	Ongoing	
Bio Inspired Geotechnical Applications to Launch Pan-European Solutions	LALOUI Lyesse		LALOUI Lyesse	; SERI	933,508 out of 2,690,345	27.09.2022		Pending	

Title	Principal Investigator (PI)	Co-PI(s)	EPFL coordinator	Funding organisation; Program	Granted amount (CHF)	Starting date	Duration (Months)	Status	in
LABS: Living and Assembling Building Systems	Terzis Dimitrios		Lignos Dimitrios	; FNS-transitional mea	1,799,941 out of 1,799,941	01.02.2022		Rejected	

Other funded research projects

Empty category

Funded equipment

Empty category

Research facilities

Empty category

Awards

Empty category

Publications & Presentations

Resources retrieved from Infoscience

Journal articles

Data	Peer reviewed	Key
Loria A. F. R., Richard N., Laloui L., Analysis of barrette foundations subjected to mechanical and thermal loads , in Geomechanics For Energy And The Environment , vol. 32, p.100333 , 2022, Abstract: yes, Status: published	✓	
Escoffler N., Perolo P., Many G., Pasche N. T., Perga M.-E., Fine-scale dynamics of calcite precipitation in a large hardwater lake , in Science Of The Total Environment , vol. 864, p.160699 , 2023, Abstract: yes, Status: published	✓	
Ferrari A., Rosone M., La Rosa S., Sapienza G., Microstructural characterization of a 3D-printed soil , in Soils and Rocks , vol. 45, num. 4 , 2022, Abstract: yes, Status: published	✓	
Stavropoulou E., Laloui L., Insights into the interaction of a shale with CO2 , in Solid Earth EGUsphere , 2022-12-05, Abstract: yes, Status: published	✓	
Elmaloglou A., Terzis D., De Anna P., Laloui L., Microfluidic study in a meter-long reactive path reveals how the medium's structural heterogeneity shapes MICP-induced biocementation , in Scientific Reports , vol. 12, p.19553 , 2022-11-15, Abstract: yes, Status: published	✓	
Houhou R., Mjahed R. B., Sadek S., Najjar S., Drained Axial Pipe-Soil Resistance at Low Confinement Using Tilt Table and Direct Shear Tests , in Journal Of Geotechnical And Geoenvironmental Engineering , vol. 148, num. 11, p.04022086 , 2022, Abstract: yes, Status: published	✓	
Rosone M., Ferrari A., Role of Stress History on the Swelling-Shrinkage Behavior of Compacted Scaly Clay , in International Journal Of Geomechanics , vol. 22, num. 9, p.04022135 , 2022, Abstract: yes, Status: published	✓	
Harran R., Terzis D., Laloui L., Characterizing the Deformation Evolution with Stress and Time of Biocemented Sands , in Journal of Geotechnical and Geoenvironmental Engineering , vol. 148, num. 10, p.1-12, 04022074 , 2022-07-20, Abstract: yes, Status: published	✓	
Speranza G., Ferrari A., Lassalle P. L., Life cycle environmental assessment of retaining walls in unsaturated soils , in Geomechanics For Energy And The Environment , vol. 30, p.100241 , 2022, Abstract: yes, Status: published	✓	
Stavropoulou E., Laloui L., Evaluating CO2 breakthrough in a shaly a caprock material: a multi-scale experimental approach , in Scientific Reports , vol. 12, num. 10706 , 2022-06-23, Abstract: yes, Status: published	✓	
Ravera E., Laloui L., Failure mechanism of fine-grained soil-structure interface for energy piles , in Soils and Foundations , vol. 62, num. 3, p.101152 , 2022, Abstract: yes, Status: published	✓	
Houhou R., Laloui L., Geomechanics for Energy and the Environment: Current Developments , in Geomechanics for Energy and the Environment , p.100345 , 2022-04-06, Abstract: yes, Status: published	✓	
Ferrari A., Bosch Llufrui J. A., Barylá P. E., Rosone M., Volume change response and fabric evolution of granular MX80 bentonite along different hydro-mechanical stress paths , in Acta Geotechnica , vol. 17, p.3719–3730 , 2022-02-12, Abstract: yes, Status: published	✓	

Data	Peer reviewed	Key
Crisci E., Ferrari A., Laloui L., Discussion on "Experimental Deformation of Opalinus Clay at Elevated Temperature and Pressure Conditions: Mechanical Properties and the Influence of Rock Fabric" of Schuster, V., Rybacki, E., Bonnelye, A., Herrmann, J., Schleicher, AM, Dresen, G., in Rock Mechanics And Rock Engineering , vol. 55, p.463–465 , 2022, Abstract: yes, Status: published	✓	

Conference papers

Data	Peer reviewed	Key
Stavropoulou E., Laloui L., Visualising the coupled mechanics of CO2 breakthrough , 2nd International Conference on Energy Geotechnics (ICEGT 2020) , California, USA, September 20-23, 2020, Abstract: no	✓	
Tuttolomondo A., Ferrari A., Laloui L., Editor(s):McCartney J..S., Effective stress concept for mechanical modeling of clays under different environmental conditions , 2nd International Conference on Energy Geotechnics (ICEGT 2020) , La Jolla, California, US, September 20-23, 2020, Abstract: no	✓	

Theses

Data	Key
Kim J., Advisor(s): Laloui L., Ferrari A., Swelling and shrinkage of partially saturated gas shales: from laboratory tests to an effective stress framework , Thèse EPFL, n° 10149, 2022, Abstract: yes, Status: submitted	
Kim T., Advisor(s): Laloui L., Ferrari A., Investigation of the effect of mineral dissolution on the geomechanical behaviour of geomaterials , Thèse EPFL, n° 9989, 2022, Abstract: yes, Status: submitted	
Harran R., Advisor(s): Laloui L., Terzis D., Mechanical performance and upscaling of bio-improved soils , Thèse EPFL, n° 9990, 2022, Abstract: yes, Status: published	

Other Open Resources

Other Open Teaching Resources

Empty category

Other Open Research Datasets

Dataset	Which sustainability challenges does the project tackle?
Domain: Name: Evaluating CO2 breakthrough in a shaly caprock material: a multi-scale experimental approach Provider: Eleni Stavropoulou; Lyesse Laloui Format: .tif, .zip Coverage: Scale: Privacy: CC-BY-4.0 Link to data or DOI: https://doi.org/10.5281/zenodo.5939022 Dataset type: Description (optional): These are image datasets analysed in the publication "Evaluating CO2 breakthrough in a shaly a caprock material: a multi-scale experimental approac...	

Dataset	Which sustainability challenges does the project tackle?
Domain: Name: Insights into the interaction of a shale with CO2 Provider: Stavropoulou, Eleni; Laloui, Lyesse Format: .zip Coverage: Scale: Privacy: CC-BY-4.0 Link to data or DOI: https://doi.org/10.5281/zenodo.7330453 Dataset type: Description (optional): These are image datasets analysed in the publication "Insights into the interaction of a shale with CO2" by Stavropoulou and Laloui in 2022 in Scie...	

Open research scripts and software

Empty category

Open Research scripts and software - Important recent additions

Empty category

Any other open research highlights from your lab?

Empty category

Outreach

Current ongoing collaborations

People involved at ENAC & EPFL wide	Collaborating institution(s) (if not EPFL)	Additional information on cooperation partner(s)	Project topic/Description, Financial support (CHF) if any	Collaboration includes...	Which sustainability challenges does the collaboration tackle?
Laloui, Lyesse (LMS)	Swiss Competence Center for Energy Research (SCCER-SoE), CH (Swiss Universities and Research Centers)	Swiss Competence Center for Energy Research – Supply of Electricity (SCCER-SoE)	Geothermal energy and CO2 storage	joint publication(s)	
Laloui, Lyesse (LMS); Ferrari, Alessio (LMS)	Chevron Corporation, US (Private sector)	CHEVRON	Geomechanical characterization of gas shales	joint publication(s)	
Laloui, Lyesse (LMS); Ferrari, Alessio (LMS)	National Cooperative for the Disposal of Radioactive Waste (NAGRA), CH (Private sector)	NAGRA	Experimental and constitutive analysis of the Opalinus Clay shale	joint publication(s)	

Innovation – Technology Transfer – Start-ups

Empty category

Distinguished work

Empty category

Appointments at other institutions

Name	Title	Institution	Additional information on institution
Ferrari, Alessio (LMS)	Associate professor	University of Palermo, IT (European Universities and Research Centers)	
Laloui, Lyesse (LMS)	Adjunct professor	Duke University, US (World Universities and Research Centers)	

Visiting scholars

Visitor	Home Institution	Additional information on home institution	Aim of visit, Duration
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Visitor	Home Institution	Additional information on home institution	Aim of visit, Duration
Di Donna, Alice	Université Grenoble Alpes, FR (European Universities and Research Centers)		April. Development of new approaches and methodologies for the geotechnical design of energy geostructures using machine-learning techniques and to adapt algorithms of machine learning able to predict the mechanical response of energy geostructures, starting from a training phase based on real scale data and numerical result (to be focused first on energy piles).
Prodan, Iulia	Technical University of Cluj-Napoca, RO (European Universities and Research Centers)		3 months. Energetic geostructures.
Rotta Loria, Alessandro Francesco	Northwestern University, US (World Universities and Research Centers)		3 months. Geomechanics for energy production and storage and preparation of a new book.

Alumni

Empty category

Distinguished alumni

Alumnus	Achievement / Distinction
Peltier, Margaux Marie Valérie (LMS)	all the prize ???

Organization of events

Date (month)	Location (if held in person)	Event title	Key people in lab involved	Description / URL
11/2022	Bois Chamblard	ISSMGE Europe National Assemblies Meetings	Laloui, Lyesse (LMS); Smith, Brendan (LMS); Tinguely, Barbara (LMS)	

Invited talks and contributions to events

Empty category

News / Actus

News channel	Title, Date	Heading	Authors	Links	Which sustainability challenges does the news tackle?
LMS	The Laloui Group Releases Its Annual Report for 2021 20.01.2022	"COVID-19 has highlighted the need to work together as a global society... if we are to solve the existential threats of the 21st century"			

News channel	Title, Date	Heading	Authors	Links	Which sustainability challenges does the news tackle?
LMS	Civil engineering “that will change the world” 07.02.2022	“Millions of years ago some bacteria tried to reach for the sun and they made it.”		Dr. Terzis’ full TEDx talk	
LMS	A new innovation project with Amberg Engineering: ventilation systems 07.02.2022	Energy geostructures are an innovative way to produce renewable heating and/or cooling energy for our cities. They can be used in a variety of installation settings including within existing road and rail transportation tunnels.		Energy Geostructures at the Lemman Express railway	
LMS	«Ça me donne de l'espoir d'avoir 18 ans aujourd'hui» 07.03.2022	Natacha Romanens poursuit à l'EPFL sa troisième année d'apprentissage de laborante en physique au Laboratoire de mécanique des sols.	Brouet Anne-Muriel		
LMS	Professeur Laloui classé dans les 1000 meilleurs scientifiques 01.04.2022	Le Professeur Laloui se place dans les 1000 meilleurs scientifiques en Ingénierie et Technologie	LMS	Reserach.com. Les 1000 meilleurs scientifiques en Ingénierie et Technologie	
LMS	LMS à l'honneur dans le Dimensions Magazine de l'EPFL 04.04.2022	« Les physiques que nous mettons dans nos modèles doivent être très, très forte et nos outils numériques de prédiction très capable. »		Energie 2050: comment sortir du carbone	
LMS	LMS-EPFL to join Mont Terri Project 07.04.2022	LMS to bring its expertise to this international project for the deep geological disposal of radioactive waste and geological storage of CO2.	Smith Brendan		
LMS	The Laloui Group on show in San Diego 14.04.2022	The group had a strong presence at the 2nd ICEGT event in San Diego with a keynote address from Prof. Laloui and strong contributions from the rest of the team.	Smith Brendan	Conference Proceedings	
LMS	Professor Lyesse Laloui delivers Vienna Terzaghi Lecture 19.04.2022	Professor Lyesse Laloui delivers the prestigious Vienna Terzaghi Lecture for 2022	Smith Brendan		

News channel	Title, Date	Heading	Authors	Links	Which sustainability challenges does the news tackle?
LMS	<i>The Laloui Group joins Swiss project into carbon capture and storage</i> 02.05.2022	Professor Laloui's Laboratory of Soil Mechanics to contribute to exploring the potential storage of CO2 deep underground in Iceland		DemoupCARMA website	
LMS	<i>Laloui Group Start-Up featured on RTS' Forum program</i> 03.05.2022	Enerdrape CEO Margaux Peltier appears on Swiss public radio to discuss the successful trial of Enerdrape's geoenery panels.	Smith Brendan	Enerdrape ; RTS Forum Program	
LMS	<i>Enerdrape, a solution for Switzerland's energy challenges?</i> 02.06.2022	Enerdrape appears in Le Temps feature on the challenges in the Swiss energy sector	Smith Brendan	Access the article ; Enerdrape website	
LMS	<i>Enerdrape, a solution for Switzerland's energy challenges?</i> 02.06.2022	Enerdrape appears in Le Temps feature on the challenges in the Swiss energy sector	Smith Brendan	Enerdrape website ; Read article	
LMS	<i>Enerdrape takes the PERL prize for best innovative company</i> 02.06.2022	Enerdrape featured in 24 Heures and Handelszeitung as winner of PERL	Smith Brendan	25 heures article ; Enerdrape Website ; Handelszeitung article ; PERL website	
LMS	<i>Medusoil target global expansion</i> 20.09.2022	With a recent order for 4 tons of soil additives successful delivered, Medusoil is now turning its sights on the global market.	Smith Brendan	24 heures article ; Medusoil website	
LMS	<i>Medusoil target global expansion</i> 23.06.2022	With a recent order for 4 tonnes of soil additives successful delivered, Medusoil is now turning its sights on the global market.	Smith Brendan	24 Heures article ; Medusoil	
LMS	<i>Professor Lyesse Laloui awarded a doctorate honoris causa</i> 21.06.2022	The Director of The Laloui Group has once again been recognized for his outstanding contribution to the field of geomechanics with an honoris causa from Heriot-Watt University in Edinburgh.	Smith Brendan	Heriot-Watt University news story	

News channel	Title, Date	Heading	Authors	Links	Which sustainability challenges does the news tackle?
LMS	2023 Intensive Course on Energy Geostrutures: 5th edition 05.07.2022	The annual intensive Course on Energy Geostrutures: Analysis and Design for 2023 is now open for applications.	Smith Brendan	Course link	
LMS	The Laloui Group joins Swiss project on carbon capture and storage 24.08.2022	Professor Laloui's Laboratory of Soil Mechanics to contribute to exploring the potential storage of CO2 deep underground in Iceland	Smith Brendan	DemoupCARMA website	
LMS	Laloui Group research key to NAGRA site selection 20.09.2022	Keen media interest in EPFL's Laboratory of Soil Mechanics following Switzerland's radioactive waste disposal site selection.	Smith Brendan	Le Temps ; RSI Modem Program ; RTS Forum Program	
LMS	Un métro à grande vitesse dans les Alpes Suisse ? 08.11.2022	Un nouveau projet mené par l'EPFL et conduit par le Prof. L. Laloui (LMS) et l'UNIL avec le Prof. M. Jaboyedoff (ISTE) vise à explorer le potentiel usage de transport à grande vitesse en montagne pour promouvoir le tourisme Alpin durable ainsi que d'aider les communautés régionales à rester attractives afin de ralentir l'urbanisation croissante. Alors que la population de nos villes ne fait qu'augmenter, souvent au détriment des collectivités régionales, L'EPFL et l'UNIL cherchent de potentielles solutions afin de connecter les collectivités alpines régionales aux voies de transport à grande vitesse de la manière la plus durable possible.	Smith Brendan	EPFL LMS ; Swiss mobility blog (French) ; UNIL ISTE	
LMS	Professor Lyesse Laloui awarded a doctorate honoris causa 10.11.2022	The Director of The Laloui Group has been recognized for his ongoing contributions to geotechnical engineering solutions for a sustainable world with an honoris causa from the Technical University of Cluj-Napoca.	Smith Brendan	Watch the ceremony	
LMS	LMS Master's student awarded the 2022 RIE Prize. 18.11.2022	Annik Schaufelberger has received the 2022 RIE Prize for her Master's thesis in Civil Engineering at EPFL on storing thermal energy in the ground using underground infrastructure.	Smith Brendan	RIE	

News channel	Title, Date	Heading	Authors	Links	Which sustainability challenges does the news tackle?
LMS	<i>Une puce permet d'étudier la formation du biociment en temps réel</i> 05.12.2022	Des scientifiques de l'EPFL et de l'Université de Lausanne ont utilisé une puce initialement conçue pour les sciences de l'environnement afin d'étudier les propriétés de la formation du biociment. Ce dernier a le potentiel de remplacer les liants traditionnels du ciment dans certaines applications de génie civil.	Perroud Sandrine	Environmental Fluid Mechanics ; Laboratoire de mécanique des sols (LMS) ; MeduSoil	

EPFL committees and services

Name	Service	Role	Role in funding allocation
Ferrari, Alessio (LMS)	Doctoral School in Mechanics (EDME)	Commission member	no
Laloui, Lyesse (LMS)	Faculty Search Committee for a position of Professor in Digital Infrastructure	Member	no
Laloui, Lyesse (LMS)	Faculty Search Committee for a position of Professor in Human-Centric Emerging Mobility	Member	no
Laloui, Lyesse (LMS)	Faculty Search Committee for a position of Professor in Sustainable Civil Engineering	Member	no
Laloui, Lyesse (LMS)	Civil Engineering Section	Director	yes
Laloui, Lyesse (LMS)	Direction of the School of Architecture, Civil and Environmental Engineering (ENAC)	Member	yes

Other committees and services (national including the EPF domain, international...)

Name	Service	Role	Role in funding allocation
Ferrari, Alessio (LMS)	International School on "LAndslide Risk Assessment and Mitigation" (LARAM)	Member of the Scientific Committee	no
Ferrari, Alessio (LMS)	Journal Geomechanics for Energy and the Environment	Member of the Editorial Board	no
Ferrari, Alessio (LMS)	International Society of Soil Mechanics and Geotechnical Engineering (ISSMGE) TC 308 "Energy Geotechnics"	Vicechair of the technical committee	no
Ferrari, Alessio (LMS)	International Society of Soil Mechanics and Geotechnical Engineering (ISSMGE) TC 101 "Unsaturated Soils"	Member of the technical committee	no
Ferrari, Alessio (LMS)	Sixth EAGE shale workshop 2019, Bordeaux, France	Member of the Scientific Committee	no
Ferrari, Alessio (LMS)	International Society of Soil Mechanics and Geotechnical Engineering (ISSMGE) TC 106 "Laboratory Testing"	Member of the technical committee	no
Laloui, Lyesse (LMS)	Swiss Academy of Engineering Sciences SATW	Member	no

Name	Service	Role	Role in funding allocation
Laloui, Lyesse (LMS)	Faculty Search Committee for a position of Professor in Engineering Geology at ETHZ	Member	no
Laloui, Lyesse (LMS)	International Energy Agency Greenhouse R&D Technology Collaboration Program	Executive Committee representative for the Government of Switzerland	no
Laloui, Lyesse (LMS)	Swiss Competence Center for Energy Research - Supply of Electricity	Member of the executive committee	no
Laloui, Lyesse (LMS)	Acta Geotechnica	Member of Editorial Board	no
Laloui, Lyesse (LMS)	Chinese Journal of Geotechnical Engineering	Member of Editorial Board	no
Laloui, Lyesse (LMS)	European Journal of Environmental and Civil Engineering	Member of Editorial Board	no
Laloui, Lyesse (LMS)	Journal of Coupled Systems and Multiscale Dynamics	Member of Editorial Board	no
Laloui, Lyesse (LMS)	Environmental Geotechnics	Advisory Board Member	no
Laloui, Lyesse (LMS)	International Journal for Numerical and Analytical Methods in Geomechanics	Member of Editorial Board	no
Laloui, Lyesse (LMS)	International journal Geomechanics for Energy and the Environment	Editor-in-Chief	no
Laloui, Lyesse (LMS)	ISSMGE - International Society for Soil Mechanics and Geotechnical Engineering	Vice-President for Europe.	no

Vision

Highlights

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Goals

Goals

Goals

The LMS activities are designed to promote engineering solutions in the field of the alternative sources of energy, including nuclear waste disposal, geothermal energy and CO₂ sequestration.

The LMS activities will continue to cover education, research and technology transfer in the large field of Geomechanics. The vision aims at contributing to a sustainable development of our built and natural environment by addressing selected key questions with the highest possible academic standard, within transdisciplinary internal and international collaborations and through contacts with industry with long-term research focuses.

The research activities will focus on problems involving a variable environment and new and advances in existing technologies of energy production. These two areas: environment and energy are expected to dominate technological agenda for forthcoming years. The reason for that is two-fold: first there is world-wide crisis of environment endangerment related to the geosphere: soil and groundwater pollution by accidental spills, CO₂ emission driven reduction of fossil fuel usage and/or inadequate isolation of pollutants, and second there is a host of new sources of energy related to geosphere. In both cases, there is an emerging new fundamental research concerning the effects of chemical, thermal and biological variables on mechanical properties and mechanical variables of soils and shales, and vice versa the effects of mechanical variables as stress, strain, damage affecting chemical and biological, physical or thermal processes and properties that require a multi-disciplinary approach. The levels of these couplings are multiple and often poorly recognized.

Especially with nascent technologies related to the energy production it is rational to include the environmental considerations early in the phase of development rather than seek remedies post factum, or after the damage has been induced. This clearly may refer to production of natural gas from shales, the techniques of hydraulic and chemical fracturing, CO₂ sequestration technologies, nuclear waste isolation (long and short term), heat and fuel storage in the underground and under structures, geothermal fluid energy, energy from methane hydrates, oil production from high temperature, high pressure deposits, and many others. Effects of chemical and biological pollution on isolation geo-structures constitute a separate class of problems. Finally, technologies of chemical and biological improvement of mechanical and hydraulic quality of soils and shales involve knowledge and methods based on the same principles.

The intrinsic nature of coupling of chemical, biological, thermal and mechanical properties, variables and fields distinguishes the related problems from those in classical geomechanics. It is believed that continuing and establishing new research activities dedicated to these issues of Energy and Environmental Geomechanics is a great opportunity for LMS and ENAC.

Some examples of activities for the coming years would be in the following areas:

Geo-energy structure

Efforts are being devoted to better understand the physical mechanisms and phenomena characterising the operation of energy geostructures for ensuring an optimal geotechnical, structural and energy performance of such ground structures. The LMS has nowadays more than 10 years of experience on this scope and is internationally recognised by Universities and Companies as the leader research group in this field. The analyses that are being performed are focused on various aspects that characterise energy geostructures, including the non-isothermal behaviour of soils when subjected to cyclic temperature variations, the interaction (soil-structure) with the concrete composing these ground structures, the structural behaviour of the concrete itself subjected to temperature changes, the hydraulic aspects related to the fluid flow inside of the pipes embedded in the concrete that allow for the heat exchange between the soil and the ground structure, and the optimal practices for equipping the considered elements. It is considered that the exploitation of shallow geothermal energy for satisfying the energy needs of building environments in an environmentally-friendly way will increase and spread worldwide more and more in the foreseeable future. The LMS, through its expertise in this subject matter, aims at being the representative of this revolutionary approach.

Deep Geo-Energy

Advanced theoretical, experimental and computational knowledge was developed in the recent years at the LMS for assessing

Goals

and predicting the behaviour of geomaterials subjected to changes in temperature and at different states of saturation. This state of the art expertise has been mainly applied in the fields of underground nuclear waste storage as well as the geothermal use of the building foundations. The research activities are now devoted to (i) the enhancement of the understanding of the thermo-hydro-chemical-mechanical behaviour of shales (including gas shales and host rock formations for waste disposal) and bentonites and the prediction of their long term behaviour, and (ii) the development of computational design tools for geo-energy structures.

Several highly sophisticated and unique experimental tools were developed at the lab in the recent three years with an investment of about 1000.- Kfrs (from FNS, EPFL and industry). It is planned to develop the knowledge and the understanding on the behaviour of soils and shales in the light of the extreme loading conditions that the equipment allows. There is a huge room for fundamental research on the running of coupled thermo (until 150°C) –hydro (until 400 MPa of suction)-mechanical (until 30 MPa) testing as well as on the behaviour of the materials in such conditions. I would like also to extend the laboratory facilities serving the research to micro scale observations (i.e. neutron tomography) for a better insight on the fundamental physical mechanism governing the thermo-hydro-mechanical behaviour of the involved materials.

Environmental Geomechanics

Efforts will be devoted to maintain the current research activities in the area of multi-physical coupling processes in soils at leading edge of technology with expertise in the fundamentals of soil mechanics.

LMS has a large tradition in the domain of landslides analysis. In the past years, early warning system methods have been developed. Climate change and its effects on earth equilibria, water budget are studied all around the world by thousands of researchers. Following this trend, the current researches at LMS focus on the effects of climate variations on the stability of slopes. To do so, interactions between the soil and the atmosphere have to be studied to understand the exchanges between the two systems. Making use of the foreseen climate changes, the aims of these researches would be to take a step forward in the management of the natural hazards by predicting the situation in the next century. As dry Summers as the 2015 are more often anticipated in the 21st century, the focus will be set on the mechanism of desiccation cracking in soils. The room for research on this phenomenon is extremely important and its implications on landfill liners integrity, stability of foundations, agriculture and stability of slopes have to be assessed.

The project of bio-improved soils currently carried out at LMS has proven great potential in building a sustainable, environmental-friendly method for stabilizing soils and preventing failures in a vast range of engineering problems. The project has already offered the chance for interdisciplinary collaboration between LMS and EML and offers common ground for collaboration with other ENAC laboratories. As a foreseen step, a pilot, large-scale application of the technique is planned in order to better design and suggest an efficient method, adaptable to the needs of the geotechnical problem.

CO2 storage

The financial support of Petrosvibri to the Chair allows the development of a deep knowledge in the area of CO2 storage. Experimental facilities devoted to this topic are developed. Also computational tools at the basin scale will be introduced for the analysis of the various scenarios.

These objectives would help the ENAC to strengthen its research and teaching profile and to play an important national and an international role in the most advanced and strategically important areas of research in Energy and Environmental Geomechanics.

Contribution to ENAC Strategy

Contribution to ENAC Strategy in 2022 (please refer to the presentation of ENAC strategy)

Empty category

Planned contribution to ENAC Strategy for the upcoming year(s)

Empty category

Suggestions

Empty category

Others

Empty category

The activity report has not been validated by the head of the unit and can still be modified.

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