

LMS | ACTIVITY REPORT 2019

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 2019

Teacher(s)	Code	Course title	Section-Semester	Credits / Coeff.	Student number
Laloui , Lyesse (LMS); Bernier-Latmani , Rizlan (EML); Perrault , Dominique (PH-ENAC); Fernandez Andrino , Juan (SAR-ENS); Nguyen , Richard (SAR-ENS)	PENS-211	Terra Epidermis	ENAC-BA4	4	25
Vulliet , Laurent (LMS)	CIVIL-203	Mécanique des sols et écoulements souterrains	GC-BA4	5	67
Laloui , Lyesse (LMS)	CIVIL-444	Energy geostructures	GC-MA2, GC-MA4	3	16
Laloui , Lyesse (LMS); Ferrari , Alessio (LMS)	CIVIL-530	Slope stability	GC-MA2, GC-MA4	3	22

Fall semester 2019

Teacher(s)	Code	Course title	Section-Semester	Credits / Coeff.	Student number
Vulliet , Laurent (LMS); Defert , Raphaël (SGC-ENS)	CIVIL-438	Analyse et gestion de risques	GC-MA1, GC-MA3	3	20
Laloui , Lyesse (LMS); Koliji , Azad (SGC-ENS)	CIVIL-402	Geomechanics	GC-MA1, GC-MA3	3	75

Teacher(s)	Code	Course title	Section-Semester / Coeff.	Credits	Student number
Laloui , Lyesse (LMS); Terzis , Dimitrios (LMS)	CIVIL-424	Innovation for construction and the environment	GC-MA1, GC-MA3	2	34

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
Laloui , Lyesse (LMS)	Energy Geostructures: Analysis and Design. 2nd ed. continuing education	March 6-8, 2019		14		Rotta Loria, Alessandro, Northwestern University

Advising

Postdoc works (completed in 2019 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
Crisci, Eleonora (LMS)	Time-dependent response and sample-size effect on the geomechanical response of Opalinus Clay shale for radioactive waste disposal	11/2019		Laloui, Lyesse (LMS)		
Kim, Daehyun (LMS)	Multiscale study of biocementation process	10/2019		Laloui, Lyesse (LMS)		
Lee, Kwangwoo (LMS)	Evaluation of rainfall-induced slope failure based on material point method	09/2019		Laloui, Lyesse (LMS)		
Madaschi, Aldo (LMS)	Modelling activities on buffer and host rock materials for High Level Waste geologic repositories	10/2016		Laloui, Lyesse (LMS)		
Minardi, Alberto (LMS)	Geomechanical characterization of caprock formations for the geological storage of carbon dioxide	02/2018	09/2019	Laloui, Lyesse (LMS); Ferrari, Alessio (LMS)		
Rotta Loria, Alessandro Francesco (LMS)	Application of energy geo structures at the city scale	03/2018	03/2019	Laloui, Lyesse (LMS)		
Stavropoulou, Eleni (LMS)	Impact of CO ₂ on the sealing capacity of caprock representative shale	09/2019		Laloui, Lyesse (LMS)		
Sütman, Melis (LMS)	Experimental and numerical investigation of thermo-active piles	10/2016	07/2019	Laloui, Lyesse (LMS)		

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
Terzis, Dimitrios (LMS)	Bio-cemented soils	11/2017		Laloui, Lyesse (LMS)		

PhD thesis (completed in 2019 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
Bosch Llufriu, Jose Antonio (LMS)	Constitutive modelling of active soils under environmental actions	EDME	2020	Laloui, Lyesse (LMS)	Ferrari, Alessio (LMS)			
Cassini, Etienne André (LMS)	Multi-scale thermo-chemo-mechanical modelling of MX-80 bentonite from atomistic description of clay-ions-water interactions	EDME	2020	Laloui, Lyesse (LMS)				
Crisci, Eleonora (LMS)	Hydro-mechanical response of Opalinus Clay shale: dependency on composition and burial depth	EDME	2019	Laloui, Lyesse (LMS)	Ferrari, Alessio (LMS)			
Elmaloglou, Ariadni (LMS)	Ground bio-stabilization: Bio-chemo-mechanical monitoring and optimized upscaling	EDME	2022	Laloui, Lyesse (LMS)	Terzis, Dimitrios (LMS)			

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
Fryer, Barnaby Padraig (LMS)	Hazard and Risk Assessment of Large Seismic Events Owing to Fluid Injection	EDME	2020	Laloui, Lyesse (LMS)	Siddiqi, Gunter (EDME-ENS)			
Garbellini, Cristiano (LMS)	Soil-structure interaction in the context of piled-raft foundations with groups of energy piles	EDME	2020	Laloui, Lyesse (LMS)				
Harran, Ray (LMS)	Geotechnical aspects of Bio-improved soils in the context of BIOGEOS	EDME	2022	Laloui, Lyesse (LMS)	Terzis, Dimitrios (LMS)			
Kim, Jinwoo (LMS)	Effective Stress Framework for Partially Saturated Gas Shales	EDME	2022	Laloui, Lyesse (LMS)	Ferrari, Alessio (LMS)			
Kim, Taeheon (LMS)	The chemical effect of CO2 on geomechanical properties of geological carbon sequestration	EDME	2022	Laloui, Lyesse (LMS)				
Martin, Grégoire (LMS)	Multiphysical and Multiscale Modelling of Biogrout Transport for MICP	EDME	2023	Laloui, Lyesse (LMS)				
Ravera, Elena (LMS)	Cyclic thermo-mechanical behaviour of energy piles	EDME	2021	Laloui, Lyesse (LMS)				

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
Speranza, Gianluca (LMS)	Methods for carbon footprint assessment of geostructures	EDME	2020	Laloui, Lyesse (LMS)	Ferrari, Alessio (LMS)			
Tuttolomondo, Angelica (LMS)	Constitutive and numerical modeling of the coupled thermo-hydro-chemo-mechanical behaviour of shales	EDME	2020	Laloui, Lyesse (LMS)	Ferrari, Alessio (LMS)			
Zannin, Jacopo (LMS)	Shallow geothermal energy for renovated civil engineering structures: a geomechanical and environmental approach	EDME	2020	Laloui, Lyesse (LMS)	Ferrari, Alessio (LMS)			

Master diploma projects in Civil Engineering, Environmental Engineering and other programs (started in spring or fall 2019)

Advisee(s)	Project title	Section-Semester	Advisor(s)	Co-advisor(s)	Institution(s) involved (if not EPFL)	Additional information on external institution(s) involved
Casanova, Michela (GC-PME)	Laboratory Testing on Hydraulic Fracturing of Barre Granite: Studying Visual Observations, Acoustic Emissions and Radiated Energy related to Fracture Mechanisms	GC-PME	Laloui, Lyesse (LMS)			

Advisee(s)	Project title	Section-Semester	Advisor(s)	Co-advisor(s)	Institution(s) involved (if not EPFL)	Additional information on external institution(s) involved
Fessler, Yannick	Tunnel en terrain meuble - métro m3 de Lausanne entre le Flon et la Blécherette	GC-PME	Laloui, Lyesse (LMS)			
Fuselier, Héroïse (GC-PMH)	Evaluation of failure criteria for rock under various stress states	GC-PMH	Laloui, Lyesse (LMS)			
Gindrat, Gaëtan (GC-PMH)	GIS-based hazard and risk assessment of transportation infrastructure	GC-PMH	Laloui, Lyesse (LMS)			
Hartmann, Stéphane (GC-PMH)	City scale application of energy geostructures	GC-PMH	Laloui, Lyesse (LMS)			
Llabjani, Qazim (GC-PME)	Thermo-Mechanical Behaviour of Energy Geostructures Subjected to Bending Thermal Actions	GC-PME	Laloui, Lyesse (LMS)			
Meier, Katinka (GC-PMH)	Piping phenomena during construction of a hydro electrical power plant on Sakarya river	GC-PMH	Laloui, Lyesse (LMS)			
Walid Mahmoud Helmy Nadeem, Mohamed (GC-PME)	Analyse et gestion des risques dans la planification d'un projet de Génie Civil	GC-PME	Vulliet, Laurent (LMS)			
Wojnarowicz, Matthias (GC-PMH)	Thermo-hydro-mechanical behaviour of energy tunnels	GC-PMH	Laloui, Lyesse (LMS)			
Wyss, Richard Alois (GC-PMH)	Integration of geological data into the BIM process in infrastructure projects	GC-PMH	Vulliet, Laurent (LMS)			

Advisee(s)	Project title	Section-Semester	Advisor(s)	Co-advisor(s)	Institution(s) involved (if not EPFL)	Additional information on external institution(s) involved
Yilmaz, Fikret Can (GC-PME)	Enterprise Risk Management and Civil Engineering Consulting Firms in Switzerland	GC-PME	Vulliet, Laurent (LMS)			

Master diploma projects in Architecture (completed in spring 2019, direct link to Infoscience)

Empty category

Prestudies of master projects in Civil Engineering (completed in fall 2019)

Advisee(s)	Project title	Section-Semester	Tutors(s)	Supervisors(s)	Institution(s) involved (if not EPFL)	Additional information on external institution(s) involved
Matthews Salmon, Scott David (GC-MA4)	BIM (Building Information Modeling) 5D	GC-MA3	Vulliet, Laurent (LMS)			
Richard, Nicolas Paul (GC-PME)	Thermo-hydro-mechanical modeling of energy barrettes	GC-MA3	Laloui, Lyesse (LMS)			
Schenk, Benjamin Simon (GC-PME)	Métro m3 à Lausanne, station et tunnel de Beaulieu	GC-MA3	Laloui, Lyesse (LMS)			
Wüthrich, Thomas Matthias (GC-PME)	Numerical and deep learning modeling of energy geostructure systems at the district scale	GC-MA3	Laloui, Lyesse (LMS)			
Zaarour, Mohamad (GC-PME)	Engineered Geothermal Systems - Hydraulic Fracturing and Induced Seismicity	GC-MA3	Laloui, Lyesse (LMS)			

Theoretical statements of master projects in Architecture (completed in

january 2019, direct link to Infoscience)*Empty category***Semester projects (completed in 2019)**

Advisee(s)	Project title	Section-Semester	Tutor(s)	Supervisor(s)	Institution(s) involved (if not EPFL)	Additional information on external institution(s) involved
Cassina, Lisa (GC-PME); Fouad, Zineb (GC-MA2)	Projet de construction: Projet géotechnique	GC-MA2	Vulliet, Laurent (LMS)			
Dederichs, Anno Christian (GC-PME)	Projet de systèmes civils: Risk Management in Civil Engineering Projects	GC-MA3	Vulliet, Laurent (LMS)			
Falconi, Gabriele (GC-MA2); Sala, Enea (GC-MA2)	Projet de construction: Parking souterrain	GC-MA2	Vulliet, Laurent (LMS)			
Gindrat, Gaëtan (GC-PMH)	Projet de construction: Limit State design of thermo-active diaphragm walls: understanding the role of thermal loads	GC-MA4	Laloui, Lyesse (LMS)			
Hartmann, Stéphane (GC-PMH)	Laboratoire GC: Investigation of the ground in-situ temperature profile with regards to ambient temperature changes	GC-MA4	Laloui, Lyesse (LMS)			
Incollingo, Sara (GC-H)	Projet spécifique pour étudiant d'échange/visiteur: Experimental analysis of the hydro-mechanical behaviour of gas shales subjected to suction variations	GC-H	Ferrari, Alessio (LMS)			
Karlen, Claudine Bettina (SIE-PME); Weber, Mischa Jascha (SIE-PME)	Design project: Analyse technique et financière de production de chaleur par géothermie moyenne profondeur	SIE-MA2	Laloui, Lyesse (LMS)			

Advisee(s)	Project title	Section-Semester	Tutor(s)	Supervisor(s)	Institution(s) involved (if not EPFL)	Additional information on external institution(s) involved
Lebbar, Youssouf (GC-MA4)	Laboratoire GC: Cracks analysis by micro-CT	GC-MA3	Laloui, Lyesse (LMS); Turberg, Pascal (SGC-GE)			
Liardon, Tristan (GC-MA4)	Projet de construction: Use of high stress path reservoirs for CO2 sequestration	GC-MA3	Laloui, Lyesse (LMS)			
Richard, Nicolas Paul (GC-PME)	Projet de construction: Analysis of the vertical deformation of energy barrettes	GC-MA3	Laloui, Lyesse (LMS)			
Zaarour, Mohamad (GC-PME)	Projet de construction: Stress preconditioning for hydraulic fracturing	GC-MA2	Laloui, Lyesse (LMS)			
Zarate Mendieta, Saskya Damaris (GC-PME)	Projet de construction: Thermo-mechanical behavior of energy tunnels	GC-MA3	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
Cousin, Benoît (LMS)	Others	Scientific assistant / Machine learning techniques for the optimisation of geothermal system (GeoBrain project)	11/2018		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
Di Bari, Francesco (GC-H)	Internship	The project deals with the development of a complete performance-based design methodology for energy pile foundations in the framework of Eurocodes, based on the use of theoretical analyses and experimental results.	03/2018	02/2019	Laloui, Lyesse (LMS)	Polytechnic University of Turin, IT (European Universities and Research Centers)	Master student
Dornberger, Sarah Catherine (LMS)	Others	Scientific assistant / In-situ applications of bio-cementation for ground reinforcement	10/2018		Laloui, Lyesse (LMS)		
Houhou, Roba	Internship	Structural characterization of unsaturated aggregated soil.	04/2019	07/2019	Sütman, Melis (LMS)	American University in Beirut (AUB), LB (World Universities and Research Centers)	
Katterbach, Maren (LMS)	Others	Scientific assistant / In-situ applications of bio-cementation for ground reinforcement	10/2019		Laloui, Lyesse (LMS); Terzis, Dimitrios (LMS)		
Lagioia, Michela	Internship	Thermal efficiency of energy piles: numerical assessment of the thermal resistance	02/2019	06/2019	Laloui, Lyesse (LMS); Madaschi, Aldo (LMS)	Université Grenoble Alpes, FR (European Universities and Research Centers)	

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
Mamers, Sam	Internship	Réalisation d'essais en laboratoire sur la mécanique de sols et à l'étude de géomatériaux bio-cimentés.	05/2019	08/2019	Terzis, Dimitrios (LMS)	École Centrale de Lyon, FR (European Universities and Research Centers)	
Pan, Yize	Internship	Development of a laboratory experimental campaign to investigate the thermo-mechanics of soils.	07/2019	09/2019	Laloui, Lyesse (LMS)	Northwestern University, US (World Universities and Research Centers)	
Peltier, Margaux Marie Valérie (LMS)	Others	Scientific assistant / Development of geothermal-inspired technologies for existing built environments	01/2019		Laloui, Lyesse (LMS)		
Romann, Erwan (LMS)	Apprenticeship	1st year apprentice, laborant en physique	08/2016	07/2020	Laloui, Lyesse (LMS); Dubey, Patrick (LMS)		
Wang, Zhen (LMS)	Internship	Advanced thermo-hydro-chemo mechanical behaviour of geomaterials.	10/2018	09/2019	Laloui, Lyesse (LMS)	Hohai University, CN (World Universities and Research Centers)	PhD student

Research

Funded and submitted research projects

Title	Principal Investigator (PI)	Co-PI(s)	Funding organisation; Program	Granted amount (CHF)	Starting date	Duration (Months)	Status
Construction & Environmental Biocementation in Real World Applications	LALOUI Lyesse		Excellent Science	164,105 out of 164,105	19.09.2019		Pending
GeoBrain : A Machine Learning approach to the optimisation of geothermal systems.	Cousin Benoît Claude Henri	Cousin Benoît Claude Henri	FNS; FNS-CTI BRIDGE	97,149 out of 97,149	01.09.2019	12	Ongoing
Experimental assessment of shale properties for safe geological CO2 storage	LALOUI Lyesse		Non lucr.; Mont Terri	10,000 out of 10,000	01.09.2019	10	Ongoing
Comportement Thermo-Hydro-Mechanique du Callovo-Oxfordien sous chargement thermique	LALOUI Lyesse		INT Governmental; ANDRA	307,500 out of 307,500	01.08.2019	48	Ongoing
MeduSoil: Ground Bio-stabilization	Terzis Dimitrios	Terzis Dimitrios	FNS; FNS-CTI BRIDGE	99,296 out of 99,296	01.06.2019	12	Ongoing
INNOBOOSTER MEDUSOIL	Terzis Dimitrios		Non lucr.; GR Stiftung	130,000 out of 130,000	01.06.2019	16	Ongoing
European Joint Programme on Radioactive Waste Management	GARCIA Marie	LALOUI Lyesse	H2020; Other	273,862 out of 35,142,221	01.06.2019	60	Ongoing
BIOGEOS - Bio-mediated Geo-material Strengthening for engineering applications	LALOUI Lyesse		H2020; Excellent Science	2,991,544 out of 2,991,544	01.11.2018	60	Ongoing
DOn (prix BCV)	LALOUI Lyesse	LALOUI Lyesse	Non lucr.; BCV	132,000 out of 132,000	01.11.2018	24	Ongoing
Experimental assessment of shale properties for safe geological CO2 storage	LALOUI Lyesse		Non lucr.; Mont Terri	10,000 out of 10,000	01.09.2018	22	Ongoing

Title	Principal Investigator (PI)	Co-PI(s)	Funding organisation; Program	Granted amount (CHF)	Starting date	Duration (Months)	Status
Cyclic Thermo-Mechanical Behaviour of Energy Piles	LALOUI Lyesse		FNS; FNS-Project Funding	450,000 out of 450,000	01.11.2017	42	Ongoing
ELEGANCY - Efficient generation of renewables H2 from Biomass, while harvesting geothermal heat and enabling negative CO2 emissions	Giardini Domenico	LALOUI Lyesse	Off. Conf.; Divers Confédération	45,000 out of 2,500,000	01.09.2017	36	Ongoing
BEACON - Bentonite Mechanical Evolution	Ferrari Alessio	LALOUI Lyesse	Autres EU; Euratom	268,193 out of 4,131,368	01.06.2017	48	Ongoing
SoE - Supply of Electricity	AVELLAN François	SCHLEISS ANTON; LALOUI Lyesse; Lehning Michael; Lecampion Brice; Violay Marie	Off. Conf.; CTI / KTI	310,000 out of 18,200,120	01.01.2017	48	Ongoing
HostIng the Greenhouse Gas Technology Conference GHGT-13 at the Swlss Tech Centre of EPFL	LALOUI Lyesse		Off. Conf.; Divers Confédération	350,000 out of 350,000	01.11.2013	98	Ongoing
TERRE - Training Engineers and Researchers to Rethink geotechnical Engineering for a low carbon future	Tarantino Alessandro		H2020; Excellent Science	371,319 out of 4,745,934	01.11.2015	48	Completed
Geomechanical behavior of Opalinus Clay: time-dependent, scale effects and constitutive model validation	Lyesse LALOUI		NAGRA National Cooperative for the Disposal of Radioactive Waste	300,000 out of 300,000	01.11.2019	32	Industrial contract
Triaxial tests for buffer bentonite on rock shear	Lyesse LALOUI		AINS (A-Insinnöörít Civil Oy)	51,000 out of 51,000	01.07.2019	10	Industrial contract

Title	Principal Investigator (PI)	Co-PI(s)	Funding organisation; Program	Granted amount (CHF)	Starting date	Duration (Months)	Status
Support in geomechanical test analysis : conclusion of benchmark study and derivation of reference parameters	Lyesse LALOUI		NAGRA National Cooperative for the Disposal of Radioactive Waste	64,000 out of 64,000	01.07.2019	8	Industrial contract
FE-M Work Package 5 (Modelling): Model-based analysis and interpretation of the THM-data of the FE experiment	LALOUI Lyesse		NAGRA National Cooperative for the Disposal of Radioactive Waste	180,000 out of 180,000	01.01.2019	36	Industrial contract
Study on effective stress definition for gas shales in partially water saturated conditions	Lyesse LALOUI		Chevron USA Inc.	150,000 out of 150,000	06.12.2017	37	Industrial contract
Study on effective stress definition for gas shales in partially water saturated conditions - Avenant 1	Lyesse LALOUI		Chevron USA Inc.	30,000 out of 30,000	06.12.2017	37	Industrial contract

Funded equipment

Empty category

Awards

Awardee(s)	Name of prize / Competition	Place / Organization	Award description / URL	Prize sum (CHF)
Peltier , Margaux Marie Valérie (LMS)	3rd place Global Grand Final / ClimateLaunchpad 2019	Amsterdam	https://actu.epfl.ch/news/enerdrape-wins-3rd-place-at-global-grand-final-cli/	
Peltier , Margaux Marie Valérie (LMS)	1st place Swiss final / ClimateLaunchpad 2019	Basel	https://actu.epfl.ch/news/enerdrape-wins-1st-prize-at-the-swiss-final-of-cli/	
Peltier , Margaux Marie Valérie (LMS)	Pitch Your Impact Context	Lausanne / ENAC	https://actu.epfl.ch/news/pitch-your-impact-energy-and-collaborative-resea-2/	
Rotta Loria , Alessandro Francesco (LMS)	Zeno Karl Schindler Award 2019	Lausanne	https://actu.epfl.ch/news/zeno-karl-schindler-award-2019-alessandro-f-rott-2/	

Research facilities

Research facilities

Research facilities

ENAC special call for equipment 2019 of CHF 20'000.- for equipment and UPS units.

Publications & Presentations

Books (direct link to InfoScience)

Data	Key
Laloui L., Rotta Loria A. F., <i>Analysis and Design of Energy Geostructures</i> , Elsevier, 2019-11-01, 9780128206232, Abstract: yes, Status: published	

Reviews (direct link to InfoScience)

Data	Peer reviewed	Key
Terzis D., Laloui L., <i>A decade of progress and turning points in the understanding of bio-improved soils: A review</i> , in <i>Geomechanics for Energy and the Environment</i> , 2019-03-04, Abstract: yes, Status: published	✓	

Journal articles (direct link to InfoScience)

Data	Not produced at EPFL	Peer reviewed	Key
Rotta Loria A. F., Laloui L., Catala Oltra V., <i>Equivalent pier analysis of full-scale pile groups subjected to mechanical and thermal loads</i> , in <i>Computers and Geotechnics</i> , 2019, Abstract: yes, Status: accepted		✓	
Garbellini C., Laloui L., <i>Thermal stress analysis of energy piles</i> , in <i>Géotechnique</i> , 2019, Abstract: yes, Status: accepted		✓	
Rotta Loria A. F., Bocco M., Garbellini C., Muttoni A., Laloui L., <i>The role of thermal loads in the performance-based design of energy piles</i> , in <i>Geomechanics for Energy and the Environment</i> , p.100153, 2019, Abstract: yes, Status: published		✓	
Ravera E., Sutman M., Laloui L., <i>Analysis of the interaction factor method for energy pile groups with slab</i> , in <i>Computers and Geotechnics</i> , p.103294, 2019, Abstract: yes, Status: published		✓	
Schäfers A., Gens A., Rodriguez-Dono A., Baxter S., Tsitsopoulos V., Holton D., Malmberg D., Sawada M., Qiao Y., Ferrari A., Laloui L., Sjöland A., <i>Increasing understanding and confidence in THM simulations of Engineered Barrier Systems.</i> , in <i>Environmental Geotechnics</i> , 2019-05-09, Abstract: yes, Status: published	✓	✓	
Qiao Y., Yingming X., Laloui L., Ding W., He M., <i>A double-structure hydromechanical constitutive model for compacted bentonite.</i> , in <i>Computers and Geotechnics</i> , vol. 115, p.10-21, 103173, 2019-11-01, Abstract: yes, Status: published	✓	✓	
Peltier M., Loria A. F. R., Lepage L., Garin E., Laloui L., <i>Numerical investigation of the convection heat transfer driven by airflows in underground tunnels</i> , in <i>Applied Thermal Engineering</i> , vol. 159, p.113844, 2019, Abstract: yes, Status: published		✓	
Sütman M., Speranza G., Ferrari A., Larrey-Lassalle P., Laloui L., <i>Long-term performance and life cycle assessment of energy piles in three different climatic conditions</i> , in <i>Renewable Energy</i> , 2019-07-05, Abstract: yes, Status: published		✓	

Data	Not produced at EPFL	Peer reviewed	Key
Cousin B. C. H., Rotta Loria A. F., Bourget A., Rognon F., Laloui L., Energy performance and economic feasibility of energy segmental linings for subway tunnels , in Tunnelling and Underground Space Technology , vol. 91, p.102997 , 2019, Abstract: yes, Status: published		✓	
Vilarrasa Riano V., Carrera J., Olivella S., Rutqvist J., Laloui L., Induced seismicity in geologic carbon storage , in Solid Earth , vol. 10, p.871-892 , 2019, Abstract: yes, Status: published	✓	✓	
Garbellini C., Laloui L., Three-dimensional finite element analysis of piled rafts with energy piles , in Computers and Geotechnics , vol. 114, p.103115 , 2019-10, Abstract: yes, Status: accepted		✓	
Shetty R., Singh D.N., Ferrari A., Volume change characteristics of fine-grained soils due to sequential thermo-mechanical stresses , in Engineering Geology , vol. 253, p.47-54 , 2019, Abstract: yes, Status: published		✓	
Fryer B. P., Siddiqi G., Laloui L., Compaction-induced permeability loss's effect on induced seismicity during reservoir depletion , in Pure and Applied Geophysics , 2019, Abstract: no, Status: accepted		✓	
Crisci E., Ferrari A., Giger S., Laloui L., Hydro-mechanical behaviour of shallow Opalinus Clay shale , in Engineering Geology , vol. 251, p.214-227 , 2019-01-24, Abstract: yes, Status: published		✓	
Sutman M., Olgun C. G., Laloui L., Cyclic Load-Transfer Approach for the Analysis of Energy Piles , in Journal Of Geotechnical And Geoenvironmental Engineering , vol. 145, num. 1, p.04018101 , 2019, Abstract: yes, Status: published		✓	
Sutman M., Brettmann T., Olgun C. G., Full-scale in-situ tests on energy piles: Head and base-restraining effects on the structural behaviour of three energy piles , in Geomechanics For Energy And The Environment , vol. 18, p.56-68 , 2019, Abstract: yes, Status: published		✓	
Terzis D., Laloui L., Cell-free soil bio-cementation with strength, dilatancy and fabric characterization , in Acta Geotechnica , 2019, Abstract: yes, Status: accepted		✓	

Conference papers (direct link to InfoScience)

Data	Peer reviewed	Key
Tuttolomondo A., Ferrari A., Laloui L., An Effective Stress Framework for Clayey Geomaterials Including a Chemical-Dependent Variable , XVI Pan-American Conference on Soil Mechanics and Geotechnical Engineering (XVI PCSMGE), Cancun, Mexico, 17-20, 2019, Abstract: yes	✓	
Laloui L., Sütman M., Energy geostructures: anew era for geotechnical engineering practice. , ECSMGE 2019 - XVII European Conference on Soil Mechanics and Geotechnical Engineering., Reykjavík, Iceland, Septembre, 1 –6, 2019, Abstract: yes, Status: published	✓	
Zannin J., Ferrari A., Pousse M., Laloui L., Tarantino A., Erdin I., Thermal design and full-scale thermal response test on Energy Walls , 7th International Symposium on Deformation Characteristics of Geomaterials (IS-Glasgow 2019), Glasgow (UK), 26-28/06/2019, Abstract: yes	✓	

Data	Peer reviewed	Key
Speranza G., Ferrari A., Pousse M., Laloui L., <i>An experimental investigation on the water retention behaviour of a silty soil for the computation of the lateral earth thrust on a retaining wall</i> , 7th International Symposium on Deformation Characteristics of Geomaterials (IS-Glasgow 2019), Glasgow UK, 25-06, 2019, Abstract: yes	✓	
Crisci E., Ferrari A., Giger S., Laloui L., <i>Impact of Mineralogical Composition on Geotechnical Properties of Opalinus Clay</i> , Sixth EAGE Shale Workshop, Bordeaux, 28 April – 1 May 2019, Abstract: yes	✓	
Tuttolomondo A., Ferrari A., Laloui L., <i>On the definition of an effective stress for shales</i> , Sixth EAGE Shale Workshop, Bordeaux, France, 29 April - 2 May, 2019, Abstract: yes	✓	
Minardi A., Ferrari A., Ewy R., Laloui L., <i>Experimental Assessment of the Impact of Partial Saturation On the Mechanical Properties of Gas Shales</i> , Sixth EAGE Shale Workshop, Bordeaux, France, April 29 - May 2, 2019, Abstract: yes	✓	
Crisci E., Ferrari A., Giger S., Laloui L., <i>Anisotropic behaviour of shallow opalinus clay</i> , International Symposium on Energy Geotechnics, SEG 2018, Lausanne, Switzerland, 25-28 September, 2018, Abstract: yes	✓	
Rotta Loria A., Laloui L., <i>Thermo-mechanical schemes for energy piles</i> , International Symposium on Energy Geotechnics, SEG 2018, Lausanne, Switzerland, 25-28 September, 2018, Abstract: yes	✓	

Presentations & talks (direct link to InfoScience)

Data	Key
Laloui L., <i>Subsurface Energy Applications and the Importance of Coupled Processes in Shales</i> , DECOVALEX 2019 Symposium, Brugg, Suisse, November 4-5, 2019, Abstract: no, Status: published	
Kim J., Ferrari A., Ewy R., Laloui L., Ferrari A., <i>Laboratory Study on the Volumetric Response of Gas Shale Samples with Controlled Pore Fluid Pressures</i> , Symposium on Coupled Processes in Radioactive Waste Disposal and Subsurface Engineering Applications (DECOVALEX 2019), Brugg, Switzerland, November 4-5, 2019, Abstract: no, Status: published	

Posters (direct link to InfoScience)

Data	Key
Kim T., Minardi A., Laloui L., <i>Geomechanical response of carbonate-rich Opalinus clay to carbonated water</i> , DECOVALEX 2019 SYMPOSIUM, Brugg, Switzerland, November 4-5, 2019, Abstract: no, Status: published	
Bosch Llufríu J. A., Ferrari A., Laloui L., <i>Modelling Volume Change Behaviour of Compacted Bentonite Using a Hydro – Mechanical Coupled Framework</i> , DECOVALEX Symposium on Coupled Processes in Radioactive Waste Disposal and Subsurface Engineering, Brugg, Switzerland, November 4-5, 2019, Abstract: no, Status: accepted	

Theses (direct link to InfoScience)

Data	Key
Crisci E., <i>Advisor(s): Laloui L., Ferrari A., Hydro-mechanical response of Opalinus Clay shale: dependency on composition and burial depth</i> , Thèse EPFL, n° 7421, 2019, Abstract: yes, Status: published	

Media (direct link to InfoScience)

Data	Key

Data	Key
Peltier M. M. V., Fraîcheur durable grâce aux géostructures énergétiques , in Commune suisse , p.28-29 , 2019-08-07, Abstract: yes	
Terzis D., Le biomimétisme (2/5): un biociment éco-responsable grâce au génie d'une bactérie , in RTS La 1ère , p.4:46 , 2019-03-19, Abstract: yes	
Ferrari A., Laboratoire Mont-Terri , in RTS 1 , p.02:55 , 2019-03-12, Abstract: yes	
Laloui L., Un livre veut favoriser le développement des géostructures énergétiques , in RTS La 1ère , p.08:20 , 2019-11-05, Abstract: yes	
Peltier M. M. V., Produire de l'énergie avec les tunnels de métro , in RTS La 1ère , p.08:48 , 2019-06-26, Abstract: yes	
Laloui L., Géo Ingénierie : la promesse de Prométhée , in RTS La 1ère , p.32:17 , 2019-05-25, Abstract: yes	
Laloui L., Pourquoi négliger une énergie indigène, renouvelable et durable et neutre en carbone? , in AGEFI , 2019-02-25, Abstract: yes	

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...
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	
Laloui , Lyesse (LMS); Ferrari , Alessio (LMS)	Chevron Corporation, US (Private sector)	CHEVRON	Geomechanical characterization of gas shales	
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	

Innovation

Inventor(s)	Description of innovation	Additional information

Inventor(s)	Description of innovation	Additional information
<p>Peltier, Margaux Marie Valérie (LMS); Laloui, Lyesse (LMS)</p>	<p>Enerdrape (Startup) turns existing underground environments into renewable sources of energy for the heating and cooling needs of buildings. It develops an architecturally integrated panel-like technology that allows capturing both geothermal and residual heat in existing underground environments. The Enerdrape solution offers an alternative, cost-effective and easier way to source thermal energy for heat pumps in existing constructions. As a result, it mitigates energy-related CO2 emissions and contributed to</p>	<p>Supports by Enable (2019) and InnoSeed ENAC Support (December 2019 to April 2020).</p>

Inventor(s)	Description of innovation	Additional information
	the energy transition and sustainable development of urban environments.	
Rotta Loria , Alessandro Francesco (LMS); Laloui , Lyesse (LMS)	A panel-like flexible heat exchanger (Prototype)	PCT Application filed with the TTO.
Cousin , Benoît (LMS); Laloui , Lyesse (LMS); Rotta Loria , Alessandro Francesco (LMS)	GeoBrain is a Machine Learning approach developed to tackle the design and the lifetime management of geothermal installations. Efficiently capturing the specific behaviour of installations, it provides visibility in order to characterise the performance of the overall system, offering solutions for cost-efficient, sustainable and reliable geothermal systems.	GeoBrain benefited from the Innoseed ENAC support in early stages of development and was then selected for the SNSF/InnoSuisse Bridge Proof of Concept Grant for pilot projects with implementation partners such as Romande Energie among others.

Inventor(s)	Description of innovation	Additional information
Terzis , Dimitrios (LMS); Laloui , Lyesse (LMS)	Stabilizing a cliff using biomineral binders - Innovative product	https://actu.epfl.ch/news/stabilizing-a-cliff-using-biomineral-binders/

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)	
Laloui , Lyesse (LMS)	Advisory Professor	Hohai University, CN (World Universities and Research Centers)	

Visiting scholars

Visitor	Home Institution	Additional information on home institution	Aim of visit, Duration
Darve , Felix	Université Grenoble Alpes, FR (European Universities and Research Centers)		Seminar
Gens , Antonio	Polytechnic University of Catalonia (BarcelonaTech), ES (European Universities and Research Centers)		Lecturer at GETE Winter School, Villars-sur-Ollon
Ghiadistri , Giulia	Imperial College London, GB (European Universities and Research Centers)		Seminar
Hueckel , Tomasz	Duke University, US (World Universities and Research Centers)		Lecturer at GETE Winter School, Villars-sur-Ollon
Labuz , Joseph F.	University of Minnesota, US (World Universities and Research Centers)		Lecturer at GETE Winter School, Villars-sur-Ollon
Lu , Ning	Colorado School of Mines, US (World Universities and Research Centers)		Civil Engineering Seminar Series
Rowe , Kerry	Queen's University Kingston, CA (World Universities and Research Centers)		Lecturer at GETE Winter School, Villars-sur-Ollon
Świdziński , Waldemar	Polish Academy of Sciences, PL (European Universities and Research Centers)		Civil Engineering Seminar Series

Alumni

Alumnus	Level	First position out of lab	Country	Sector of activity
Baryla , Patrycja Ewelina (LMS)	Post doc	Private company	Switzerland	Industry
Minardi , Alberto (LMS)	Post doc	Private company	Italy	Industry
Rotta Loria , Alessandro Francesco (LMS)	Post doc	Assistant professor (tenure track) Northwestern University (Chicago)	USA	Academia
Sütman , Melis (LMS)	Post doc	Assistant professor at Heriot-Watt University	United Kingdom	Academia

Distinguished alumni

Empty category

Organization of events

Date (month)	Location	Event title	Key people in lab involved	Description / URL
01/2019	Villars sur Ollon	Winter School on Geomechanics for Energy and the Environment	Laloui , Lyesse (LMS); Ferrari , Alessio (LMS); Tuttolomondo , Angelica (LMS)	https://actu.epfl.ch/news/gete-winter-school-2019/

Invited talks and contributions to events

Date (month)	Location	Event title	Key people in lab involved	Role / Talk title	Description / URL	Organizing institution (if not EPFL)	Additional information on organizing institution
09/2019	Reykjavik	XVII European Conference on Soil Mechanics and Geotechnical Engineering	Laloui , Lyesse (LMS)	Keynote / Energy Geotechnology: A New Era for Geotechnical Engineering Society	https://actu.epfl.ch/news/upcoming-keynote-lectures-of-prof-laloui-4/	ISSMGE (Other)	International Society for Soil Mechanics and Geotechnical Engineering
06/2019	Glasgow	7th International Symposium on Deformation Characteristics of Geomaterials	Laloui , Lyesse (LMS)	Keynote / Geothermal structures: from laboratory testing to engineering design	https://actu.epfl.ch/news/upcoming-keynote-lectures-of-prof-laloui-4/	ISSMGE (Other)	International Society for Soil Mechanics and Geotechnical Engineering

Date (month)	Location	Event title	Key people in lab involved	Role / Talk title	Description / URL	Organizing institution (if not EPFL)	Additional information on organizing institution
09/2019	Mugla, Turkey	1st Mediterranean Young Geotechnical Engineers Conference (MYGEC)	Laloui, Lyesse (LMS)	Keynote / Tailor-made soil properties with novel bio-geo-chemical means	https://actu.epfl.ch/news/upcoming-keynote-lectures-of-prof-laloui-4/	ISSMGE (Other)	International Society for Soil Mechanics and Geotechnical Engineering
11/2019	Brugg, Switzerland	DECOVALEX 2019 Symposium on Coupled Processes in Radioactive Waste Disposal and Subsurface Engineering Applications	Laloui, Lyesse (LMS)	Keynote / Subsurface Energy Applications and the Importance of Coupled Processes in Shales	https://actu.epfl.ch/news/upcoming-keynote-lectures-of-prof-laloui-4/	ISSMGE (Other)	
11/2019	Cancun, Mexico	XVI Pan-American Conference on Soil Mechanics and Geotechnical Engineering	Laloui, Lyesse (LMS)	Keynote / Analysis, Design and Application of Energy Geostuctures from the Building to the City Scale	https://actu.epfl.ch/news/upcoming-keynote-lectures-of-prof-laloui-4/	ISSMGE (Other)	International Society for Soil Mechanics and Geotechnical Engineering
10/2019	Casablanca, Morocco	EPFL Alumni Maroc Association and Chambre du Commerce suisse au Maroc	Laloui, Lyesse (LMS)	Invited speaker / Les géostructure énergétiques: une énergie renouvelable sous nos pieds	https://actu.epfl.ch/news/prof-laloui-invited-to-give-a-conference-by-epfl-a/		
02/2019	Geneva	Cobalty Réunion-déjeuner	Laloui, Lyesse (LMS)	Invited speaker / Geo-structures for revolutionizing the energy supply for future constructions	https://actu.epfl.ch/news/prof-laloui-talks-about-energy-geo-structures-in-g/		

News / Actus

News channel	Title, Date	Heading	Authors	Links
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News channel	Title, Date	Heading	Authors	Links
LMS	Le Mont-Terri, laboratoire de la capture du CO2 21.01.2019	Une étude de grande ampleur devrait permettre de mieux évaluer les risques liés à cette nouvelle technologie et de faciliter son application, défendue par beaucoup d'experts comme le Prof. Lyesse Laloui, directeur du Laboratoire de mécanique des sols (LMS) de l'EPFL.		
LMS	GeoBrain obtient un InnoSeed pour optimiser la géothermie 05.02.2019	L'outil GeoBrain vise à utiliser des techniques de Machine Learning afin d'optimiser les systèmes géothermiques de faible profondeur, technologie en pleine expansion en Suisse et dans le monde.		
LMS	Prof. Laloui présente les géo-structures énergétiques à Genève 22.02.2019	A l'occasion d'un déjeuner statutaire de l'association COBATY, à Genève, le Prof. Laloui présentera aux professionnels de l'immobilier comment les géo-structures énergétiques sont sur le point révolutionner l'approvisionnement énergétique de nos futures constructions.		
Chaire Gaz Naturel	Annual Report 2018 26.02.2019	The 2018 annual report of the Chair Gaz Naturel - Petrosvibri at Laboratory for Soil Mechanics of EPFL has been released.		
LMS	Prof Detournay honoré: 2020 EPFL Geomechanics Distinguished Lecture 01.03.2019	Prof. Emmanuel Detournay est accordé le 2020 EPFL Distinguished Lecture in Geomechanics, qui récompense ses contributions aux domaines de fracturation hydraulique, dynamiques de forages et poroélasticité. Une conférence aura lieu le 20 Janvier 2020 sous le titre, « The role of scaling in geomechanics ».		

News channel	Title, Date	Heading	Authors	Links
LMS	Le Journal Immorama convaincu par les géo-structures énergétiques ! 14.03.2019	La dernière édition de la revue Immorama consacre un article sur les géo-structures énergétiques suite à l'allocution du Prof. Laloui au Cercle Littéraire en novembre dernier.		
LMS	Pitch Your Impact: l'énergie et la collaboration scientifique lauréat 12.04.2019	Margaux Peltier, ingénieure civil, et Shin Koseki, architecte, ont convaincu respectivement le public et le jury de l'impact de leur projet de recherche sur la société lors de l'édition 2019 du concours Pitch Your Impact, organisé par la Faculté ENAC.	ENAC Communication	ENABLE EPFL ; EPFL Actualités (05.03.2018) ; Pitch your impact
Chaire Gaz Naturel	Upcoming keynote lectures of Prof. Laloui 13.05.2019	Prof. Laloui is invited to deliver keynote talks at the following coming international events:		
LMS	Performance de la première station énergétique souterraine de Suisse 06.06.2019	Le Laboratoire de mécanique des sols (LMS) de l'EPFL mène l'évaluation de la performance énergétique de la première station énergétique souterraine en Suisse. Ce projet est mis en œuvre dans le cadre du projet CEVA à Genève. Le projet est développé pour les Services industriels de Genève (SIG) en collaboration avec BG Ingénieurs Conseils.		Projet CEVA
LMS	Geomechanics for Energy and the Environment's journal growth 06.06.2019	The 2018 Citescorers have just been released and the journal, "Geomechanics for Energy and the Environment" has achieved a high Citescorers of 2.52.		
LMS	MeduSoil remporte la EPFL Innogrant 14.06.2019	Dr. Dimitrios Terzis est récompensé par la EPFL Innogrant et remporte 600 kCHF afin de croire la spinoff EPFL, MeduSoil.		MeduSoil in 90 seconds

News channel	Title, Date	Heading	Authors	Links
LMS	<i>Un tunnel de métro converti en source d'énergie géothermique</i> 25.06.2019	Des chercheurs de l'EPFL sont parvenus à quantifier avec précision les échanges de chaleur dans un tunnel. En appliquant leurs calculs à la future ligne de métro M3 de Lausanne, ils ont estimé l'économie d'énergie que ferait la ville en équipant le tunnel d'un système géothermique. Il s'agirait d'une première mondiale.	Perroud Sandrine	Laboratoire de mécanique des sols
LMS	<i>Et si on utilisait les métros comme source d'énergie ?</i> 28.06.2019	Margaux Peltier, assistante scientifique au LMS est intervenue dans l'émission « CQFD » de la RTS au sujet du potentiel géothermique de la future ligne de métro m3 de Lausanne.		20 minutes : EPFL: un tunnel du métro M3 source d'énergie? ; 24heures : EPFL: un tunnel du métro M3 source d'énergie? ; Avis d'Experts : Produire de l'énergie avec les tunnels de métro ; Baublatt : Metrotunnel könnten Laussannes Wohnungen heizen und kühlen ; Handelszeitung : Metro-Tunnel als Kühltruhe und Heizkörper ; La Liberté : EPFL: un tunnel de métro source d'énergie géothermique ; LeMatin.ch : Géothermie: EPFL: un tunnel du métro M3 source d'énergie? ; Mirage News : Engineering heat out of metro tunnels ; RSI : Ricerca : L'EPFL valorizza il calore biotermico ; RTS : L'EPFL imagine un tunnel du M3 converti en source d'énergie géothermique ; RTS : Produire de l'énergie avec les tunnels de métro ; TDG : EPFL: un tunnel du métro M3 source d'énergie? ; Tech Explorist : Researchers precisely quantified convection heat transfer in rail tunnels
LMS	<i>Evaluer la faisabilité technico-économique des tunnels énergétiques</i> 06.08.2019	Dans une étude récente, les chercheurs du Laboratoire de Mécanique des Sols (LMS) proposent une nouvelle méthodologie pour l'évaluation de la faisabilité technique et économique des tunnels échangeurs de chaleur.		Paper: Energy performance and economic feasibility of energy segmental linings for subway tunnels

News channel	Title, Date	Heading	Authors	Links
LMS	<i>Pieux énergétiques: parmi 50 points forts de l'EPFL dans L'Illustré</i> 26.08.2019	Les pieux énergétiques, développés au Laboratoire de Mécanique des Sols (LMS) par le Prof. Lyesse Laloui, ont été retenus parmi les 50 points forts ayant marqué l'EPFL à l'occasion de ses 50 ans.		Lien vers l'article
LMS	<i>GeoBrain obtient le soutien de Bridge pour des projets pilotes</i> 12.09.2019	L'outil GeoBrain utilise des techniques de Machine Learning afin d'optimiser les systèmes géothermiques de faible profondeur, technologie en pleine expansion en Suisse et dans le monde. Le soutien apporté par BRIDGE permettra la réalisation de projets pilotes en collaboration avec des partenaires industriels majeurs tel que Romande Energie, Energo et Viessmann.		
LMS	<i>Enerdrape remporte la 1ère place de la finale ClimateLaunchpad 2019</i> 12.09.2019	Le projet Enerdrape développé au sein du Laboratoire de Mécanique des Sols (LMS) de l'EPFL a remporté la première place de La finale suisse du ClimateLaunchpad 2019.		Link to event
LMS	<i>Félicitations aux nouveaux ingénieurs du LMS !</i> 07.10.2019	7 étudiants en master génie civil sont diplômés au Laboratoire de Mécanique des Sols (LMS).		
LMS	<i>Utiliser la chaleur des tunnels de métro</i> 24.10.2019	Utiliser les tunnels de métro urbains comme gigantesque échangeur de chaleur pour le chauffage des bâtiments aux alentours, voilà un des résultats de la recherche de Margaux Peltier, assistante scientifique au Laboratoire de Mécanique des Sols (LMS), qui est parue cet été.		Link to Article

News channel	Title, Date	Heading	Authors	Links
LMS	<i>L'EPFL veut favoriser le développement des géostructures énergétiques</i> 01.11.2019	Très performantes sur les constructions neuves, les géostructures énergétiques offrent une énergie renouvelable continue. Le professeur Lyesse Laloui, directeur du Laboratoire de mécanique de sols de l'EPFL, co-signe un ouvrage qui dresse le bilan d'un domaine dont Lausanne revendique le leadership mondial.	Perroud Sandrine	Dossier de presse (images, contact) ; Laboratoire de mécanique des sols (LMS)
LMS	<i>Nos métros, nouvelle source de chaleur renouvelable pour nos villes</i> 06.11.2019	Les résultats des recherches du LMS sur le potentiel des tunnels de métros comme source de chaleur renouvelable sont repris dans l'édition Automnale du journal Efficienc21.		
LMS	<i>Géostructures énergétiques avec Prof. Laloui à la RTS</i> 06.11.2019	Prof. Laloui et Prof. Rotta Loria couronnent des années de recherches au laboratoire de mécanique des sols (LMS) sur les géostructures énergétiques par un nouveau livre, qui condense entre ses pages à la fois l'essentiel théorique et des recommandations pratiques pour maintes applications.		Link to Interview
LMS	<i>Des panneaux géothermiques en finale d'un concours international</i> 14.11.2019	Récupérer la chaleur emmagasinée dans les sous-sols, les métros ou les parkings souterrains grâce à des capteurs thermiques optimisés placés sur les parois: le concept, issu d'un laboratoire de l'EPFL, sera défendu dès aujourd'hui à la finale internationale du ClimateLaunchPad, le plus grand concours de projets liés au développement durable.	Carron Cécilia	Laboratoire de mécanique des sols

News channel	Title, Date	Heading	Authors	Links
LMS	Des terrains stabilisés grâce à un mélange de biominéraux 20.11.2019	Une spin-off de l'EPFL, Medusoil, a testé avec succès sa technologie de stabilisation des sols à base de biominéraux sur des falaises victimes d'une érosion de surface. Cette solution durable, facilement injectable, permet de protéger les terrains sablonneux et caillouteux, ainsi que les infrastructures, sans utiliser de fluide industriel dont la fabrication et l'injection peuvent être nocives pour l'environnement. La jeune entreprise est prête à passer à une production industrielle.	Carron Cécilia	Laboratoire de mécanique des sols ; Medusoil
LMS	Enerdrape remporte la 3ème place de la finale ClimateLaunchpad 2019 21.11.2019	Le projet Enerdrape développé au sein du Laboratoire de Mécanique des Sols (LMS) de l'EPFL a remporté la troisième place de la finale internationale du ClimateLaunchpad 2019 à Amsterdam.		Clean technica article ; Enerdrape in competitions ; Startup ticker article
LMS	Enerdrape soutenu par InnoSeed ENAC 28.11.2019	Enerdrape développe des solutions géothermiques sans forage adaptées aux constructions existantes.		
LMS	Laurent Vulliet nommé au sein de la Commission fédérale de géologie 10.12.2019	Professeur ordinaire au Laboratoire de mécanique des sols de la Faculté ENAC, Laurent Vulliet vient d'être nommé par le Conseil fédéral membre de la Commission fédérale de géologie pour la période 2020-2023.	ENAC Communication	Communiqué de presse du Conseil fédéral ; Laboratoire de mécanique des sols ; Laurent Vulliet
LMS	Prof. Laloui parle d'innovation dans le Nouvelliste 21.12.2019	Dans une chronique du Nouvelliste, Prof. Lyesse Laloui parle des géostructures énergétiques développées au LMS.		Article Le Nouvelliste ; Laboratoire de mécanique des sols ; Prof. Lyesse Laloui

Services

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 Hydraulics at EPFL	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)	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

Name	Service	Role	Role in funding allocation
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

Vision

Highlights

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ERC BIOGEOS

The ERC Advanced project BIOGEOS has successfully entered its second year. With a team of 4 Ph.D.s students and 3 post-doctoral researchers, the project is addressing complex and multiphysical phenomena of reactive flow-transport and mineralization in porous media. Among the achievements our team is most proud of is the construction of a state-of-the-art biogeochemical system to improve and strengthen 300 tons of soil. This unique setup enables our team to apply, control and demonstrate the beneficial effects of biomineralization as a ground improvement technology. Several rounds of experiments are planned until 2023 to shed light on previously unknown, coupled mechanisms involved in soil biocementation.

TERRE

The TERRE project was funded in the framework of the EC's Marie-Sklodowska Curie Actions and involved 14 educational and industrial institutions. Within Terre, several topics related to soil mechanics and geotechnical engineering were investigated through a nature-centric approach, paving the road towards a low carbon future for geotechnical engineering practice. LMS was involved in this project with two Ph.D. theses related to the carbon-efficient design of geostructures, developed in collaboration with the industrial partner Nobatek/INEF4 (Bordeaux, France). The first Ph.D. thesis dealt with activities on energy geostructures involving experimental, in-situ tests, numerical and analytical modeling applied to understand the thermomechanical behavior of underground energy infrastructures. The second one dealt with geomechanical and environmental aspects related to the interaction between unsaturated soils and retaining structures employing experimental and analytical approaches. The environmental performance of geostructures was investigated following Life Cycle Assessment modeling.

BEACON

The EU project Beacon (Bentonite Mechanical Evolution) started in June 2017 and involves 25 European partners. It aims at improving the numerical models for predicting the behavior of bentonite seals, buffers and backfills in the context of deep nuclear waste disposal. Robust numerical tools, able to predict the long-term performance of such elements are key technical issues for the implementation of planned geological disposals. LMS contributes to the task by enhancing the constitutive model ACMEG, successfully used to predict the behavior of a broad range of geomaterials, to deal with the expansive features that characterize bentonite-based materials. In the context of the project, the new constitutive approach has been implemented to model the long-term evolution of deep geological repositories. In parallel, a set of experiments have been performed at LMS to improve the understanding of relevant physical processes, such as bentonite-steel interface interactions and an in-depth evaluation of stress path dependency bentonite behavior.

EURAD

The EU project EURAD-WP 6 Gas (European Joint Programme on Radioactive Waste Management) aims at improving the understanding of gas transport processes in natural and engineered clay materials. Besides, it focuses on the gas transport regimes that can be active at the scale of a geological disposal system and their potential impact on barrier integrity and repository performance. The work package consists of 20 beneficiaries and a total of 18 participating organizations. LMS is participating in the project with a Ph.D. thesis focusing on Gas-induced impacts on host rocks and clay-based engineered barrier systems.

SNF - GEOBRAIN

GeoBrain is a Machine Learning approach developed to tackle the design and the lifetime management of geothermal installations, offering solutions for cost-efficient, sustainable and reliable geothermal systems. The AI-driven GeoBrain solutions comprise a methodology to determine the ground thermal properties based on previous testing experience as well as a supervision tool for the long-term performance characterization of operating and future geothermal installations. GeoBrain benefits for the SNSF/InnoSuisse Bridge Proof of Concept Grant for pilot projects with implementation partners such as Romande Energie among others. This pilot stage allows us to validate efficient ways for data collection and train and consolidate algorithms and methodologies.

SNF - Cyclic thermo-mechanical behavior of energy piles

Highlights

The LMS obtained SNF funding to study the long-term cyclic thermo-mechanical behavior of energy piles. The response of soils and soil-concrete interfaces to thermal cycles remains a major challenge and may contribute to the development of reliable, long-term predictions of the behavior and performance of energy pile groups. Also, the current interest in the energy geostructure technology requires the development of simplified, yet reliable analysis and design tools.

Goals

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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.

Goals

Deep Geo-Energy

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

Goals

international role in the most advanced and strategically important areas of research in Energy and Environmental Geomechanics.

Others

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