

Table of Contents

Preface	xiii
Keynote Lectures	1
Physical Mechanics of In-Pore Phase Transition – O. Coussy	3
Localized Failure in Brittle Rock – J. W. Rudnicki	25
Coupled Analysis of Chemo-Mechanical Processes – A. Gens, L. do N. Guimarães, A. M. Fernández, S. Olivella, M. Sánchez	41
Drilling Into the San Andreas Fault – T.-F. Wong	59
Section 1. Fundamentals of Mechanics of Porous Media	75
A Numerical Model for CO ₂ Wells Ageing through Water/Supercritical CO ₂ /Cement Interactions – J. Corvisier, A. Fabbri, F. Brunet, Y. Leroy, B. Goffé, G. Rimmelé, V. Barlet-Gouédard	77
Study on Shear Stress-Strain Model for Unsaturated Soil – W. Wang, T. Lu, L. Ji	85
How Lead Affects the Hydraulic and Microscopic Properties of a Smectite H. Souli, J-M Fleureau	93
Study of Settlements in a Granular Medium by a Probabilistic Approach D. Boumezerane, L. Herzine, F. Ouali, B. Tabti	101
Mechanics of a Soil, a Dynamically Coupled Solid-Water Gas System. Conceptual Aspects – J. P. Oostveen	113
Mechanics of a Soil, a Dynamically Coupled Solid-Water Gas System. Undrained Compression – J. P. Oostveen	121
Mechanics of a Soil, a Dynamically Coupled Solid-Water Gas System. Shear Compression Interaction – J. P. Oostveen	131

Simulation and Contrastive Analysis of Typical Pollutant Transporting L. Chen, Y. Liang	141
Section 2. Experimental Characterization of Coupled T-H-M-C Processes in Porous Media	149
Gas Retention Phenomenon in Dry or Partially-Saturated Concrete: Permeability Assessment – X. Chen, F. Robert, C. Davy, F. Skoczylas, M. Moranville	151
Simultaneous Measurement of Expansion and Water Humidity Sorption on Montmorillonitic Clays – I. Kolarikova, R. Hanus	161
Effect of Temperature on Migration of Gas and Brine in Compacted Salt Y. Cinar, H. Alkan, O. Olafuyi	171
The effect of Wetting Conditions on the Mechanical Strength of Chalk B. Zangiabadi, T. A. Davidian, R. I. Korsnes, K. A. N. Vorland, T. G. Kristiansen, M. V. Madland	179
Induced Geometry in Chalk during Hydrochloric Acid Stimulation – E. Omdal, E. Dirdal, K. Ormark, K.A.N. Vorland, R.I. Korsnes, T.G. Kristiansen, T.L. Knutsen, T. Hildebrand-Habel, M.V. Madland.	187
An Experimental Investigation of the Evolution of Rock Poromechanical. Properties Associated with Chemical Alteration Processes – E. Bemer, J-M. Lombard	195
Electrokinetic Treatment of a Natural Silt in Saturated and Unsaturated Conditions – L. Gabrieli, C. Jommi, G. Musso, E. Romero	203
Normal Stress-Induced Permeability Reduction of a Fracture in a Large Granite Cylinder – A.P.S. Selvadurai	211
Experimental Study of the Water Permeability of a Partially Saturated Argillite – P. Semete, C. Imbert, P. Desgree, B. Février, A. Courtois, G. Touzé	219
Application of the Maturity Concept for the Prediction of Restrained Autogenous Shrinkage of Cement Pastes – A. Pertué, P. Mounanga, A. Khelidj.	231
Laboratory Experiments on Thermal Effects on Clay Rocks – C-L Zhang, T. Rothfuchs, K. Su.	239
Mechanical Compaction of Porous Sandstone: an Experimental Study using Acoustic Emission (AE) Monitoring – J. Fortin, S. Stanchits, G. Dresen, Y. Guéguen	251
An Analysis of the Pulse Test and the Light of Residual Hydraulic Potentials A.P.S. Selvadurai	259

Section 3. Constitutive Models for T-H-M-C Coupling and Multi-scale Approaches	267
Formulating Material Properties in Coupled Hydro-Mechanical Modeling G. Ziefle, J. Maßmann, M. Kohlmeier, W. Zielke	269
Partially Coupled Fluid Flow Modeling for Stress Sensitive Naturally Fractured Reservoirs – A.R. Shaik, N.H. Tran, M.A. Aghighi, A.H. Syed, S.S. Rahman	277
Poromechanical Modeling of Hygric Shrinkage and Crystallization Swelling in Layered Porous Materials – H. Derluyn, A.S. Poupeleer, D. Van Gemert, J. Carmeliet.	289
Fan-shaped Model of Clay Swelling Process – M. G. Khramchenkov	297
Early Age Autogenous Deformations of Cement-Based Materials M. Bouasker, F. Grondin, P. Mounanga, A. Khelidj	305
Identification of the Hydro-Mechanical in-Situ Properties of Tournemire Argillite from Mine-by-test Experiment – A. Millard, A. Rejeb	313
Model of Coupled Thermo-Hydraulic Transport in Bentonite Based on Mobile and Immobile Water Phase – M. Hokr, D. Frydrych	321
Orthotropic Anisotropic Damage Coupled Modeling of Saturated Porous Rock – Y.F. Lu, D.F. Liu	329
Numerical Evaluation of Effective Transport Properties of Random Cell Models: Two-Point Probability Approach – A. Rozanski, D. Lydzba, J. F. Shao.	345
Section 4. Numerical Modeling of T-H-M-C Processes	353
Numerical Analysis of the Desaturation Process at the Argillaceous Tournemire Site (France) – J. Maßmann, G. Ziefle, M. Kohlmeier, W. Zielke, H. Shao, A. Rejeb.	355
Numerical Study of the Influence of Fractures on the EDZ around a Nuclear Waste Emplacement Drift – X-T Feng, J. Rutqvist, P-Z Pan	363
Modeling THM Processes in Rocks with the Aid of Parallel Computing – R. Blaheta, P. Byczanski, R. Kohut, J. Starý	373
Influence of Excavation of Disposal Tunnel on the Near-Field Coupled Thermal, Hydraulic and Mechanical Phenomena – M. Chijimatsu, Y. Tsukada, A. Kobayashi, T. Fujita.	381
The Probabilistic Method: An Efficient Tool to Take into Account the Parameters Variability of Modeling for Durability Design Process F. Deby, M. Carcasses, A. Sellier.	391
The Influence of Fractures in the Wall-Block Model Domain in the EDZ using an EPCA Code – P-Z Pan, X-T Feng, X-H Huang, H. Zhou	399

Simulations of the Thermo-Hydro-Mechanical Behavior of an Annular Reinforced Concrete Structure Heated up to 200°C – M. V. G. De Morais, B. Bary, G. Ranc, S. Durand, A. Courtois.	409
Hydraulic Modeling of Unsaturated Zones Around Three Openings at the Argillaceous Tournemire Site (France) – S. Uehara, A. Kobayashi, M. Chijimatsu, Y. Ohnishi, T. Fujita, A. Rejeb	419
Modeling of Non-Isothermal THM Coupled Processes In Multi-Phase Porous Media – W. Wang, H. Shao, O. Kolditz	427
Scale and Stress Effects on Permeability Tensor of Fractured Rocks with Correlated Fracture Length and Aperture – A. Baghbanan, L. Jing.	439
3D Fully Coupled Multiphase Modeling of Ekofisk Reservoir – C. Ringlet, R. Charlier, Ch. Schroeder, F. Collin	447
Evolution of Permeability in Siliceous Rocks by Dissolution and Precipitation Under Hydrothermal Conditions – H. Yasuhara, N. Kinoshita, H. Kurikami, S. Nakashima, K. Kishida	457
Are Uncertainties on the Spatial Distribution of Rock Properties Influential in Coupled Reservoir/Geomechanical Modeling? – T. Hu, F. Fournier, J-J. Royer	465
Thermo-Hydro-Mechanical Behavior of Concrete at High Temperature C. Melhem, H. Boussa, H. Dumontet	473
Development of Loads in a Shaft Foundation in Salt Rock due to Seasonal Temperature Changes – S. Krug, J. Hesser, H. Shao	481
An Analytical Model to Calculate the Stress Field Induced by a Thin Axisymmetric Producing Reservoir – M. Chertov, M. Thiercelin	489
Time and Chemical Effects on Rock Sample Failure – M. Rinne, B. Shen, T. Backers	499
Effects of Pore Pressure on Failure Process and Acoustic Emissions of Rock Specimen with Pre-existing Random Imperfections – X.B.Wang.	507
Modeling the Three-dimensional Hydraulic Performance of a Prototype Repository System within Fractured Crystalline Rock – P. Vardon, H.R. Thomas, P. Cleall	517
Numerical Simulation of laboratory coupled shear-flow tests for Rock Fractures – T. Koyama, T. Tsukahara, L. Jing, H. Kawamura, Y. Ohnishi	525
Section 5 - T-H-M-C Processes in Durability Mechanics of Concrete and Structures	533
Ultra High Performance Fibre Reinforced Concrete Activation Energy A. Kamen, H. Sadouki	535

Modeling of Mechanical Behavior of Steel Fibre-Reinforced Concrete in a Chemical Evolution Context – G. Camps, A. Turatsinze, A. Sellier, G. Escadeillas, X. Bourbon	543
A Model for Hydration-Drying Interactions in the Concrete Cover M.D. Nguyen, M. Thiery, P. Belin	553
Performance Assessment of a Mortar Added with High Calcareous Filler Amounts – Y. Benachour, C. A. Davy, F. Skoczylas, H. Houari	563
Modeling of Isothermal Drying Process in Cementitious Materials – M. Thiery, P. Belin, V. Baroghel-Bouny, M. D. Nguyen	571
Separation of Damage Mechanisms in Concrete at High Temperature C. De Sa, F. Benboudjema, J. Sicard.	581
Experimental Analysis of Concrete Structures Affected by DEF – R.-P. Martin, D. Siegert, F. Toutlemonde	589
Percolation and Early Age Behavior of Concrete – L. Stefan, F. Benboudjema, J.M. Torrenti, B. Bissonnette	597
How can a Crack Opening be Extracted from a Continuous Damage Finite Element Computation? Application for the Estimation of Permeability M. Choinska, F. Dufour, G. Pijaudier-Cabot, A. Huerta, A. Khelidj	605
Effect of Carbonation on the Hydro-Mechanical Properties of Portland Cement A. Fabbri, J. Corvisier, A. Schubnel, F. Brunet, J. Fortin, B. Goffé, V. Barlet- Gouédard, G. Rimmele, Y. Leroy	613
Assessing the Long-Term Behavior of a Radioactive Waste Disposal Tunnel with a Damage Model Incorporating Chemical Degradation Effects A. Kobayashi, M. Chijimatsu, T. Fujita, K. Yamamoto.	621
Thermo-Hydro-Mechanical Behavior of a Petroleum Cement Paste: Chemical Degradation Effects – I. Yurtdas, S. Xie, J. Secq, N. Burlion, J.-F. Shao, J. Saint-Marc	629
Experimental Study of Water Desorption and Shrinkage in Mortars and Cement Pastes – T. Rougelot, F. Skoczylas, N. Burlion	637
Section 6. T-H-M-C in Engineering Applications and In-situ Investigations	647
Hydro-Mechanical Response of the Tournemire Argillite to the Underground Openings Excavation: Unsaturated Zones and Mine-by-test Experiment A. Rejeb, K. Ben Slimane, J. Cabrera, J.M. Matray, S. Savoye	649
The Belgian Supercontainer Concept for Radioactive Waste Geological Disposal – S. Poyet	657

Comparative Simulation Study on THM-induced Changes in Hydrological Properties of Fractured Rock near Nuclear Waste Repositories – J. Rutqvist, D. Barr, J.T. Birkholzer, K. Fujisaki, O. Kolditz, Q.-S. Liu, T. Fujita, W. Wang, C.-Y. Zhang	669
Long-term Response of Near-Field BMT Models around a Deposition Hole by BEM – H.S. Lee, M. Rinne, B. Shen	679
Assessment of Modeling Approaches for Analysis of Coupled THMC Processes in the EDZ of Geological Nuclear Waste Repositories – J. Rutqvist, A. Bäckström, M. Chijimatsu, X-T Feng, P-Z Pan, J. Hudson, L. Jing, A. Kobayashi, T. Koyama, H-S Lee, X.-H Huang, M. Rinne, B. Shen, E. Sonnenthal	687
Hydro-Mechanical Modeling of Seepage in Gotvand Dam Foundation M. Sharifzadeh, R. Nateghi, M. Kiyani	697
Atomized Rainfall Effect on Stability of Coupling Hydraulic-Mechanical Unsaturated Rock Slope – Q. Ren, W. Y.Xu	707
Index of Authors	715