

54th US Rock Mechanics / Geomechanics Symposium 2020

**Golden, Colorado, USA
28 June - 1 July 2020**

Volume 1 of 5

ISBN: 978-1-7138-1890-8

Printed from e-media with permission by:

Curran Associates, Inc.
57 Morehouse Lane
Red Hook, NY 12571



Some format issues inherent in the e-media version may also appear in this print version.

Copyright© (2020) by the American Rock Mechanics Association
All rights reserved.

Printed with permission by Curran Associates, Inc. (2020)

For permission requests, please contact the American Rock Mechanics Association
at the address below.

American Rock Mechanics Association
Peter Smeallie, Executive Director
600 Woodland Terrace
Alexandria, Virginia 22302-3319

Phone: (703) 683-1808
Fax: (703) 997-6112

info@armarocks.org

Additional copies of this publication are available from:

Curran Associates, Inc.
57 Morehouse Lane
Red Hook, NY 12571 USA
Phone: 845-758-0400
Fax: 845-758-2633
Email: curran@proceedings.com
Web: www.proceedings.com

TABLE OF CONTENTS

VOLUME 1

A 3D SPATIAL MODEL OF SLOPE MASS RATING TO ASSESS POTENTIAL RISK OF PIT WALL FAILURE.....	1
<i>F. Cudjoe, K. Esmaeili</i>	
ABOVE, THROUGH AND BELOW TRAP: INTEGRATED GEOMECHANICS UNDERSTANDING AND DRILLING SOLUTIONS FOR OFFSHORE KUTCH-SAURASHTRA REGION	11
<i>R. Talreja, S. Bahuguna, R. Kumar, J. Zacharia, A. Kundan, V. Kalpande</i>	
ACOUSTIC APPROACH TO DETERMINE BIOT EFFECTIVE STRESS COEFFICIENT OF SANDSTONE USING TRUE TRIAXIAL CELL (TTSC).....	23
<i>H. Salemi, N. Nourifard, S. Iglauer, M. Sarmadivaleh</i>	
ACOUSTIC EMISSION MONITORING OF PROGRESSIVE DAMAGE IN PRISMATIC BARRE GRANITE ROCKS WITH AN EXISTING FLAW	28
<i>S. Zafar, A. Hedayat, O. Moradian</i>	
ADVANCED PORE PRESSURE PREDICTION METHODOLOGIES INCORPORATING THE FULL STRESS TENSOR AND THEIR APPLICATION TO THE SANDIA FIELD, TARFAYA BASIN.....	38
<i>D.T. Roberts, G.J. Richards, J. Kato, A.T. Bere, J.J. Hoogvorst, M.A. Nikolinakou, T.W.D. Harrold</i>	
ADVANCED STATISTICAL METHODOLOGIES FOR CABLE BOLT PERFORMANCE CHARACTERISATION	46
<i>D. Li, H. Masoumi</i>	
ALTERNATIVE, LESS WATER-INTENSIVE, FRACTURING FLUIDS FOR ENHANCED GEOTHERMAL SYSTEMS.....	54
<i>G. Jian, C.A. Fernandez, J. Burghardt, A. Bonneville, V. Gupta, G. Garrison</i>	
ANALYSIS OF AN UNDERGROUND POWERHOUSE COMPLEX BY THE FINITE ELEMENT METHOD	68
<i>D. Shirole, K.G. Sharma</i>	
ANALYSIS OF BRAZILIAN DISC TEST EXPERIMENTS USING DIGITAL IMAGE CORRELATION	74
<i>P.N. Parrikar, M. Mokhtari</i>	
ANALYSIS OF GEOMECHANICAL BEHAVIOR OF CARBONATE ROCK FRACTURES.....	80
<i>S.M.F. Oliveira, A.D. Oliveira, L.J.N. Guimaraes, I.F. Gomes, O.J.C. Filho</i>	
ANALYSIS OF HYDRAULIC FRACTURING ON THE 4100 LEVEL AT THE SANFORD UNDERGROUND RESEARCH FACILITY	88
<i>M.D. Ingraham, P.C. Schwering, J. Burghardt, C. Ulrich, T. Doe, W.M. Roggenthen, C. Reimers</i>	
ANALYSIS OF SEM TUNNEL WITH QUASI-STATIC EXPLICIT FINITE ELEMENT	94
<i>R.G. Mikola</i>	

ANALYTICAL AND EXPERIMENTAL ANALYSIS OF THE ROLLING AND LIFTING OF CUTTINGS IN DEVIATED WELLBORES	102
<i>F. Badrouchi, N. Scott, H. Feilen, N. Badrouchi, O.S. Tomomewo, N. Benouadah, V. Rasouli</i>	
AN ANALYTICAL SOLUTION FOR SPATIAL ORIENTATIONS OF CRITICALLY STRESSED FRACTURE PROBLEM AND ITS APPLICATION FOR TRANSITIONAL STRESS REGIMES	112
<i>N.V. Dubinya</i>	
AN ANALYTICAL STUDY OF ROCKFALL TRAJECTORY SIMULATION TO DEVELOP HAZARD MAPS FOR OPEN-PIT MINES.....	121
<i>B. Peik, M.Z. Naghadehi, R. Battulwar, B. Abbasi, J. Sattarvand, M.S. Sadrabadi, B. Azarf</i>	
ANISOTROPIC FRACTURE TOUGHNESS OF POORMAN SCHIST ROCKS FROM EGS COLLAB EXPERIMENT 1 SITE	131
<i>C. Ruplinger, R. O'Connell, H. Sone, M. Trzeciak, H. Wang</i>	
APPLICATION OF A MODIFIED STRAIN RATE DEPENDENT CONSTITUTIVE MODEL FOR WELL-BORE STABILITY ANALYSES IN CHALK RESERVOIRS.....	137
<i>M.R. Hajiabadi, M. Medetbekova, H.M. Nick</i>	
APPLICATION OF A TIME-DEPENDENT MATERIAL LAW FOR SHOTCRETE TO A THREE-DIMENSIONAL TUNNEL MODEL	144
<i>D. Zapf, B. Leuger</i>	
APPLICATION OF AN OPTICAL FIBER BASED MONITORING SYSTEM TO A MASS MOVEMENT AREA	151
<i>A.A. Kelam, M.K. Kockar, H. Akgun</i>	
APPLICATION OF ARTIFICIAL INTELLIGENCE FOR CHARACTERIZATION OF ROCKS FROM OTANMÄKI, FINLAND.....	157
<i>A.E. Aladejare, K. Karenlampi, A.I. Lawal</i>	
APPLICATION OF ENHANCED OIL RECOVERY METHODS IN UNCONVENTIONAL RESERVOIRS: A REVIEW AND DATA ANALYSIS	165
<i>M. Elturki, A. Imqam</i>	
THE APPLICATION OF NEW BRITTLENESS INDEX MODEL BASED ON THE COUPLING EFFECT OF MACRO AND MICRO PARAMETERS	180
<i>D.W. Gao, H.L. Huang, J. Li, Z.C. Zhang, L. Sun, S.P. Cao, J.J. Xie</i>	
APPLICATION OF PRESSURE DERIVATIVE IN WELL-TEST INTERPRETATION, CASE STUDY FROM BUZURGAN OILFIELD, SOUTHERN IRAQ.....	185
<i>A.K. Abbas, H.A. Baker, A. Ellafi</i>	
APPLICATION OF QUANTITATIVE RISK ASSESSMENT FOR OPTIMUM MUD WEIGHT WINDOW DESIGN.....	197
<i>A.K. Abbas, R.E. Flori, M. Alsaba, M.F. Al Dushaishi</i>	
AN APPROACH TO STOPE STABILITY ASSESSMENT IN OPEN STOPE MINING ENVIRONMENT	206
<i>M. Zhalel, A.C. Adoko, S. Korigov</i>	
ARTIFICIAL NEURAL NETWORKS MODEL FOR PREDICTION OF THE RATE OF PENETRATION WHILE HORIZONTALLY DRILLING CARBONATE FORMATIONS	212
<i>A.A. Mahmoud, S. Elkhatatny, A. Al-AbdulJabbar, T. Moussa, H. Gamal, D. Al Shehri</i>	

ASSESSING THE STABILITY OF ROCK BLOCK SUBJECT TO SEISMIC LOAD USING BLOCK THEORY	221
<i>Z.X. Zhang, S.F. Wang, X. Huang</i>	
ASSESSMENT OF FREESTANDING VERTICAL FACE FOR THE BACKFILL USING THE RUN OF THE MINE TAILINGS AND PORTLAND CEMENT	228
<i>J. Someehneshsin, W. Quan, A. Abugharara, S. Butt</i>	
ASSESSMENT OF ROCK DAMAGE USING SEISMIC METHODS: WAVE SPEEDS AND ATTENUATION FROM BOREHOLE MEASUREMENTS IN THE CHICXULUB IMPACT STRUCTURE.....	238
<i>C.G. Nixon, R. Kofman, D.R. Schmitt, S.P.S. Gulick, G.L. Christeson, S. Sastrup, J. Lofi, J.V. Morgan</i>	
AN ASSESSMENT OF ROCK MASS CLASSIFICATION FOR ROCK SLOPES IN COLD REGIONS BASED ON ENTROPY WEIGHT METHOD AND MATTER-ELEMENT EXTENSION THEORY	246
<i>J. Li, J. Wang, H. Chen, W. Liu, K. Zhou</i>	
AUTOMATED BOREHOLE BREAKOUT INTERPRETATION FROM ULTRASONIC IMAGING: APPLICATION TO A DEEP BOREHOLE DRILLED INTO THE CRYSTALLINE CRUST	254
<i>W. Wang, D.R. Schmitt</i>	
AUTOMATED ROCK SLOPE MATERIAL CLASSIFICATION USING MACHINE LEARNING.....	261
<i>L. Weidner, G. Walton, R. Kromer</i>	
BACK ANALYSIS OF AN OPEN PIT SLOPE FAILURE USING NUMERICALLY UPSCALED ROCK STRENGTH	270
<i>C. Guajardo, D. Elmo, S. Rogers</i>	
BACK-ANALYSIS OF A STOPE FAILURE USING SEISMIC AND GEOTECHNICAL DATA	281
<i>R.L. Hauta, D.B. Reboli, S. Meyer</i>	
A BAYESIAN APPROACH TO STRESS INVERSION AND WELLBORE STABILITY PROBLEMS	288
<i>A. Rodriguez-Herrera, R. Prioul, S. Kisra</i>	
BENCH SCALE STABILITY ANALYSIS USING DISCRETE FRACTURE NETWORKS	302
<i>S. Rogers, M. Valerio, M. Yetisir, K.P. Lawrence</i>	
BOREHOLE FAILURE MECHANISMS IN NATURALLY AND HYDRAULICALLY FRACTURED FORMATIONS INVESTIGATED WITH A FAST TIME-STEPPED LINEAR SUPERPOSITION METHOD (TLSM)	307
<i>R. Weijermars, J. Wang, T. Pham</i>	
BOREHOLE MEASUREMENTS OF VERTICAL INJECTION HORIZON IN OVERBURDEN IN LONGWALL SUBSIDENCE CONTROL ENGINEERING	331
<i>D. Xuan, C. Wang, J. Xu, R.B. Kaunda, J.F. Brune</i>	
BRITTLENESS INDEX PREDICTION IN 3D BULK VOLUME VIA SEISMIC INVERSION IN UNCONVENTIONAL RESERVOIRS.....	337
<i>S. Esmaeilpour, I. Ispas</i>	

BUILDING A COMPREHENSIVE GEOMECHANICAL MODEL FOR CHALK COMPACTION. PHASE 1: MODEL CALIBRATION FROM PLUG TO RESERVOIR SCALE	343
<i>F. Amour, M.R. Hajabadi, H.M. Nick</i>	
A CALCULATION MODEL FOR PROPPED FRACTURE WIDTH CONSIDERING THE PLACEMENT OF PROPPANTS OF DIFFERENT PARTICLE SIZES	351
<i>C. Lu, F.L. Huang, L. Ma, C.H. Huang, J.C. Guo, B.Y. Jiang, Z.B. Tang, H.R. Yuan, H.T. Zhao, Y.L. Zhou, L. Chen</i>	
CALIBRATION OF A NUMERICAL MODEL OF THE EISENHOWER-JOHNSON MEMORIAL TUNNEL PILOT BORE BY BACK ANALYSIS	357
<i>G. Alexander, M. Gutierrez, A. Krajnovich, S. Harelson</i>	
CAN NEURAL NETWORKS PREDICT THE CRACK INITIATION THRESHOLD FROM STRESS-STRAIN DATA?	365
<i>L. Weidner, G. Walton</i>	
CAPTURING NON-LINEAR STRESS-STRAIN RESPONSE OF BRITTLE ROCKS DUE TO CLOSURE OF CORING-INDUCED MICRO-CRACKS USING 3D BONDED BLOCK MODEL	372
<i>N. Bahrani, B. Valley</i>	
CARBON DIOXIDE STORAGE IN SHALE: AN EXPERIMENTAL EVALUATION	381
<i>S. FAkher, H. Abdelaal, Y. Elgahawy, A. Imqam</i>	
CASE STUDY: INVESTIGATION, ANALYSIS AND MITIGATION OF A THREE-CATCH BENCH SLOPE FAILURE AT PINTO VALLEY MINE IN ARIZONA.....	388
<i>S.D. Ureel, M. Sather, K. Triebel</i>	
A CASE STUDY ON LONGWALL MINING NEAR SHALE GAS WELLS IN BARRIER PILLARS – INFLUENCE, SAFETY, AND RISKS	396
<i>P. Zhang, D. Su, H. Dougherty, R. Kimutis, S. Schatzel, J. Lu</i>	
CASE STUDY ON WATERFLOODING OF LOW-PERMEABILITY RESERVOIRS BY HORIZONTAL WELLS WITH WATER-INJECTION INDUCED FRACTURES	404
<i>I. Bazyrav, E. Shel, A. Gimazov, A. Roshchektaev, M. Khasanov</i>	
CASE STUDY: TREATING PARAMETERS OPTIMIZATION IN CASING DEFORMATION WELLS OF SHALE GAS IN SICHUAN BASIN	415
<i>Z. Chen, R. Huang, B. Zeng, Y. Song, X. Zhou</i>	
CFD SIMULATION OF PROPPANT DISTRIBUTION IN A VERTICAL FRACTURE DURING SUPERCritical CO ₂ FRACTURING	427
<i>Y. Zheng, H. Wang, Z. Shen, B. Yang, G. Tian</i>	
CHARACTERIZATION OF FAILURE LOADS AND FAILURE MODES IN SCHIST FROM INDIRECT TENSION TESTS.....	435
<i>N.W. Hudyma, B.B. Avar</i>	
CHARACTERIZATION OF PERMEABILITY/POROSITY RELATIONSHIPS AS A FUNCTION OF RUBBLE PILE POLYDISPERSITY DURING ROOM CLOSURE AT THE WASTE ISOLATION PILOT PLANT	441
<i>E.N. Matteo, C. Mitchell, T.A. Dewers, R. Lander, L. Bonnell</i>	
CHARACTERIZATION OF STRESS FIELD AROUND A REVERSE FAULT BASED ON A CONSTRAINT STRESS MODEL	448
<i>Q. Zhang, B. Lin, J. Kao, A. Chen, S. Shi, H. Yu, G. Tian</i>	

CHARACTERIZATION OF SYNTHETIC MUDSTONE FOR PHYSICAL MODEL STUDIES	455
<i>K. Arora, E.C.V. Cruz, M. Gutierrez, A. Hedayat</i>	
CHARACTERIZE HYDRAULIC FRACTURING TREATMENT DIRECTLY FROM PRODUCTION DATA USING CONNECTED RESERVOIR STORAGE MODEL.....	463
<i>D.R. Childers, X. Wu</i>	
CHARACTERIZING FAULT ZONE STRUCTURE AND GEOMETRY USING PHOTOGRAHAMMETRY AND 3D GEOLOGIC MODELING	472
<i>A. Krajnovich, W. Zhou, M. Gutierrez</i>	
CHOICE OF CORRELATION FUNCTION FOR PROBLEM OF STRESS ESTIMATION BASED ON CRITICALLY STRESSED FRACTURES APPROACH	479
<i>N.V. Dubinya, S.A. Tikhotskiy</i>	
COAL RIB GEOMECHANICS: A NUMERICAL APPROACH FOR THE ANALYSIS OF RIB STABILITY IN UNDERGROUND COAL MINES	489
<i>M. Sunkpal, M. Alebayat, T. Sherizadeh</i>	
A COMPARATIVE STUDY ON SHEAR STRENGTH OF CRUSHED WASTE GLASS WITH NATURAL AND MANUFACTURED SAND	500
<i>D. Kazmi, M. Serati, D.J. Williams, S. Qasim, Y.P. Cheng, S.Q. Olaya</i>	
COMPARISON OF DUAL POROSITY DUAL PERMEABILITY WITH EMBEDDED DISCRETE FRACTURE MODEL FOR SIMULATION FLUID FLOW IN NATURALLY FRACTURED RESERVOIRS	505
<i>F. Torres, M. Xavier, J. Ailin, W. Yu, Y. Wei, J. WAng, H. Xie, N. Li, J. Miao</i>	
A COMPARISON OF HYDRAULIC FRACTURE PROPAGATION AND WELL PRODUCTIVITY USING DIFFERENT ENERGIZED FRACTURING FLUIDS.....	513
<i>S. Zheng, M.M. Sharma</i>	
COMPARISON OF MINE SUBSIDENCE ESTIMATES FROM FINITE ELEMENT MODELING WITH DIN SAR OBSERVATIONS	522
<i>W.G. Pariseau, J.M. Wempen</i>	
COMPARISON OF THE ELASTIC PROPERTIES OF ROCKS OBTAINED USING STATIC, BOREHOLE ACOUSTIC, AND ULTRASONIC MEASUREMENTS.....	532
<i>H. Kareem, M. Khadijeh, E. Maalouf</i>	
COMPARISON OF TOMOGRAPHY TO NUMERICAL MODELING FOR STRESS MONITORING IN AN INSTRUMENTED PILLAR.....	539
<i>M.M. Murphy, B.A. Slaker, M.M. Sears, E.C. Westman</i>	
COMPOSITIONAL SIMULATION OF HUFF-N-PUFF GAS INJECTION IN A VOLATILE OIL RESERVOIR FROM DUVERNAY SHALE IN ALBERTA, CANADA	549
<i>X. Kong, W. Yu, H. Wang, M.X.F. Torres, Z. Xia, P. Wang</i>	
A COMPREHENSIVE OPTIMIZATION METHOD OF MULTI FRACTURING PARAMETERS FOR SHALE GAS WELL FACTORY	555
<i>X. Bian, S. Ding, T. Jiang, S. Li, H. Wang, R. Wei, B. Xiao, Y. Su, G. Zhong, L. Zuo, J. Zhou</i>	
A COMPREHENSIVE STRATEGY OF PROPAGATING MULTIPLE FRACTURES WITHIN ONE STAGE IN HORIZONTAL WELL STIMULATION TO MAXIMIZE SRV	561
<i>T. Jiang, B. Lu, X. Bian, H. Wang, S. Li, R. Wei, J. Zhou, Y. Su, B. Xiao, L. Zuo, G. Zhong</i>	

COMPRESSIVE BEHAVIOR OF NOVEL HYBRID STANDING SUPPORT INCORPORATING FIBER-REINFORCED POLYMER	567
<i>H. Zhao, T. Ren, A. Remennikov</i>	
CONCEPT OF FATIGUE HYDRAULIC FRACTURING AND APPLICATIONS IN HARD ROCK PREDICTED FROM LABORATORY AND IN SITU EXPERIMENTS.....	573
<i>A. Zang, O. Stephansson, G. Zimmermann, H. Hofmann, P. Niemz, K.Y. Kim, M. Diaz, J.S. Yoon</i>	
A CONCEPTUAL PROTOCOL FOR INTEGRATING MULTIPLE PARAMETERS FOR RISK ASSESSMENT DUE TO INDUCED SEISMICITY IN A DEEP MINE.....	582
<i>S.G. Afrouz, E.C. Westman, K.K. Dehn, B. Weston, K.D. Luxbacher</i>	
CONSTITUTIVE MODELING APPROACHES FOR CROSS-ANISOTROPIC POROUS ROCKS	591
<i>G. Buscarnera, F. Marinelli, G. Shahin</i>	
CONSTRAINING THE MATERIAL PROPERTIES AND TRIGGERING MECHANISM OF A CATASTROPHIC LAVA DOME COLLAPSE AT SHIVELUCH VOLCANO, RUSSIA, USING THE FINITE ELEMENT METHOD	600
<i>C.S. Wallace, L.N. Schaefer, M.C. Villeneuve</i>	
A CONTINUUM NON-LOCAL DAMAGE-TRANSPORT MODEL FOR HYDRAULIC FRACTURING	613
<i>M.E. Mobasher, H. Waisman, P.B. Woelke</i>	
CONVOLUTIONAL NEURAL NETWORKS FOR PREDICTING TUNNEL SUPPORT AND LINER PERFORMANCE: CIGAR LAKE MINE CASE STUDY	623
<i>J. Morgenroth, M.A. Perras, U.T. Khan</i>	
COUPLED 3D THERMO-HYDRO-MECHANICAL-CHEMICAL ANALYSIS OF KARAMAY OIL SAND RESERVOIRS UNDER HOT WATER INJECTION IN SAGD WELLS CONSIDERING FORMATION HETEROGENEITY	631
<i>Y. Gao, M. Chen, W. Li</i>	
COUPLED CFD-DEM MODELING OF IMMISCIBLE FLUID INJECTION INTO GRANULAR MEDIA.....	647
<i>Z. Li, Z. Sun, M.T. Balhoff, D.N. Espinoza</i>	
A COUPLED FLOW-STRESS-DAMAGE EXPLICIT INTEGRATION NUMERICAL MODEL OF WELLBORE FRACTURING BASED ON FINITE-DISCRETE ELEMENT METHOD IN NATURAL FRACTURED SHALE GAS RESERVOIR	655
<i>H. Zhu, X. Tang, Y. Li, X. Wang, Y. Fan, N. Zhou, M.B. Dusseault</i>	
COUPLED GEOMECHANICAL-THERMAL SIMULATION UNDER WATER INJECTION IN OIL SAND RESERVOIRS CONSIDERING AN ASSISTED VERTICAL WELL	669
<i>Y. Gao, M. Chen, H. Dou</i>	
CUTTINGS DISPOSAL IN CEMENT: INVESTIGATION OF THE EFFECT ON MECHANICAL PROPERTIES	676
<i>A.E. Cedola, R. Nygaard, G. Hareland</i>	
DAMAGE DISTRIBUTION ASSOCIATED WITH BRITTLE FAILURE IN A CIRCUMFERENTIALLY NOTCHED SAMPLE OF BEREA SANDSTONE	684
<i>L. Louis, P. Boyd, S. Hender, C. Savidge</i>	

DATA PROCESSING FOR JOINT NORMAL AND SHEAR STIFFNESS TO ELIMINATE INFLUENCES OF THE SURROUNDING ROCK AND LABORATORY MACHINE.....	692
<i>T.R. Packulak, M.T.A. Labeid, J.J. Day, M.S. Diederichs</i>	
DEFINING SRV IN UNCONVENTIONAL RESERVOIRS; HOW IS IT RELATED TO PRODUCTION?	700
<i>Y. Wang, M.B. Dusseault</i>	
DEFORMATION, FAILURE AND PERMEABILITY EVOLUTION OF SEALED FRACTURES/FOLIATIONS IN EGS COLLAB POORMAN SCHIST	714
<i>Z. Ye, A. Ghassemi, T. Kneafsey</i>	
DEFORMATION PATTERNS AND 3D FACE EFFECTS ON TUNNELS MISALIGNED WITH THE GEOSTATIC PRINCIPAL STRESSES IN ISOTROPIC AND ANISOTROPIC ROCK MASSES	723
<i>O.P.M. Vitali, A. Bobet, T.B. Celestino</i>	
DESCRIBING THE FRACTURE PROCESS USING SURFACE ROUGHNESS PARAMETERS	732
<i>E. Magsipoc, G. Grasselli</i>	
DESIGN & APPLICATION OF A PDC HYBRID DRILL BIT WITH IMPREGNATED -- DIAMOND CUTTER (IDC) FOR THE HARD AND STRONG ABRASIVE FORMATIONS	741
<i>B. Wang, J. Li, D. Zou</i>	
DESTABILIZATION OF FRACTURES UNDER CONDITIONS OF RESERVOIR PRESSURE DEPLETION	750
<i>S.V. Zhigulskiy</i>	
DETERMINATION OF MAXIMUM SAFE GAS INJECTION PRESSURE IN A HP, TIGHT OIL CARBONATE RESERVOIR FROM SRT, PTA AND GEOMECHANICS	757
<i>A. Onaisi, L. Francia, A. Kauzhanova, B. Daulbayev, I.T. Ehighebolo</i>	
DETERMINATION OF MINIMUM HORIZONTAL STRESS MAGNITUDES FROM CONVENTIONAL WELL LOGGING DATA USING ARTIFICIAL NEURAL NETWORK	767
<i>A.K. Abbas, M. Alsaba, M.F. Al Dushaishi, H.H. Dahm, M.A. Alhumairi</i>	
DETERMINATION OF SIGNIFICANT PARAMETERS AFFECTING THE RISK LEVEL OF LOST CIRCULATION WHILE DRILLING	774
<i>A.K. Abbas, G. Alqatrani, H.Q. Mohammed, H.H. Dahm, M.A. Alhumairi</i>	
DETERMINING THE RELATIVE INFLUENCE OF JOINT AND ROCK PROPERTIES ON THE PROPAGATION OF PLANAR WAVES IN JOINTED ROCK MASSES USING MULTIVARIATE STATISTICAL TECHNIQUES	782
<i>H.T. Holmes, C. Paraskevopoulou, R. de Moraes</i>	

VOLUME 2

DETERMINISTIC DISCRETE FRACTURE NETWORK (DFN) MODEL FOR THE EGS COLLAB PROJECT ON THE 4850 LEVEL OF THE SANFORD UNDERGROUND RESEARCH FACILITY (SURF)	791
<i>P.C. Schwering, T.W. Doe, W.M. Roggenthen, G.H. Neupane, H. Johnston, P.F. Dobson, C. Ulrich, A. Singh, N. Uzunlar, C. Reimers</i>	
DEVELOPING A FULLY COUPLED THMD MODEL FOR DRILLING AND PRODUCTION IN GAS-HYDRATE-BEARING-SEDIMENTS	800
<i>Y. Wang</i>	

DEVELOPING AN EMPIRICAL MODEL FOR PDC CUTTER ROCK INTERFACIAL FRICTION ANGLE ESTIMATION USING DIFFERENTIAL EVOLUTION ALGORITHM	812
<i>A. Atashnezhad, S. Akhtarmanesh, S. Sleeper, S. Hellvik, G. Hareland</i>	
DEVELOPMENT OF A FRAMEWORK FOR ROCKFALL MONITORING VALUE OF INFORMATION STUDIES.....	819
<i>H. Haugen, W. Trainor-Guitton, G. Walton, D. Gauthier</i>	
DEVELOPMENT OF A PROBABILISTIC RISK ASSESSMENT METHODOLOGY TO EVALUATE THE EFFECT OF LITHOLOGICAL HETEROGENEITY ON ROCK BURSTS AND GAS OUTBURSTS IN LONGWALL COAL MINING	827
<i>H. Agrawal, W. Cao, S. Durucan, A. Korre</i>	
DEVELOPMENT OF A SUPPORTING TOOL FOR THE EVALUATION OF STORAGE CAPACITY OF CAVERNS FOR RENEWABLE ENERGIES – ROCK MECHANICAL DESIGN FOR HYDROGEN STORAGE CAVERNS	835
<i>D. Zapf, B. Leuger, S. Donadei, P.L. Horvath, D. Zander-Schiebenhoefer, S. Fleig, M. Henneberg, J. Onneken, S. GAst, S. Roehling, A. Ruales</i>	
DFN ANALYSIS CONSTRAINED BY SITE CONDITIONS	843
<i>W. Junkin, E. Ben-Awuah, L. Fava</i>	
DFN MODEL VALIDATION AND INPUT PARAMETER CALIBRATION FOR HAWKESBURY SANDSTONE	851
<i>C.J. Wang, R. Szczurowski, A. Vecchiarelli</i>	
DIGITALIZED DATA COLLECTION AND MANAGEMENT FOR MINE PLANNING AND SUPPORT DESIGN	860
<i>C.A. Ozturk, A.S. Kantarci</i>	
DIRECTIONAL HYDRAULIC FRACTURING USING RADIAL JET DRILLING TECHNOLOGY	866
<i>S. Salimzadeh, X. Zhang, J. Kearn, Z. Chen</i>	
DISCRETE ELEMENT MODELING OF SCALED BUCKET EXCAVATION.....	872
<i>U.R. Atta, K. Awuah-Offei, T. Sherizadeh</i>	
DISCRETE FRACTURE NETWORK (DFN) AND HYDRAULIC FRACTURING ANALYSIS BASED ON A 3D GEOMECHANICAL MODEL FOR PROSPECTIVE SHALE PLAYS IN COLOMBIA.....	879
<i>L.A. Medina, A.N. Tutuncu, J.L. Miskimins, A.W. Eustes</i>	
DISRUPTING THE CONCEPT OF ROCK BRIDGES	900
<i>D. Elmo, D. Stead, B. Yang</i>	
DRAINAGE OF ROCK SLOPES WITH SIDE DRAINS.....	906
<i>J.F. da Silva</i>	
DRAINED AND UNDRAINED THERMAL VOLUME CHANGES OF WEAK ARGILLACEOUS FORMATIONS: LESSONS LEARNED	912
<i>H.A. Kasani, R.J. Chalaturnyk</i>	
DYNAMIC ADAPTIVITY FOR COUPLED FLOW AND GEOMECHANICS IN UNCONVENTIONAL RESERVOIRS USING A POSTERIORI ERROR ESTIMATION WITH ENRICHED GALERKIN METHOD	927
<i>X. Lu, V. Girault, M.F. Wheeler</i>	

DYNAMIC BEHAVIORS OF SANDSTONE UNDER ACCUMULATED DAMAGE CONDITION.....	935
<i>H. Pu, J. Xu, Z. Sha, S. Liu</i>	
DYNAMIC FAILURE BEHAVIOR OF SHALE WITH DIFFERENT WATER CONTENT UNDER CONFINING PRESSURE.....	946
<i>Z. Cheng, M. Sheng, G.S. Li, P. Li, S. Cheng, Y. Zhang</i>	
DYNAMIC INDENTATION MEASUREMENTS FOR FINE-SCALE PHYSICAL PROPERTIES	952
<i>J.C. Hampton, G.N. Boitnott</i>	
CONTENT UNDER CONFINING PRESSURE	963
<i>D. Malovichko, P.K. Kaiser</i>	
EFFECT OF DAMPING MODE IN LABORATORY AND FIELD-SCALE UNIVERSAL DISTINCT ELEMENT CODE (UDEC) MODELS.....	973
<i>S. Sinha, R. Abousleiman, G. Walton</i>	
EFFECT OF FAULTING REGIME, POISSON'S RATIO, AND NON-UNIFORM RESERVOIR DEFORMATION ON FAULT REACTIVATION DUE TO INJECTION AND PRODUCTION	981
<i>S.P. Lele, T.E. Tyrrell, B.J. DeMartin</i>	
EFFECT OF FLUID SATURATION ON NON-LINEAR ENERGY INTERACTION BETWEEN DIFFERENT FREQUENCIES OF SEISMIC WAVE.....	989
<i>Rozhko, A. Yu</i>	
EFFECT OF FRICTIONAL NATURAL FRACTURES ON THE HYDRAULIC FRACTURE PROPAGATION.....	1001
<i>J. Rueda, C. Mejia, D. Roehl, L.C. Pereira</i>	
EFFECT OF GRAIN GEOMETRY AND GRAIN ARRANGEMENT ON THE BEHAVIOR OF BONDED BLOCK MODELS FOR PREDICTION OF BRITTLE ROCK DAMAGE	1011
<i>C.E.C. Inga, G. Walton, E. Holley</i>	
EFFECT OF NON-LINEAR ELASTICITY ON STRESS PATHS IN DEPLETED RESERVOIRS AND THEIR SURROUNDINGS	1021
<i>S. Lozovskyi, H. Yan, R.M. Holt, A. Bakk</i>	
THE EFFECT OF POROSITY ON MECHANICAL PROPERTIES IN SILICA SAMPLES BY REACTIVE MOLECULAR DYNAMICS	1029
<i>V.F.S. Alencar, J.C.A. Oliveira, R.V. Goncalves, L.G. Rodrigues, S.M.P. Lucena</i>	
EFFECT OF PRESSURIZATION RATE AND FLUID VISCOSITY ON HYDRAULIC FRACTURING PROCESS OF POCHON GRANITE	1036
<i>K.Y. Kim, M. Diaz, S.G. Jung, F. Guinot, K.B. Min, A. Zang, O. Stephansson, G. Zimmermann, H. Hofmann, J.S. Yoon</i>	
THE EFFECT OF PROPPANT RAMPING IN HYDRAULIC FRACTURING FOR HIGH-PERMEABLE OIL AND LOW-PERMEABLE GAS ZONES	1043
<i>F. Altawati, M. Ramezanian, H. Saoyleh, M. Soliman, H. Emadi</i>	
THE EFFECT OF TEMPORARY PLUGGING AGENTS AND PUMP RATE ON FRACTURE PROPAGATION IN DEEP SHALE BASED ON TRUE TRI-AXIAL EXPERIMENTS	1053
<i>B. Hou, W. Fu, H. Han, J. Min, A. Chen</i>	

EFFECT OF THERMAL SHOCK TREATMENTS ON PERMEABILITY AND DYNAMIC ELASTIC PROPERTIES OF WOLFCAMP FORMATION - AN EXPERIMENTAL STUDY	1059
<i>F. Altawati, M. RAmezanian, R. Khalil, H. Emadi</i>	
EFFECTS OF BRITTLENESS AND BEDDING PLANE ON SHEAR STRENGTH AND FRACTURE MORPHOLOGY OF SHALES	1065
<i>M. Sheng, B. Ma, P. Li, W.A. Khan, P.O. Anyimah</i>	
EFFECTS OF CHEMICAL OSMOSIS ON THE ELASTIC PROPERTIES OF THE PIERRE SHALE	1073
<i>O.O. Adekunle, B. Bui, D. Katsuki</i>	
THE EFFECTS OF LOADING WAVEFORM ON CREEP-FATIGUE PROPERTIES OF ROCK SALT	1090
<i>K. Zhao, H. Ma, C. Yang, Y. Liu, X. Liu, Y. Han, T. Xue</i>	
EFFECTS OF NATURAL FRACTURES ON PRESSURE DRAWDOWN AND DAMAGE EVOLUTION AROUND EXCAVATION IN FRACTURED ROCKS	1099
<i>C. Zhao, Z. Zhang, Q. Lei</i>	
EFFECTS OF PORE STRUCTURE PARAMETERS ON THE PERMEABILITY OF POROUS MEDIA AS SIMULATED BY LBM	1110
<i>W. Li, Z. Huang</i>	
EFFICACY OF SURFACE-BASED MECHANISMS IN MITIGATING MULTI-FREQUENCY STICK-SLIP OSCILLATION IN DRILLING SYSTEMS	1117
<i>G. Ramakrishnan, Z. Sun</i>	
AN EFFICIENT COUPLED HYDRO-MECHANICAL MODELING OF TWO-PHASE FLOW IN FRACTURED VUGGY POROUS MEDIA	1125
<i>L. Liu, Z. Huang, J. Yao, Q. Lei, Y. Di, Y.S. Wu, Y. Liu</i>	
EFFICIENT SIMULATION OF PRODUCTION IN SHALE RESERVOIRS WITH COMPLEX FRACTURES USING EDFM AND STRUCTURED GRIDS	1133
<i>W. Yu, W. Wu, F. Torres, M. Xavier, N. Li, H. Xie, J. Miao</i>	
ELASTODYNAMIC NONLINEAR RESPONSE OF DRY INTACT, FRACTURED AND SATURATED ROCK	1142
<i>P. Manogharan, C. Wood, J. Riviere, D. Elsworth, C. Marone, P. Shokouhi</i>	
ELEVATING GEOMECHANICAL UNDERSTANDING OF HYBRID RESERVOIRS	1151
<i>D.L. Cannon, I. Faoro, V. Singh</i>	
EMPIRICAL APPROACHES IN REGIONAL PILLARS DESIGN FOR ORE REPLACEMENT PROJECTS: AN UNDERGROUND PLATINUM MINING CASE STUDY	1161
<i>C. Mutsvanga, T. Zvarivadza</i>	
ENHANCEMENT MECHANISMS OF INDUCED SEISMICITY BY SITE-SPECIFIC OPERATIONAL AND GEOLOGICAL FEATURES IN A POREELASTICITY SYSTEM.....	1172
<i>K.W. Chang, H. Yoon, Y.H. Kim, M.Y. Lee</i>	
AN EQUIVALENT REPRESENTATION OF MULTIPLE HYDRAULIC FRACTURES WITH A FEWER NUMBER OF FRACTURES FOR RESERVOIR MODELING	1177
<i>E.V. Dontsov, R. Suarez-Rivera</i>	

EVALUATING PRESSURE AND TEMPERATURE EFFECTS ON PERMEABILITY AND ELASTIC PROPERTIES OF WOLFCAMP FORMATION – AN EXPERIMENTAL STUDY	1187
<i>R. Khalil, M. RAmezanian, F. Altawati, H. Emadi</i>	
EVALUATING THE INFLUENCE OF ROCK BRIDGE CHARACTERISTICS: ROCK BRIDGE PERCENTAGE AND SPATIAL LOCATION, ON THE STRENGTH OF A SYNTHETIC ROCK MASS – EXPERIMENTAL APPROACH	1194
<i>P. Hamdi, F. Amann</i>	
EVALUATING THE RELATIONSHIP BETWEEN PROPPANT PERFORMANCE AND CONDUCTIVITY USING MULTIVARIATE STATISTICAL ANALYSIS METHOD	1200
<i>X. Zheng, T. Liang, N. Yang, J. Qiu, Z. Zhang, B. Cai, Y. Yan</i>	
EVALUATING VOLUMETRIC STRAIN FOR IDENTIFYING THE LOADING STAGE TERMINATION POINTS FOR THE MULTISTAGE TRIAXIAL TEST: A CASE STUDY WITH UTAH COAL SPECIMENS	1206
<i>E. Orilogi, S.M. Berry, M.M. MacLaughlin</i>	
EVALUATION OF ACOUSTIC EMISSION TESTS (AET) TO INVESTIGATE ROCK BURST	1213
<i>L. Gottsbacher, J. Biermann, A. Klammer, T. Marcher</i>	
EVALUATION OF FALL OF GROUND MANAGEMENT APPROACHES AS OBSERVED FROM A SHALLOW UNDERGROUND CHROME MINE.....	1222
<i>V.C. Netshilaphala, T. Zvarivadza</i>	
EVALUATION OF PROGRESSIVE DAMAGE IN BARRE GRANITE USING ULTRASONIC VELOCITY TOMOGRAPHY AND DIGITAL IMAGE CORRELATION	1232
<i>A. Butt, A. Hedayat, E. Tudisco, H. Roshan</i>	
EVALUATION OF ROCK BRITTLENESS INDICES TO ESTIMATE CERCHAR ABRASIVITY INDEX FOR DISC CUTTER WEARINESS.....	1242
<i>S. Yagiz, O. Frough, J. Rostami</i>	
EVALUATION OF THE ANNULUS PRESSURE BUILD UP DURING INJECTION OPERATIONS	1248
<i>I.M. Mohamed, G. Woolsey, O.A. Abou-Sayed, A.S. Abou-Sayed</i>	
EVALUATION OF THE EXCAVATION DAMAGE ZONE ASSOCIATED WITH THE MINING METHODS FOR UNDERGROUND MINE SAFETY	1259
<i>B.H. Kim, M.K. Larson, G.J. Min, S.H. Cho</i>	
EVALUATION OF THE INFLUENCE OF HORIZONTAL WELL ORIENTATION OF SHALE GAS ON STIMULATION AND PRODUCTION EFFECT BASED ON TILT-METER FRACTURE DIAGNOSTIC TECHNOLOGY: A CASE STUDY OF CHANG-NING SHALE GAS DEMONSTRATION AREA IN SICHUAN BASIN, CHINA.....	1266
<i>N. Xiu, Z. Wang, Y. Yan, X. Wang, T. Liang, H. Fu, Y. Xu</i>	
EXPANDING UNDERSTANDING OF THE VOUSSOIR BEAM ANALOG IN FLAT ROOF EXCAVATIONS USING THE DISCRETE ELEMENT METHOD	1272
<i>R. Abousleiman, G. Walton, S. Sinha</i>	
EXPERIMENTAL AND NUMERICAL INVESTIGATION OF THE PLASTIC ZONE PERMEABILITY	1282
<i>A.D. Shabdirova, F. Khamitov, A.A. Kozhagulova, Y. Amanbek, N.H. Minh, Y. Zhao</i>	

EXPERIMENTAL BIT-TESTING DATA BRINGS INSIGHT INTO BIT STEERABILITY AND DRILLING EFFICIENCY	1289
<i>A. Walvekar, J. Marck, P. Kis</i>	
EXPERIMENTAL CHARACTERIZATION OF MICROCRACK-INDUCED DAMAGE BEHAVIOR IN SHALE ROCKS USING MINIATURE TENSILE MODULE.....	1298
<i>V. Dubey, S. Abedi, A. Noshadravan</i>	
AN EXPERIMENTAL INVESTIGATION ANALYZING EFFECTS OF INJECTION PRESSURE ON EFFICIENCY OF MATRIX ACIDIZING STIMULATION ON MARCELLUS SHALE CORE SAMPLES.....	1304
<i>R.E. Khalil, H. Emadi, T. Gamadi</i>	
EXPERIMENTAL INVESTIGATION OF CO ₂ -EOR VIABILITY IN TIGHT FORMATIONS: MOUNTAIN COUNTY CASE STUDY	1311
<i>N. Badrouri, F. Badrouri, O.S. Tomomewo, H. Pu</i>	
EXPERIMENTAL INVESTIGATION OF HYDRAULIC FRACTURE BRANCHING	1318
<i>W.F. Li, L.P. Frash, J.W. Carey, M. Meng, H.S. Viswanathan, E. Rougier, Z. Lei, V.T. Chau, T.H. Nguyen, S. Rahimi-Aghdam, Z.P. Bazant</i>	
EXPERIMENTAL INVESTIGATION OF STRESS INTERFERENCE IN HORIZONTAL WELL TIGHT-SPACING FRACTURING	1328
<i>Z.P. Zhang, S.C. Zhang, X.F. Ma, Y.S. Zou, N. Li, L. Liu</i>	
AN EXPERIMENTAL INVESTIGATION OF THE COUPLING BETWEEN ELASTODYNAMIC AND HYDRAULIC PROPERTIES OF NATURALLY FRACTURED ROCK AT THE LABORATORY SCALE	1336
<i>P. Shokouhi, J. Jin, P. Manogharan, C. Wood, J. Riviere, D. Elsworth, C. Marone</i>	
EXPERIMENTAL INVESTIGATION OF THE PDC CUTTER PENETRATION PROCESS	1345
<i>X. Dai, Z. Huang, C. Xiong, H. Shi, X. Wu, W. Zou, Z. Cheng</i>	
EXPERIMENTAL INVESTIGATION ON THE UNIAXIAL MECHANICAL PROPERTIES OF SANDY MUDSTONE UNDER HIGH TEMPERATURE.....	1352
<i>M.T. Cao, W.G. Liang, S.D. Yin, W. He, Y.D. Geng, P.F. Wu</i>	
EXPERIMENTAL OBSERVATION OF FRACTURE PROCESS ZONE IN SANDSTONE FROM DIGITAL IMAGING.....	1360
<i>L. Chen, G. Zhang, Z. Zou, Y. Guo, X. Du</i>	
EXPERIMENTAL PERMEABILITY TENSOR FOR FRACTURED ROCKS	1369
<i>D. Cabrera, F. Samaniego</i>	
EXPERIMENTAL STUDIES ON THE BREAKING OF ICE BY HIGH-PRESSURE WATER JET	1379
<i>P. Zhang, S. Tian, Y. Zhang, K. Zhao, X. Wu, Z. Shen</i>	
AN EXPERIMENTAL STUDY ANALYZING EFFECTS OF CRYOGENIC TREATMENTS ON POROSITY, PERMEABILITY, AND DYNAMIC ELASTIC PROPERTIES OF MARCELLUS FORMATION CORE SAMPLES.....	1385
<i>R.E. Khalil, H. Emadi, L.R. Heinze</i>	
EXPERIMENTAL STUDY OF THE EFFECT OF MICROSCOPIC MECHANICAL PROPERTIES ON THE EFFECTIVENESS OF UNPROPPED FRACTURES IN TIGHT RESERVOIRS.....	1393
<i>Y. Zhang, Y. Shen, H. Ge, P. Liu, J. Wang, H. Zeng, Y. Lei, J.D. McLennan</i>	

EXPERIMENTAL STUDY ON EXPANSION LAW OF MICRO-FRACTURES INDUCED BY SHALE HYDRATION	1401
<i>L. Tao, J. Guo, H. Yang, C. Zhao, G. Li, C. Chen, M. Li</i>	
EXPERIMENTAL STUDY ON MECHANICAL CHARACTERISTICS OF SANDSTONE INDUCED BY FREEZE-THAW PROCESS UNDER STRESS-SEEPAGE COUPLING	1406
<i>B. Liu, Y. Sun, Y. Han, M. Yang, H. Deng</i>	
EXPERIMENTAL STUDY ON THE CREEP BEHAVIOR OF SHALE IN UNIAXIAL COMPRESSION TEST.....	1412
<i>D. Gao, H. Yang, J. Dong, M. Chen, Y. Hou, J. Li</i>	
EXPERIMENTAL TECHNIQUE TO INVESTIGATE SHALE CREEP FOR ANNULAR BARRIER FORMATION IN OIL AND GAS WELLS.....	1417
<i>A. Thombare, M. Aldin, E. Van Oort</i>	
EXPERIMENTAL VERIFICATION OF THE DUAL BIT CORING METHOD DEVELOPED FOR STRESS MEASUREMENT APPLICABLE IN DEEP AND HIGH TEMPERATURE ENVIRONMENT	1425
<i>T. Ito, A. Kumazawa, K. Tezuka, T. Yokoyama, K. Ogawa, A. Funato</i>	
EXPLICIT VERSUS IMPLICIT METHOD TO CONSTRAIN THE MAXIMUM HORIZONTAL STRESS ON VERTICAL AND DEVIATED WELLBORES BY USING DATA FROM BREAKOUTS AND INDUCED FRACTURES.....	1432
<i>B.M. Lacerda, S.A.B. Fontoura, V.R. Marchesi, C.B. Morales-Monsalve, C.J.C. Goncalves, F. Lima</i>	
FACTORS CONTRIBUTING TO THE VARIATION OF BACKFILL TEST RESULTS	1442
<i>M.E. Matlou, R. Mitra</i>	
FAILURE MECHANISM OF ROCK BASED ON THE UNIFIED STRENGTH THEORY UNDER WAVE INJECTION HYDRAULIC FRACTURING	1451
<i>S.K. Tong, D.L. Gao, V. Rasouli</i>	
FAILURE MODE OF CONCRETE UNDER POLYAXIAL STRESSES	1461
<i>M. Serati, E. Mutaz, D.J. Williams, S.Q. Olaya, J. Karlovsek</i>	
FALL OF GROUND MANAGEMENT THROUGH UNDERGROUND JOINT MAPPING: SHALLOW CHROME MINING CASE STUDY	1467
<i>V.C. Netshilaphala, T. Zvarivadza</i>	
A FEM-BASED METHODOLOGY TO ACQUIRE BROADBAND EMPIRICAL GREEN'S FUNCTIONS TO UNDERSTAND CHARACTERIZATION TESTS OF ACOUSTIC EMISSION SENSORS	1478
<i>R. Wu, P.A. Selvadurai, C.J. Chen, O. Moradian</i>	
FEM-BPM SIMULATION OF SHPB TESTING FOR MEASUREMENT OF ROCK TENSILE STRENGTH	1486
<i>M.R. Majedi, M. Afrazi, A. Fakhimi</i>	
FINITE ELEMENT IMPLEMENTATION FOR FULLY COUPLED HYDROMECHANICAL MODELING OF SPHERICAL INDENTATION	1495
<i>M. Liu, H. Huang</i>	
FINITE ELEMENT MODEL CALIBRATION IN THE CONTEXT OF LIMITED DATA AND LIMITED ACCESS: A CASE STUDY FROM A LARGE LANDSLIDE IN SOUTHERN PERU	1505
<i>A. Gruber, P. Santi, K. Radach, P.M. Arestegui, S.C. Arcaya</i>	

FLOW IN TOP DRAINS OF TUNNELS	1518
<i>J.F. Da Silva, A.P.M. Saliba</i>	
FLOWBACK DATA EVALUATION AT FORGE	1522
<i>P. Xing, A. Goncharov, D. Winkler, B. Rickard, B. Barker, A. Finnila, A. Ghassemi, R. Podgorney, J. Moore, J. McLennan</i>	
FRACTURE ABUNDANCE MEASURES	1533
<i>W. Dershowitz, M. Mauldon, P. La Pointe</i>	
FRACTURE AND FAILURE PROCESSES OF GEOPOLYMERIZED MINE TAILINGS UNDER UNIAXIAL COMPRESSION	1549
<i>N. Zhang, A. Hedayat, H.G.B. Sosa, J.J.G. Cardenas, G.E.S. Alvarez, V.A. Rivera, J. Gonzalez</i>	
FRACTURE CAGING TO CONTROL EARTHQUAKE MAGNITUDE FROM INDUCED SEISMICITY: PREVENTING A REPEAT OF POHANG	1558
<i>L.P. Frash</i>	

VOLUME 3

FRACTURE INITIATION CHARACTERISTICS FROM MULTIPLE RADIAL WELLBORES.....	1564
<i>T. Wang, Q. Liu, B. Zhu, S. Tian, G. Li, Z. Guo</i>	
FRACTURE PERMEABILITY: EXPERIMENTS AND LITERATURE REVIEW	1573
<i>J.W. Carey, L.P. Frash, N.J. Welch</i>	
FRACTURES CHARACTERIZATION AND THEIR IMPACT ON THE PRODUCTIVITY OF HAMRA QUARTZITE RESERVOIR (HAOUD-BERKAOUI FIELD, OUED-MYA BASIN, ALGERIA)	1586
<i>S. Djezzar, A. Boualam</i>	
FULLY COUPLED PROCESS MODELING OF FRACTURED MEDIA ACROSS SCALES.....	1593
<i>M. Hu, J. Rutqvist</i>	
A FULLY COUPLED THERMODYNAMICALLY CONSISTENT MODEL FOR GAS FLOW IN COALS AND ITS NUMERICAL IMPLEMENTATION	1603
<i>A. Lv, M.A. Aghighi, H. Masoumi, H. Roshan</i>	
A FULLY-COUPLED, THERMO-HYDRO-MECHANICAL MODELLING LOGIC FOR A GPU-ACCELERATED, FINITE-DISCRETE ELEMENT METHOD CODE.....	1610
<i>A. Lisjak, O.K. Mahabadi, L. He, B.S.A. Tatone</i>	
FUNCTIONAL NEURAL NETWORKS-BASED MODEL FOR PREDICTION OF THE STATIC YOUNG'S MODULUS FOR SANDSTONE FORMATIONS	1626
<i>A.A. Mahmoud, S. Elkhatatny, A. Alsabaa, D. Al Shehri</i>	
GAS PERMEABILITY MEASUREMENTS DURING CONFINED BRAZILIAN TESTING	1634
<i>T. Hagengruber, J.C. Stormont, M.M.R. Taha, E. Rougier, E.E. Knight, B. Euser</i>	
GENERATING SYNTHETIC BULK DENSITY LOGS FOR CARBONATE FORMATIONS	1639
<i>F.A. Hadi, R. Nygaard, A. Al-Neeamy</i>	

GEOLOGICAL AND GEOMECHANICAL CHARACTERIZATION OF A CARBONATE ROCK FROM MORRO DO CHAVES FORMATION, NE BRAZIL	1647
<i>G.L. Righetto, R.V. Sampaio, V.L.O. Guimaraes, R.R.L. Chavez, S.B. Inoue, L.F.L. Fernandes, S.A.B. Fontoura</i>	
GEOLGY OF HOT DRY ROCKS IN GONGHE BASIN OF QINGHAI-TIBET PLATEAU	1657
<i>J. Feng, Y. Zhang, J. Luo</i>	
GEOMECHANICAL ASSESSMENT OF GROUNDFALL HAZARDS IN A SMALL-SCALE UNDERGROUND MINE IN THE AREQUIPA REGION, PERU	1672
<i>C.E.C. Inga, R.Q. Aquino, R.C. Loza, L.T. Prado, G. Walton</i>	
GEOMECHANICAL PROPERTIES FROM NANOINDENTATION TESTING AND INCLUSION-BASED ROCK PHYSICS MODELS	1679
<i>H. Celleri, E. Camilion, M. Noya, M.A. Floridia, C.G. Grasetti, G. Panizza, T.M. Pique, A. Caneiro, M. Sanchez, J.I. Ramallo, C. Fuertes</i>	
GEOMECHANICAL STUDIES OF VERTICAL WELL ASSISTED DILATION ON SAGD WELL IN SHALLOW SUPER-HEAVY OIL RESERVOIR	1690
<i>L. Sang, C. Shan, G. Yang, B. Xu, B. Li, J. Du</i>	
GEOMETRIC EFFECTS ON ROCK BEHAVIOR SURROUNDING UNDERGROUND CROSS TUNNEL STRUCTURES.....	1702
<i>Z. Simsek, J.C. Healy, B. Hawkins, K. Atefi-Monfared</i>	
GLOBAL SENSITIVITY ANALYSIS OF ROCKMASS AND SUPPORT DESIGN PARAMETERS IN TUNNEL-SUPPORT SYSTEM	1709
<i>B. Pandit, G.L.S. Babu</i>	
GROUND RESPONSE AND SUPPORT INTERACTION IN COAL MINE LONGWALL GATEROADS SUBJECT TO CHANGING STRESS	1716
<i>G.S. Esterhuizen, I.B. Tulu, T.M. Barczak, H. Dougherty</i>	
GROUT COMPARISON FOR FULLY GROUTED ROCK BOLTS USING DISTRIBUTED FIBER OPTIC SENSORS.....	1723
<i>T.P. O'Connor, N. Vlachopoulos, B. Forbes, M. Diederichs</i>	
GUIDELINES ON THE EVALUATION OF ROCK BRIDGE CALCULATIONS FROM 2D DFN MODELS	1731
<i>K. Veltin, R. Mah, S. Rogers, R. Tsai, M. Valerio</i>	
A HALF-CENTURY WEATHERING OF MUDSTONE IN A HIGHWAY CUT SLOPE	1737
<i>S. Bhowmik, M. Nagata, M. Kikumoto</i>	
HIGH-SPEED PHOTOGRAPHY OF ASPHALT CRACKING	1743
<i>M. Serati, T. Valluru, I. Van Wijk, H. Masoumi</i>	
HYDRAULIC FRACTURE MODELING OF FRACTURE-INDUCED STRAIN VARIATION MEASURED BY LOW-FREQUENCY DISTRIBUTED ACOUSTIC SENSING (LF-DAS) ALONG OFFSET WELLS	1749
<i>Y. Liu, K. Wu, G. Jin, G.J. Moridis</i>	
HYDRAULIC FRACTURE PROPAGATION PATHS MODELED USING TIME-STEPPED LINEAR SUPERPOSITION METHOD (TLSM): APPLICATION TO FRACTURE TREATMENT STAGES WITH INTERACTING HYDRAULIC AND NATURAL FRACTURES AT THE WOLFCAMP FIELD TEST SITE (HFTS).....	1758
<i>R. Weijermars, T. Pham, N. Stegent, R. Dusterhoff</i>	

HYDRAULIC FRACTURING DESIGN IN A COMPLEX CLASTIC RESERVOIR: CASE STUDY SOUTHERN OF IRAQ.....	1780
<i>G.S. Alqatrani, A.A. Alsabah, S.L. Mahdi, N. Alkanani, L. Al Asadi, S. Hayfaa</i>	
HYDRAULIC FRACTURING IN HETEROGENOUS RESERVOIRS; MODELLING AT PETROPHYSICAL VS. GEOMECHANICAL RESOLUTION	1786
<i>G.J. Richards, A.T. Bere, D.T. Roberts, S.D. Thomas, O. Mutlu, P.J. Gaillet</i>	
HYDRAULIC FRACTURING PROCESSES AND MICRO-SEISMICITY IN GRANITE AFFECTED BY INJECTION RATES	1803
<i>G.S. Gunarathna, B.Q. Li, B.G. Da Silva</i>	
HYDRO-MECHANICAL MODELLING OF NATURALLY FRACTURED RESERVOIR USING EXPLICIT AND IMPLICIT REPRESENTATION OF FRACTURES	1814
<i>C. Mejia, J. Rueda, R. Quevedo, D. Roehl</i>	
IDENTIFICATION OF A SHEAR RELEASE MECHANISM IN A JOINTED MEDIUM CAUSED BY CHEMICAL EXPLOSIONS	1820
<i>D.W. Steedman, C.R. Bradley</i>	
IMPACT OF MECHANICAL LOADING ON SEALING CAPACITY OF ROCK SALT	1829
<i>F. Al Sahyouni, F. Golfier, D. Grgic</i>	
IMPACT OF WEAK ROCK INTERFACES ON FRACTURING PATTERNS OF SYNTHETIC LAMINATED SAMPLES	1836
<i>G.G. Giozzi, C. Torres-Verdin, D.N. Espinoza, E. Maalouf</i>	
IMPROVEMENT AND STABILIZATION OF FISSURED ROCK BY ACRYLATE GELS AND POLYURETHANE RESINS	1841
<i>C. Boley, Y. Forouzandeh, P. Pratter</i>	
IMPROVING PREDICTED ABILITY OF GEOMECHANICAL MODEL USING NEURAL NETWORKS (DEEP LEARNING) DATA RECOVERY	1847
<i>N.N. Zakharenko, A.K. Gula, A.V. Bochkarev</i>	
INDUCED FRACTURING DURING CORING AND CORE RETRIEVAL IN UNCONVENTIONAL RESERVOIRS.....	1854
<i>P. Xing, R. Suarez-Rivera, E. Dontsov</i>	
INFLUENCE OF GRAIN SIZE AND INTERLOCK ON INTACT ROCK PARAMETERS	1865
<i>J. Ganye, A. Vasileiou, M.A. Perris, T.G. Carter</i>	
THE INFLUENCE OF GRAVELS ON HYDRAULIC FRACTURE PROPAGATION OF CONGLOMERATE	1874
<i>C.Z. Xv, G.Q. Zhang, Y.J. Lyu, Q.S. Xv</i>	
INFLUENCE OF PROPPANT BEHAVIOR ON UNCONVENTIONAL OIL/GAS RECOVERY	1879
<i>K.M.A.S. Bandara, P.G. Ranjith</i>	
INFLUENCE OF SALINITY CHANGE OF FRACTURING FLUID ON ROCK MECHANICAL PROPERTIES AND FRACTURE DIAGNOSIS AFTER FRACTURING IN TIGHT RESERVOIRS.....	1886
<i>Y. Zhang, X. Wang, H. Ge, Y. Lei, H. Zeng, L. Jia, H. Chen, J.D. McLennan</i>	
INFLUENCE OF STOPE GEOMETRY ON SLOUGHING AND DILUTION IN OPEN STOPE MINING	1896
<i>A. Alipov, A.C. Adoko</i>	

INFLUENCE OF THE INITIAL STRESS STATE OF THE CEMENT SHEATH ON THE CASING-CEMENT SHEATH-FORMATION SYSTEM STRESS DISTRIBUTION	1904
<i>Y. Luo, Y. Shan, H. Liu, W. Liu, W. Cao, Y. Wang</i>	
INFLUENCE OF WET-DRY AND FREEZE-THAW CYCLES ON THE PHYSICAL AND MECHANICAL PROPERTIES OF MICP TREATED SLOPE SOIL	1910
<i>S. Gowthaman, K. Nakashima, H. Nakamura, S. Kawasaki</i>	
INITIAL FIELD TESTING IN THE DEEP SUBSURFACE FOR THE THERMAL BREAKOUT PROJECT FOR MEASURING IN SITU STRESS.....	1917
<i>J. Nopola, S. Voegeli, J. Knight, T. Artz, M. Jones</i>	
INITIAL SIMULATIONS OF EMPTY ROOM COLLAPSE AND RECONSOLIDATION AT THE WASTE ISOLATION PILOT PLANT	1927
<i>B. Reedlunn, G. Moutsanidis, J. Baek, T.H. Huang, J. Koester, X. He, H. Wei, K. Taneja, Y. Bazilevs, J.S. Chen</i>	
IN-SITU ROCK BLOCK SHAPE ESTIMATION BASED ON CHARACTERISTIC BLOCK GAUSSIAN PROCESS MORPHABLE MODELLING USING 3D POINT CLOUDS	1937
<i>B. Gray, G. Walton, R. Kromer</i>	
IN-SITU STRESS EVALUATION OF DEEP CARBONATE RESERVOIR IN BLOCK S OF TARIM BASIN	1943
<i>P. Su, W. Long, Q. Tan, H. Weng, J. Zhang</i>	
IN-SITU STRESS PERTURBATION, WELLBORE STABILITY AND HYDRAULIC FRACTURING DESIGN NEAR A FAULT REGION	1952
<i>Y. Wang</i>	
INTERACTION BETWEEN FINE-GRAINED BEDROCK AND WATER DURING CAISSON CONSTRUCTION AND ITS EFFECT ON THE AXIAL BEARING CAPACITY	1960
<i>S. Singh, M. Sisodiya, Y. Zhang</i>	
INTERPRETATION OF THE PEAK AND RESIDUAL STRENGTH OF INDUCED TENSION FRACTURES IN SANDSTONE BY SINGLE-STAGE AND MULTI-STAGE DIRECT SHEAR TESTS	1968
<i>S. Gaines</i>	
INTERPRETATION OF TRACER DATA USING A MARKOV CHAIN MONTE CARLO APPROACH FOR THE CHARACTERIZATION OF THE EGS COLLAB TESTBED.....	1978
<i>H. Wu, P. Fu, J. Zhang, J.P. Morris</i>	
INVENTORYING GEOHAZARDS OF OHIO'S FIRST PUBLIC-PRIVATE PARTNERSHIP ROADWAY PROJECT	1985
<i>S.M. Abrams, K.D. Beach</i>	
INVESTIGATING EFFECTS OF WATER ON SHALE OIL FORMATION BY USING CYCLIC GAS INJECTION TECHNIQUE- AN EXPERIMENTAL STUDY	1992
<i>F. Altawati, J. Sheng, H. Emadi</i>	
INVESTIGATING THE EFFECT OF CYCLIC LOADING ON THE BREAKDOWN PRESSURE OF THE XUJIAHE SANDSTONE.....	2002
<i>H. Kang, X. Fan, Z. Huang, J. Zhang</i>	

AN INVESTIGATION INTO THE EFFECTS OF WALL THICKNESS IN THICK-WALLED CYLINDER TESTS ON NEAR CAVITY DEFORMATIONS FOR WELLBORE STABILITY APPLICATIONS.....	2011
<i>M. Dessouki, M.T. Myers, L.A. Hathon</i>	
INVESTIGATION OF INFLUENCE OF CONFINEMENT IN PROPPANT EMBEDMENT IN COAL.....	2022
<i>S. Zhi, D. Elsworth</i>	
INVESTIGATION OF PARENT-WELL PRODUCTION INDUCED INTERLAYER STRESS INTERFERENCE IN MULTILAYER UNCONVENTIONAL RESERVOIRS	2035
<i>Y. Pei, K. Sepehrnoori</i>	
INVESTIGATION OF THERMAL CONDUCTIVITY IN ROCK USING MOLECULAR DYNAMICS SIMULATION	2051
<i>F. Molaei, J. Kemeny, M. Rajaei</i>	
INVESTIGATION ON ROCK BREAKAGE MECHANISM OF STINGER PDC CUTTER AND HYBRID CUTTER ARRANGEMENT DESIGN	2059
<i>C. Xiong, X. Dai, H. Shi, Z. Huang, Z. Chen, H. Zhao</i>	
INVESTIGATION STUDY OF THE EFFECTIVENESS OF EGGSHells POWDER AS A MULTIFUNCTIONAL ECO-FRIENDLY ADDITIVE IN WATER-BASED FLUID.....	2067
<i>A.T. Al-Hameedi, H.H. Alkinani, S. Dunn-Norman, Z.A. Hamoud</i>	
ISSUES IN DETERMINING THE CRACK INITIATION (CI) THRESHOLD UNDER CONFINED CONDITIONS.....	2074
<i>S. Sinha, G. Walton, B.H. Kim</i>	
JET MILL BIT IN HORIZONTAL GAS DRILLING: HOW TO ACHIEVE THE MAXIMUM EFFECT OF DECREASING BOTTOM-HOLE PRESSURE AND ENHANCING ROP?	2083
<i>Y. Zou, Z. Mou, X. Chen, F. Zhang, A. Wang, X. Du, Z. Li</i>	
THE KEY FACTORS FOR RE-FRACTURING SUCCESS: A SIMULATION STUDY.....	2089
<i>V. Rignol, B. Bui</i>	
KINEMATIC ASSESSMENT OF COMPOSITE FAILURE MECHANISMS IN PIT SLOPES - A NOVEL SLIP SURFACE IDENTIFICATION ALGORITHM FOR DFN MODELS.....	2100
<i>K.P. Lawrence, M.D. Nelson, M. Yetisir, P. Matlashewski</i>	
LABORATORY EVALUATION OF TIME AND PRESSURE PATH DEPENDENT, SUBCRITICAL PERMEABILITY STIMULATION OF TIGHT SANDSTONE RESERVOIRS	2108
<i>J.H. TerHeege, B.B.T. Wassing, T. Candela</i>	
LABORATORY MEASUREMENTS OF ACID-ETCHED FRACTURE CONDUCTIVITY FOR MEDIUM-HIGH POROSITY AND LOW PERMEABILITY LIMESTONE RESERVOIRS IN EE OIL FIELD	2119
<i>Y. Xiao, H. Wang, Z. Mi, Y. Cheng, X. Cao, J. Qu</i>	
LABORATORY MEASUREMENTS OF DAMAGE EVOLUTION IN DYNAMIC VOLCANIC ENVIRONMENTS: FROM SLOW TO RAPID STRAIN EVENTS	2125
<i>L.N. Schaefer, B.M. Kennedy, J.E. Kendrick, Y. Lavallee, T. Miwa</i>	
LABORATORY MODELING OF INDUCED MICROSEISMICITY IN THE ILLINOIS BASIN	2131
<i>R.Y. Makhnenko, N.B. Bondarenko, K. Kim, S. Whittaker</i>	

LABORATORY REVIVAL OF SLEEVE FRACTURING FOR STRESS MEASUREMENT	2139
<i>R. Villamor-Lora, C. Laupretre, T. Berard, J.E. Elkhoury</i>	
LABORATORY STUDIES ON IMMISCIBLE CO ₂ INJECTION: A DATA ANALYSIS AND SCREENING CRITERIA	2145
<i>S. Fakher, Y. Elgahawy, H. Abdelaal, A. Imqam</i>	
A LABORATORY STUDY ON INTERACTION OF FILTRATION AND DEFORMATION PROCESSES IN SATURATED ROCKS	2154
<i>I.V. Fokin, N.V. Dubinya, S.A. Tikhotskiy</i>	
LABORATORY TESTING OF SALT DEFORMATION AND ESTABLISHING RELATIONSHIP WITH DRILLING MECHANICS DATA OF HYBRID DRILL BIT IN SALT FROM GULF OF MEXICO	2162
<i>U. Prasad, A.R. Chowdhury, W. Rodrigue</i>	
THE LAGRANGIAN MECHANICS OF TWO-DIMENSIONAL ASYMMETRIC HYDRAULIC FRACTURE PROPAGATION	2172
<i>A.B. Peshcherenko, D.A. Chuprakov</i>	
LARGE-SCALE LABORATORY INVESTIGATION OF THE MICROANNULUS BEHAVIOR IN THE CASING-CEMENT INTERFACE.....	2187
<i>A. Moghadam, K. Castelein, J. Ter Heege, K.V.D. Valk, B. Orlic, J. Wollenweber</i>	
MACHINE LEARNING ASSISTED GEOSTEERING	2198
<i>S.C. Bartosik, A. Amirlatifi</i>	
MANAGING WELLBORE INSTABILITY THROUGH GEOMECHANICAL MODELING AND WELLBORE STABILITY ANALYSIS	2205
<i>A.S. Dahab, A.M. Abdulaziz, A. Manhalawi, A.K. Abbas, N. Al-Husseini</i>	
MAPPING FRACTURE COMPLEXITY IN HYDRAULICALLY FRACTURED MONTNEY SHALE BY SERIAL SECTION RECONSTRUCTION	2214
<i>M. Li, E. Magsipoc, A. Abdelaziz, J. Ha, J. Guo, K. Peterson, G. Grasselli</i>	
MATERIAL TRANSITION DETECTION IN DRILLING USING DATA ANALYTICS.....	2223
<i>K.L. McBrayer, J.C. Su, L.M. Gonzalez, J.S. Pope</i>	
A MATHEMATICAL STUDY ON REACTIVATION OF NATURAL FRACTURES CAUSED BY INITIATION AND PROPAGATION OF HYDRAULIC FRACTURE	2231
<i>N.V. Dubinya, V.A. Nachev, M.A. Trimonova</i>	
MEASUREMENT AND ANALYSIS OF DRILL-BIT MOTIONS: A CASE STUDY FOR PASSIVE-VIBRATION ASSISTED ROTARY DRILLING (PVARD) TOOL	2241
<i>Y. Xiao, H. Qiu, S.D. Butt</i>	
MECHANICAL LOGS FOR HYDRAULIC FRACTURE MODELING – HONORING ROCK FABRIC WITH HIGH-RESOLUTION DATA	2246
<i>B. Abdell, D. Sassen</i>	
MECHANISM STUDY ON RELEASE OF "WATER BLOCKING DAMAGE" OF TIGHT SANDSTONE BY NANO FLUID AND CASE STUDY	2258
<i>J. Liu, H. Liu, J. Wang, E. Yao, F. Zhou</i>	
MECHANISMS FOR THE CREATION OF A STIMULATED ROCK VOLUME AROUND HYDRAULIC FRACTURES.....	2263
<i>S. Agrawal, M.M. Sharma</i>	

A METHOD FOR SELECTING THE CORRECT REAMER AND BIT COMBINATION IN REAMING WHILE DRILLING	2271
<i>J. Xu, X. Chen, X. Du, L. Sun, Y. Hong, Y. Zou, W. Wang</i>	
MISCIBLE GAS INJECTION APPLICATION FOR ENHANCED OIL RECOVERY: DATA ANALYSIS	2278
<i>M. Ahdaya, A. Imqam</i>	
MODELING COOLING EFFECTS ON MULTILATERAL JUNCTION STABILITY DURING MUD CIRCULATION.....	2295
<i>M.M. Alam, A. Mohamad-Hussein, Q. Ni, A. Rodriguez-Herrera</i>	
MODELING FRACTURE CLOSURE WITH PROPPANT SETTLING AND EMBEDMENT DURING SHUT-IN AND PRODUCTION	2305
<i>S. Zhang, M.M. Sharma</i>	
MODELING OF NEAR – WELLBORE PERMEABILITY REDUCTION DUE TO DEPLETION OF A NATURALLY FRACTURED RESERVOIR	2313
<i>L.L. Alvarez, L. Beserra, L. Guimaraes, B. Meciel, O. Manzoli</i>	
MODELING TIME-DEPENDENT DEFORMATION OF ROCK JOINT	2319
<i>M. Wang, M. Cai</i>	
MODELLING BOREHOLE EXPANSION IN WEAK ROCKS USING CDM APPROACH	2327
<i>L. Liu, R. Chalaturnyk</i>	
MODELLING INDUCED SEISMICITY WITH A HYDRAULIC-MECHANICAL - STOCHASTIC SIMULATOR: REVIEW OF CASE STUDIES	2335
<i>V.A. Ritz, A.P. Rinaldi, D. Zbinden, M. Nespoli, D. Karvounis, S. Wiemer</i>	

VOLUME 4

MODIFIED DILATANCY CRITERION TO OPTIMIZE DRILLING THROUGH SALT SECTIONS	2343
<i>G. Garcia, O. Castillo, L. Becerril</i>	
MONITORING AND MODELING OF THE DEBEQUE CANYON LANDSLIDE COMPLEX IN THREE DIMENSIONS.....	2351
<i>L. Weidner, G. Walton</i>	
MOTORIZED TILT TABLE BASED ON ARDUINO-CONTROLLED STEPPER MOTOR	2360
<i>J.M. Bustos-Espinoza, K.I. Orozco, J. Gonzalez, J. Arzua, M. Canovas, I. Perez-Rey, M. Muniz-Menendez</i>	
MULTI-HAZARD ANALYSIS OF A CIRCULAR TUNNEL IN HARD, ANISOTROPIC MEDIA, CONSIDERING THE EXCAVATION DAMAGED ZONE (EDZ)	2366
<i>J.C. McCarey, L.N. Tara, K. Atefi-Monfared</i>	
A MULTILAYER PERCEPTRON NEURAL NETWORK MODEL TO PREDICT BOREHOLE BREAKOUTS FULL GEOMETRY USING ROCK PROPERTIES.....	2375
<i>H. Soroush</i>	
MULTIPHYSICS INTEGRATED WORKFLOW TO ESTIMATE STRESSES IN THE GULF OF MEXICO DEEP WATER	2383
<i>S. Alatrach, V.K. Mishra, A.C. Reyes, A. Kumar</i>	

MULTIVARIANT CALCULATION OF HORIZONTAL WELLBORE STABILITY FOR REDUCING DRILLING RISKS IN COMPLEX GEOLOGICAL CONDITIONS	2392
<i>A.V. Sidelnik, A.K. Gula, A.V. Bochkarev</i>	
A NEW APPROACH TO CALIBRATE THE MODIFIED CAM CLAY MODEL BY USING MULTISTAGE TRIAXIAL TESTS ON RESEDIMENTED MUDROCKS	2398
<i>M. Dessouki, M.T. Myers, L.A. Hathon</i>	
A NEW DATA SET OF GRANITIC ROCK STRENGTH VALUES FROM YOSEMITE VALLEY, CALIFORNIA: APPLICATIONS TO ROCK FALL ASSESSMENT	2406
<i>B.D. Collins, F. Sandrone, L. Gastaldo, G.M. Stock, M. Jaboyedoff</i>	
A NEW DISCRETE FRACTURE NETWORK CALIBRATION WORKFLOW USING EDFM METHOD	2413
<i>F. Torres, M. Xavier, H. Wang, W. Yu, X. Kong, P. Chen, H. Xie, N. Li, J. Miao, Z. Chen</i>	
NEW EXPERIMENTAL METHODS TO STUDY PROPPANT EMBEDMENT IN SHALES	2423
<i>E. Alagoz, H. Wang, R.T. Russell, M.M. Sharma</i>	
NEW PERMEABILITY MODEL FOR ROCKS WITH ELLIPTICAL PORES BASED ON ELASTIC SOLUTION OF PORE WALL DISPLACEMENT	2430
<i>Y. Peng, J. Liu, Z. Ma, G. Zhang, Y. Wang, X. Xu</i>	
A NEW RESEARCH ON THE STICK-SLIP MECHANISM BY STUDYING THE ROCK CUTTING PROCESS	2438
<i>H. Zhenguo, S. Libao, L. Lingxi, L. Huaidong, Z. Xiaoning, L. Xinyun</i>	
A NEW SHUT IN TIME OPTIMIZATION METHOD FOR MULTI-FRACTURED HORIZONTAL WELLS IN SHALE GAS RESERVOIRS	2449
<i>L. Tao, J. Guo, J. Shan, X. Chen, C. Chen, Z. Zhao</i>	
NOVEL AND COST-TIME EFFECTIVE ROCK TYPING AND MECHANICAL PROPERTIES PREDICTION TECHNIQUE FOR UNCONVENTIONAL SAMPLES BASED ON 2D (RADIOGRAPHIC) X-RAY IMAGE ANALYSIS	2456
<i>P.R.F. Diaz, H.J.G. Perez, C.A.S. Molina, A. Cox, K. Kellet</i>	
NUMERICAL 3D-SIMULATION OF DYNAMIC NATURAL FRACTURE WIDTH FOR LOST CIRCULATION CONTROL IN DEEP FRACTURED TIGHT RESERVOIR.....	2464
<i>D. Zhang, J. Jin, D. Li, Y. Kang, J. Xu, W. Wang</i>	
NUMERICAL ANALYSES OF SHEAR BANDS FAILURE IN TUNNEL EXCAVATION PROBLEMS USING A REGULARIZED HOEK-BROWN MODEL	2473
<i>N. Zalamea, F. Marinelli, G. Cammarata, R. Brinkgreve, S. Brasile</i>	
NUMERICAL ANALYSIS OF COAL MINE ROADWAYS UNDER HIGH HORIZONTAL STRESS CONDITIONS	2482
<i>S. Vikraml, D.S. Subrahmanyam, D. Kumar</i>	
A NUMERICAL AND EXPERIMENTAL STUDY ON CEMENT INTEGRITY BASED ON A NOVEL METHOD	2490
<i>Y. Wu, S. Salehi</i>	
NUMERICAL GENERATION OF STRESS-DEPENDENT PERMEABILITY CURVES	2497
<i>F. Al Balushi, A.D. Taleghani</i>	

NUMERICAL INVESTIGATION OF ROCK BRIDGE EFFECT ON SLOPE STABILITY USING BONDED BLOCK MODELING METHOD.....	2505
<i>M. Al-E'Bayat, M. Sunkpal, T. Sherizadeh</i>	
NUMERICAL INVESTIGATION ON ROCK STRENGTH UPSCALING USING SYNTHETIC ROCK APPROACH.....	2512
<i>C. Guajardo, D. Elmo, S. Rogers</i>	
A NUMERICAL MODELING INVESTIGATION OF COUPLED-MECHANISM SUBSIDENCE OVER AN UNDERGROUND CARLIN TREND MINE	2522
<i>A.P. Perry, K.S. Kalenchuk, S.D. McKinnon</i>	
NUMERICAL MODELING OF FRACTURE PROPAGATION DURING POST-BLOWOUT CAPPING IN OFFSHORE WELLS	2536
<i>Y.A. Elnoamany, A. Michael, I. Gupta</i>	
NUMERICAL MODELING OF HEAT EXTRACTION IN HOT FRACTURED VUGGY RESERVOIR WITH THERMAL HYDRAULIC MECHANICAL COUPLING METHOD BASED ON DISCRETE FRACTURE-VUG MODEL	2547
<i>X. Zhang, Z. Huang, J. Yao, Y. Bi, Y. Li, Q. Lei</i>	
NUMERICAL MODELING OF MECHANICAL BEHAVIORS OF FRACTURED TRANSVERSELY ISOTROPIC ROCK MASSES	2557
<i>Y.M. Tien, V.B. Bui, C.H. Liu, C.H. Juang</i>	
NUMERICAL MODELING OF PILLAR STRESS REDISTRIBUTION DURING THE RETREAT MINING PROCESS	2566
<i>R.A. Dean-Pelikan, G. Walton</i>	
NUMERICAL MODELING OF WELLBORE STABILITY DURING OPEN-HOLE WELL TEST IN SANDY CONGLOMERATE RESERVOIR	2575
<i>K.C. Gao, S.G. Shang, X. Wu, H. Lin, Q. Tan, H.Y. Weng, W. Liu</i>	
NUMERICAL MODELLING OF SPALLING AROUND A NUCLEAR WASTE STORAGE DEPOSITION BOREHOLE USING A FRACTURE MECHANICS APPROACH	2581
<i>M.C. Saceanu, A. Paluszny, R.W. Zimmerman, D.M. Ivars</i>	
NUMERICAL MODELLING OF THE CEMENT SHEATH WITH RADIAL CRACKS UNDER CASING ECCENTRIC CONDITIONS.....	2590
<i>H. Dou, X. Dong, D. Gao</i>	
NUMERICAL SIMULATION OF CRACK COALESCENCE IN GYPSUM IN UNIAXIAL COMPRESSION	2597
<i>D.D.M. Moura</i>	
NUMERICAL SIMULATION OF FAULT SLIP DURING GEOTHERMAL ENERGY EXTRACTION	2602
<i>Q. Zhao, S.D. Glaser, A. Lisjak, G. Grasselli</i>	
NUMERICAL SIMULATION OF FRACTURE INITIATION AND PROPAGATION IN PULSE FRACTURING IN COAL SEAM	2608
<i>Y. Li, G. Peng, D. Jia, J. Zhang, Z. Cong, X. Fu, F. Tian, J. Tang</i>	
NUMERICAL SIMULATION OF FRACTURE INITIATION IN BARRE GRANITE USING AN EXPERIMENTALLY VALIDATED XFEM MODEL	2622
<i>P. Garg, A. Hedayat, D.V. Griffiths</i>	

NUMERICAL SIMULATION OF GABION ROCKFALL BARRIER SUBJECTED TO EXTREME LOADS.....	2633
<i>Y. Ma, J.N. Knowles, T.M. Evans</i>	
NUMERICAL SIMULATION OF GENERATION AND PROPAGATION OF TENSION FRACTURES IN LAMINATED OF FM. CRATO APPLYING FINITE ELEMENTS WITH INCORPORATED STRONG DISCONTINUITIES	2638
<i>A.I.P. Araujo, I.F. Gomes, R.F.V.C. Santos, N.M. Oliveira, A.J. Barbosa, T.S. Miranda</i>	
NUMERICAL SIMULATION OF SALT ROCK DISSOLUTION	2646
<i>L. Li, R. Gracie, M.B. Dusseault</i>	
NUMERICAL STUDY OF PROPPANT TRANSPORT IN FIELD-SCALE FRACTURES FOR SLICKWATER FRACTURING.....	2653
<i>Z. Zhang, S. Mao, Z. Shang, T. Chun, K. Wu</i>	
NUMERICAL STUDY OF WELL INTEGRITY IN HIGH TEMPERATURE WELLS.....	2663
<i>Y. Wu, S. Salehi</i>	
A NUMERICAL STUDY ON THE FAILURE PROCESS AND STRENGTH OF HETEROGENEOUS ROCKS AND HIGHLY INTERLOCKED JOINTED PILLARS	2677
<i>Y. Li, N. Bahrani</i>	
OBSERVATION OF STRAIN LOCALIZATION BY DIGITAL IMAGE CORRELATION TO STUDY THE INFLUENCE OF PARTICLE SIZE DISTRIBUTION.....	2691
<i>H. Rattez, M. Veveakis, B. Mielniczuk, Y. Shi, A. Sac-Morane, T. Klaeyle</i>	
ON A POROELASTIC NATURE OF MULTI-STRANDED HYDRAULIC FRACTURES IN HETEROGENEOUS UNCONVENTIONAL ROCKS	2697
<i>A.A. Savitski</i>	
ON NUMERICAL SIMULATION OF CASCADING FAILURE OF HYDRAULIC FRACTURES DUE TO AGGRESSIVE FLOWBACK	2704
<i>M.A. Chertov, K.F. Sinkov</i>	
ON THE ANGULAR DEPENDENCE OF YOUNG'S MODULUS: BASICS, SHORTCUTS AND APPLICATIONS.....	2712
<i>R.M. Holt, S. Rorheim</i>	
ON THE EFFECT OF INSOLUBLE MATERIALS ON ROCK SALT DILATANCY	2722
<i>M. Azabou, A. Rouabhi, L. Blanco-Martin, M. Tijani, F. Hadj-Hassen</i>	
ON THE EXTENT AND CONTRIBUTION OF NATURAL FRACTURES TO PRODUCTION OF UNCONVENTIONAL RESERVOIRS	2730
<i>A. Daneshy</i>	
ON THE IMPLEMENTATION OF A LAGRANGIAN APPROACH TO SLURRY FLOW SIMULATION IN NARROW CHANNELS	2737
<i>Isaev, V.I., Idimeshev, S.V., Semin, L.G., Tikhonov, A.A., Velikanov, I.V., Bannikov, D.V.</i>	
ON THE PIT-FALLS IN LABORATORY ACOUSTIC EMISSION SOURCE LOCATION	2743
<i>Q. Xiong, J.C. Hampton</i>	
OPTIMAL SPACING FOR THE WOLFCAMP IN THE DELAWARE BASIN USING DATA ANALYTICS: A CASE STUDY	2763
<i>A. Alzahabi, A. Kamel, A.A. Trindade, W. Baustian</i>	

ORIENTED PERFORATIONS: A NUMERICAL MODEL FOR FRACTURE INITIATION PRESSURE PREDICTION IN HORIZONTAL WELLS.....	2772
<i>A. Michael, I. Gupta</i>	
AN OVERVIEW OF OUR COUPLED THERMAL-HYDROLOGICAL-MECHANICAL SIMULATOR FOR POROUS AND FRACTURED MEDIA	2782
<i>P.H. Winterfeld, Y.S. Wu</i>	
PARTICLE CLUSTERING MECHANISMS AND INFLUENCE ON PROPPANT FLOW AND TRANSPORT.....	2794
<i>B.D. Yamashiro, I. Tomac</i>	
PHYSICS-BASED DATA-DRIVEN APPROACH FOR DOWNHOLE FRACTURE INFERENCE USING LOST CIRCULATION DATA.....	2802
<i>R. Ren, S.Z. Miska, M. Yu, E.M. Ozbayoglu</i>	
PHYSICS-INFORMED NEURAL NETWORKS FOR SOLVING INVERSE PROBLEMS OF NONLINEAR BIOT'S EQUATIONS: BATCH TRAINING	2812
<i>T. Kadeethum, T.M. Jorgensen, H.M. Nick</i>	
POISSON'S RATIO AND ANISOTROPY IN LATTICE BASED MODELS.....	2822
<i>Varun, B. Damjanac</i>	
PORE SIZE DISTRIBUTION AND PERMEABILITY HYSTERESIS IN UNCONVENTIONAL PLAYS; DIGITAL ROCK PHYSICS AND PULSE DECAY	2828
<i>A. Assady, H. Jabbari</i>	
A POREOELASTIC MODEL FOR LABORATORY WATER INJECTION TEST IN HIGHLY PERMEABLE ROCKS	2836
<i>Y. Gao, E. Detournay</i>	
POROELASTIC MODELING OF BASEMENT FAULT REACTIVATION CAUSED BY SALTWATER DISPOSAL NEAR VENUS, JOHNSON COUNTY, TEXAS	2843
<i>M. Haddad, P. Eichhubl</i>	
PORO-ELASTOPLASTIC CONSTITUTIVE LAW FOR COUPLING 3D GEOMECHANICS TO CLASSICAL PETROLEUM SYSTEM MODELING.....	2854
<i>A. Bruch, D. Colombo, J. Frey, J. Berthelon, M.C. Cacas-Stentz, T. Cornu</i>	
POROMECHANICAL CHARACTERIZATION OF A TIGHT-SANDSTONE FORMATION	2863
<i>T.M. Pique, D.N. Espinoza, E. Camilion, E. Winograd</i>	
PRACTICAL ASPECTS OF UTILIZING UAS TO CHARACTERIZE AND MANAGE ROCKFALL AND OTHER GEOHAZARDS ALONG COLORADO HIGHWAYS.....	2868
<i>R. Post, R. Pihl, A. Brown, H. Tiruneh, T. Ortiz</i>	
PRACTICAL CONSIDERATIONS IN THE MODELLING OF ADHESION FAILURE IN SHOTCRETE	2875
<i>E. Karampinos, B. Ko, J. Hadjigeorgiou</i>	
PREDICTING THE RISK OF LOST CIRCULATION USING SUPPORT VECTOR MACHINE MODEL.....	2883
<i>H.H. Alkinani, A.T. Al-Hameedi, S. Dunn-Norman</i>	
PREDICTION OF GEOMECHANICAL PROPERTIES FROM ELEMENTAL ANALYSIS USING MACHINE LEARNING ALGORITHM	2890
<i>P. Panja, J. Goral, M. Deo, J. McLennan</i>	

PREDICTION OF MONOTONIC STRENGTH OF SANDSTONE FOR ACCURATE CONTROL OF CYCLIC COMPRESSION TESTS.....	2897
<i>M. Meng, S. Miska, M. Yu, L.P. Frash, E. Ozbayoglu</i>	
PREDICTION OF SAND PRODUCTION AND OPTIMIZATION OF SAND CONTROL METHODS IN THE PRODUCTION TEST PROCESS OF DEEP WATER GAS WELLS	2903
<i>Z. Zhang, J. Yang, Y. Zhang, E. Wang, W. Meng, X. Qu, X. Zhao</i>	
PRELIMINARY RESULTS ON MULTI-STAGE CREEP EXPERIMENTS OF THE WOLFCAMP SHALE AT ELEVATED TEMPERATURE.....	2910
<i>F.S. Rassouli, M.D. Zoback</i>	
PREVENTING BARITE SAGGING USING NEW SYNTHETIC LAYERED SILICATE IN HP/HT WATER-BASED MUD	2916
<i>S.A. Basfar, S.M. Elkhatatny, A. Mohamed</i>	
PROBABILISTIC ASSESSMENT OF VOID FREQUENCY IN KARSTIC GEOLOGIC FORMATION	2922
<i>R. Gangrade, M. Mooney</i>	
PROBABILISTIC INJECTION-INDUCED FAULT SLIP ASSESSMENT IN FOX CREEK ALBERTA.....	2931
<i>A. Yaghoubi, M.B. Dusseault, S.B. Mahbaz, Y. Leonenko</i>	
PROGRESS TOWARDS A SCALING RELATIONSHIP BETWEEN SHEAR FRACTURE LENGTH, APERTURE, AND PERMEABILITY	2937
<i>L.P. Frash, N. Welch, J.W. Carey</i>	
PROPER WAY TO PREDICT PORE PRESSURE BEFORE AND WHILE DRILLING	2945
<i>A. Feokistova, A. Gula, A. Bochkarev, A. Glazyrina</i>	
PROPOSED POTENTIAL MITIGATION OF WASTEWATER DISPOSAL THROUGH TREATED PRODUCED WATER IN BAKKEN FORMATION	2954
<i>O.S. Tomomewo, N. Dyrstad-Cincotta, D. Mann, A. Ellafi, M. Alamooti, S. Srinivasachar, T. Nelson</i>	
PROPPANT SLURRY FLOW AND TRANSPORT WITHIN FRACTURES WITH ROUGH SURFACES.....	2964
<i>B.D. Yamashiro, I. Tomac</i>	
PROPPANT TRANSPORT BY HIGH VISCOSITY FRICTION REDUCER AND GUAR LINEAR GEL-BASED FRACTURE FLUIDS	2974
<i>G. Biheri, A. Imqam</i>	
PULSE PLASMA STIMULATION: EFFECT OF DISCHARGE ENERGY ON ROCK DAMAGE UNDER VARIOUS CONFINING STRESSES	2984
<i>A. Rezaei, F. Siddiqui, M.M. Awad, M. Mansi, P. Gordon, N. Callen, W. House, M.Y. Soliman</i>	
QUANTIFYING DISPLACEMENT AND STRAIN DEFORMATION OF MULTI-MATERIAL ROCKS AROUND GROWING HYDRAULIC FRACTURES	2995
<i>M.J. AITammar, M.M. Sharma</i>	
QUANTIFYING THE UNCERTAINTY OF VOLUME FRACTION ESTIMATION IN BIMROCKS – A BACKWARD ANALYSIS APPROACH	3012
<i>Y.C. Lu, C.H. Juang, Y.M. Tien</i>	

QUASI-STATIC AND DYNAMIC MECHANICAL AND FRACTURING CHARACTERISTICS OF COAL UNDER BIAXIAL CONFINEMENTS	3019
<i>J. Li, Q. Zhang, K. Du</i>	
QUESTIONING THE USE OF RQD IN ROCK ENGINEERING AND ITS IMPLICATIONS FOR ROCK ENGINEERING DESIGN.....	3025
<i>B. Yang, D. Elmo, D. Stead</i>	
QUICK CONSIDERATION FOR ROCK DOWELS IN BLOCK THEORY AND EQUILIBRIUM ANALYSES	3034
<i>F. Tonon</i>	
RAPID MEASUREMENT OF BIOT EFFECTIVE STRESS COEFFICIENT FOR CLASS-G OIL WELL CEMENTS	3042
<i>M. Meng, L.P. Frash, J.W. Carey, W. Li, N. Welch</i>	
RATE OF PENETRATION (ROP) MODEL FOR PDC DRILL BITS BASED ON CUTTER ROCK INTERACTION	3049
<i>A. Atashnezhad, S. Akhtarmanesh, S. Sleeper, G. Hareland</i>	
REAL-TIME PREDICTION OF RHEOLOGICAL PROPERTIES OF ALL-OIL MUD USING ARTIFICIAL INTELLIGENCE	3056
<i>A. Alsabaa, H.A. Gamal, S.M. Elkhatatny, A. Abdulraheem</i>	
RECENT RESULTS, DELIMITATIONS AND COMPLEMENTS FOR THE TERZAGHI MODEL OF EFFECTIVE STRESSES	3067
<i>P. Ciobanu</i>	
RELEVANT CONSIDERATIONS ON THE STABILITY OF GRANITE BOULDERS	3072
<i>L.R. Alejano, I. Perez-Rey, M. Muniz-Menendez, A. Riquelme, G. Walton</i>	
RESEARCH AND APPLICATION OF GRAIN SIZE DISTRIBUTION CURVE MODEL FOR FORMATION SAND	3082
<i>S. Liu, Z. Wang</i>	
RESEARCH AND FIELD APPLICATION OF A DEEP PENETRATING HIGH- CONDUCTIVITY ACID FRACTURING TECHNOLOGY IN ULTRA-DEEP CARBONATE RESERVOIR.....	3089
<i>T.X. Jiang, S.D. Ding, J. Zhou, L.B. Zhou, W.F. Jia, J.J. Zhang, Z.F. Song</i>	
RESEARCH IN USING POLYURETHANE FOAM TO MITIGATE ROCK BOLT INSTALLATION DIFFICULTIES.....	3096
<i>B. George, L. Pierson, R. Barrows</i>	
RESEARCH ON RESERVOIR GEOSTRESS CHARACTERISTICS OF ULTRA-DEEP CARBONATE ROCKS WITH MULTIPLE FAULT ZONES.....	3103
<i>J. Zhou, S.D. Ding, T.X. Jiang, X.B. Bian, B.Y. Liu, X. Zhang, Y.D. Geng, H.J. Mao</i>	
RESERVOIR GEOMECHANICS SIMULATION TO OPTIMIZE RESERVOIR MANAGEMENT IN SOUTHERN IRAQ FIELDS.....	3110
<i>A.A. Alsubaih, S. Hayfaa, H.S. Alboshawi, A. Alaa, E.M. Al Lawe, M. Sawdi, L.H. Al Asadi</i>	

VOLUME 5

REVIEW ON METHODOLOGIES FOR STUDYING INDUCED SEISMICITY IN UNDERGROUND MINING, TUNNELING OPERATIONS, DEEP WELL INJECTION, AND GEOTHERMAL RESERVOIRS	3117
<i>Z. Khademian, M.U. Ozbay</i>	
REVISION OF THE VOUSSOIR BEAM ANALOGUE FOR CROWN PILLARS.....	3130
<i>J.L. Carvalho, T.G. Carter</i>	
ROCK MECHANICAL PROPERTY CONTROLS HYDROCARBON CAP SEALING: AN INTEGRATED STRUCTURAL, MECHANICAL TEST AND MICROSCOPIC STUDY IN THE NORTHERN SLOPE OF THE TAZHONG UPLIFT IN THE TARIM BASIN, NW CHINA	3139
<i>F. Ning, J. Yun, J. Li, H. Song</i>	
ROCK SLOPE VULNERABILITY ASSESSMENT NEAR DEVPRAYAG, UTTARAKHAND, INDIA.....	3145
<i>T.A. Ansari, H.O. Singh, T.N. Singh, K.H. Singh</i>	
ROLE OF THERMAL MATURITY ON GEOMECHANICAL PROPERTIES IN MAHOGANY OIL SHALE	3154
<i>K. Mohanraj, D. Katsuki, A.N. Tutuncu</i>	
SAGD DILATION STARTUP AND ITS APPLICATIONS IN A SHALLOW SUPER HEAVY-OIL RESERVOIR IN XINJIANG OIL FIELD, CHINA	3167
<i>X. Sun, G. Qian, B. Xu, B. Li, J. Du</i>	
SALT ROCK BEHAVIOR PREDICTION WITH AN ELASTO-VISCOPLASTIC CONSTITUTIVE MODEL IMPLEMENTED IN FLAC3D	3183
<i>K. Ninanya, C. Romanel</i>	
SAND PRODUCTION IN THE INJECTING AND FRACTURING WELL: MODELLING, MECHANISMS, AND PREDICTIONS	3191
<i>Y. Wang</i>	
SEEING-AHEAD-OF-THE-BIT: A GAME CHANGER ENABLED BY MACHINE LEARNING.....	3200
<i>G. Taylor, B. Zhang, M. Unaldi, E. Tian, E. Alvarez, A. Sansal</i>	
SEISMIC RESPONSE IN THE HYDRAULIC-MECHANICAL COUPLING ANALYSIS OF A CCS SITE MODEL BY NMM	3207
<i>T. Sasaki, S. Horikawa, K. Kusunose, R. Hashimoto</i>	
SEISMIC RISK MITIGATION STRATEGIES FOR FLUID INJECTION AND WITHDRAWAL	3217
<i>M. Alghannam, R. Juanes</i>	
SELF-EXCITED OSCILLATIONS OF A ROTARY DRILLING SYSTEM INDUCED BY BIT-ROCK INTERACTION WITH TWO STATE-DEPENDENT DELAYS	3223
<i>H. Zhang, E. Detournay</i>	
SEMI-ANALYTICAL METHOD FOR TRACKING THE EVOLUTION OF BOREHOLE BREAKOUTS	3231
<i>N.B. Setiawan, R.W. Zimmerman</i>	
SENSITIVITY OF LONG TERM EDZ DEVELOPMENT, AROUND DEEP GEOLOGICAL REPOSITORIES, TO INTERNAL STRUCTURE OF ARGILLACEOUS LIMESTONES	3237
<i>M.S. Diedrichs, J.J. Day</i>	

SHAKE TABLE VALIDATION OF PSEUDO-STATIC FAILURE MODES OF ROCK SLOPES	3245
<i>F.J. Johnston, M.M. MacLaughlin</i>	
SHALE GAS PRODUCTION UNDER THE INFLUENCE OF UNDERGROUNG LONGWALL COAL MINING	3251
<i>D.W.H. Su, P. Zhang, H. Dougherty, M. Van Dyke, R. Kimutis</i>	
SHEAR FRACTURE HYDRAULIC CONDUCTIVITY IN THE SUBSURFACE	3268
<i>N.J. Welch, L.P. Frash, W. Li, M. Meng, J.W. Carey</i>	
A SIMPLE METHOD TO SIMULATE HYDRAULIC FRACTURING IN A POREELASTIC MEDIUM WITH APPLICATION IN GEOLOGICAL CARBON DIOXIDE STORAGE.....	3274
<i>X. Ju, P. Fu, R.R. Settgast, J.P. Morris</i>	
A SIMPLE TRANSIENT DFN MODEL WITH STRESS-DEPENDENT FRACTURE PERMEABILITY FOR SHALE GAS PRODUCTION	3281
<i>W.F. Li, L.P. Frash, N.J. Welch, J.M. Carey, M. Meng</i>	
SIMULATING THE BEHAVIOR OF COMPRESSIVELY LOADED BLANCO MERA GRANITE USING BONDED BLOCK MODELS	3290
<i>I. West, G. Walton, S. Sinha</i>	
SIMULATING THE EXCAVATION DAMAGED ZONE OF A SUPPORTED DEEP GEOLOGICAL REPOSITORY USING FDEM.....	3299
<i>J. Ha, G. Grasselli</i>	
SIMULATING TIGHTLY-SPACED SWARMING HYDRAULIC FRACTURES AT FIELD SCALE USING AN UPSCALING APPROACH.....	3305
<i>W. Fu, J.P. Morris, P. Fu, J. Huang, C.S. Sherman, R.R. Settgast</i>	
SIMULATION STUDY ON ROCK BREAKING MECHANISM OF TBM DISC CUTTERS USING MATERIAL POINT METHOD.....	3311
<i>Y. Xue, J. Wang, M. Zhou</i>	
SINGLE STAGE AND MULTISTAGE CONFINED BRAZILIAN TEST	3317
<i>Y. Li, Z. Wang, A. Ghassemi</i>	
SIZE EFFECT ON GRANITIC ROCKS FEATURING NATURAL DEFECTS.....	3325
<i>J. Arzua, J. Gonzalez, M. Canovas, M. Maleki, O. Benavente</i>	
SMASH – SMART MESHING FOR REALISTIC GEOMECHANICAL MODELS OF ROCK SLOPE FAILURE PROCESSES	3332
<i>Y.F. Alghalandis, J. Ha, G. Grasselli</i>	
A STOCHASTIC-DETERMINISTIC DISCRETE FRACTURE NETWORK MODEL FOR PIT SLOPE STABILITY ANALYSIS USING UAV COLLECTED STRUCTURAL DATA.....	3338
<i>F. Medinac, K. Esmaeili</i>	
A STRAIN SOFTENING/HARDENING CONSTITUTIVE MODEL FOR ROCK BASED ON NEWLY MODIFIED GZZ CRITERION	3346
<i>H. Chen, H. Zhu, L. Zhang</i>	
STRESS AND PRESSURE IN EXTENSIONAL SALT SYSTEMS.....	3354
<i>M.A. Nikolinakou, M. Heidari, M.R. Hudec, P.B. Flemings</i>	

STRESS DEPENDENT STORAGE AND TRANSPORT PROPERTIES IN CARBONATE RESERVOIR ROCKS: PORE TYPE AND STRESS PATH EFFECTS.....	3360
<i>W.C. Reese, B.R. Crawford, P.J. Moore, J.A. Freysteinsson, K.I. Amalokwu, R.D. Valdez</i>	
STRESS-DEPENDENT PERMEABILITY AND POROSITY IN THREE FORKS CARBONATE RESERVOIR, WILLISTON BASIN	3367
<i>A. Boualam, V. Rasouli, C. Dalkhaa, S. Djezzar</i>	
STRESS-INDUCED PERMEABILITY CHANGE IN A LAUMONTITE-RICH TIGHT ROCK	3380
<i>S. Akhtar, B. Li, X. Ma, B. Xu, B. Yang</i>	
STRUCTURAL DOMAINING FOR ENGINEERING PROJECTS	3388
<i>W.P. Barnett, T.G. Carter</i>	
A STUDY OF THE HYDRAULIC EXTENDED-REACH LIMIT OF HORIZONTAL WELLS IN NATURAL GAS HYDRATE FORMATION CONSIDERING THE WELLBORE CIRCULATING TEMPERATURE PROFILE AND WELL STABILITY	3400
<i>Y.F. Chen, H. Zhang, A.M. Chen</i>	
A STUDY OF THE INTERBURDEN STABILITY IN MULTILEVEL LIMESTONE MINES USING FLAC3D MODELS	3406
<i>G. Rashed, B.A. Slaker</i>	
A STUDY ON DEFORMATION CHARACTERISTICS OF SHALE SELF-PROPPED FRACTURE UNDER NORMAL STRESS	3416
<i>B.Y. Jiang, C. Lu, C.H. Huang, F.L. Huang, L. Ma, X.Y. Li, Y. Luo, J.C. Guo, J.F. Li, H.G. Lu, X.J. He, Y.J. Xiao, X.H. Wang</i>	
STUDY ON HOW THE HYDRAULIC FRACTURING AFFECTS INTEGRITY OF CEMENT SHEATH AT INCLINED SECTION OF SHALE GAS WELLS	3428
<i>K. Liu, S. Ding, X. Du, S. Zhou, Q. Tao, R. Liu, P. Li</i>	
STUDY ON MECHANISM OF FRACTURE FORMATION INDUCED BY ULTRA-LOW TEMPERATURE	3437
<i>X. Zheng, M. Tang, G. Zhang, S. Zheng, H. Zi, Z. Gao</i>	
STUDY ON MECHANISM OF WELLBORE INSTABILITY IN PENGLAI 7-6 STRUCTURE.....	3442
<i>Z. Zhang, J. Yang, X. Qu, Y. Zhang, T. Zhang, X. Zhao, Q. Ou, S. Shan, J. Wang, Y. Hao</i>	
STUDY ON TBM DISC CUTTER WEAR PROCESS BASED ON A NEW DEM MODEL	3450
<i>Y. Xue, Y. Fan, X. Li, L. Xu</i>	
STUDY ON THE EFFECT OF WETTABILITY ON THE OIL RECOVERY OF TIGHT CARBONATE RESERVOIRS	3458
<i>J. Wang, Y. Li, F. Zhou, E. Yao, J. Zeng, B. Zhao</i>	
STUDY ON THE SPLIT CHARACTERISTICS OF BEDDING SANDSTONE TREATED BY CO ₂	3463
<i>Z. Li, G. Zhang, S. Liu, Y. Nie</i>	
STUDY ON TIME-DEPENDENT DEFORMATION OF STRATUM IN COAL SEAM MINING AND ITS INFLUENCE ON DAM	3469
<i>J.Q. Deng, W. Cui, Y.B. Zhu, Y. Liu, X.M. Zhu</i>	
SUBCRITICAL PROPAGATION OF HYDRAULIC FRACTURES BY STEP LOADING.....	3476
<i>P. Wang, G. Zhang, Y. Wu, D. Zhou, Y. Nie</i>	

SUBSURFACE AIRFLOW MEASUREMENTS BEFORE AND AFTER A SMALL CHEMICAL EXPLOSION.....	3483
<i>S.J. Bauer, S.T. Broome, W.P. Gardner</i>	
SUGGESTED METHOD FOR DILATOMETER TESTING IN JOINTED ROCK MASS, CASE STUDY: KARUN2 DAM	3490
<i>M.G. Nik, B. Abrah, L. Framarzi</i>	
SUGGESTED TENSILE TEST DATA INTERPRETATION FOR ESTIMATING HOEK-BROWN MI	3495
<i>T.G. Carter, J.L. Carvalho</i>	
SUPERCritical CO ₂ FRACTURING INDUCED CHANGE IN WELLINGTON SHALE: INSIGHTS FROM LABORATORY	3508
<i>R. Feng, S. Memon, A. Giwelli, E.A. Al-Khdheeawi, M. Sarmadivaleh</i>	
SURROGATE MODELS IN ROCK MECHANICS: INTEGRATING NUMERICAL MODELING AND MACHINE LEARNING	3517
<i>J.K. Furtney, R. Le Goc</i>	
TEMPERATURE AND PRESSURE PROFILES FOR GEOTHERMAL BATTERY ENERGY STORAGE IN SEDIMENTARY BASINS.....	3523
<i>P. Panja, J. McLennan, S. Green</i>	
THEORETICAL AND PRACTICAL PROGRESS ON THE NEW CONSTRAINT METHOD OF DEEP ROCK STRESSES BASED ON A MODIFIED STRESS POLYGON AND FOCAL MECHANISM SOLUTION.....	3533
<i>C. Wang, P. Wang</i>	
THEORETICAL INVESTIGATION OF PERCUSSIVE DRILLING AND DROP TEST	3540
<i>X. Song, O.M. Aamo, P.A. Kane, A. Depouhon, E. Detournay</i>	
THERMAL CRACKING NEAR A HYDRAULIC FRACTURE IN HDR AND NATURALLY FRACTURED FORMATIONS	3546
<i>L.X. Pan, Y. Wang, M.B. Dusseault</i>	
THERMALLY-INDUCED BREAKOUTS: INSIGHTS FROM TRUE-TRIAXIAL TESTS WITH ACOUSTIC EMISSION MONITORING.....	3555
<i>M. Trzeciak, H. Sone, C.E. Bate, H. Wang</i>	
A THERMO-CHEMO-MECHANICAL MODEL FOR FAULT FRICTION.....	3561
<i>H. Rattez, M. Veveakis</i>	
A THERMODYNAMIC-CONSISTENT MICRO-CRACK DAMAGE MODEL FOR BRITTLE ROCKS.....	3568
<i>M. Sisodiya, Y. Zhang</i>	
THIRD-ORDER ELASTIC TENSOR OF SHALES DETERMINED THROUGH ULTRASONIC VELOCITY MEASUREMENTS.....	3576
<i>M.I. Duda, R.M. Holt, A. Bakk</i>	
THM COUPLED NUMERICAL ANALYSIS ON THE GEOTHERMAL ENERGY STORAGE & EXTRACTION IN POROUS FRACTURED RESERVOIR	3584
<i>W. Jin, R. Podgorney, T. McLing</i>	

THMC COUPLING SIMULATION FOR ESTIMATING THE LONG-TERM EVOLUTION OF ROCK PERMEABILITY DEPENDING ON GROUNDWATER CHEMISTRY	3594
<i>S. Ogata, H. Yasuhara, N. Kinoshita, K. Kishida</i>	
THREE-DIMENSIONAL ANALYSIS OF HYDRAULIC FRACTURE EFFECTIVE CONTACT AREA IN LAYERED FORMATIONS WITH NATURAL FRACTURE NETWORK.....	3601
<i>J. Wang, H.P. Lee, T. Li, J.E. Olson</i>	
THREE-DIMENSIONAL GEOMECHANICAL MODEL ESTABLISHMENT AND APPLICATION BASED ON COMPLICATED STRUCTURES IN YINGXI AREA OF QINGHAI OILFIELD.....	3614
<i>Q. Wang, Y. Wan, C. Cheng, S. Liu, X. Feng, Y. Liu</i>	
TIITMETER AND SEISMIC RESPONSE TO PRECONDITIONING WITH HYDRAULIC FRACTURES IN TWO UNDERGROUND CAVING MINES	3621
<i>D. Kasperezyk, Z. Chen, K. Jonsson</i>	
TIME- AND PRESSURE-DEPENDENT SOURCE MECHANISMS IN HYDRAULIC FRACTURING TESTS IN GRANITE CONSIDERING FLUID DIFFUSIVITY	3628
<i>C. Baptista-Pereira, B. Li, B.G. da Silva</i>	
TWO-PHASE FLOW PROPERTIES OF A WELLBORE MICROANNULUS.....	3639
<i>S.G. Fernandez, I. Anwar, M.M.R. Taha, J.C. Stormont, E.N. Matteo</i>	
TWO-SEAM STRESS CONTROL PROGRAM AT THE ENERGY WEST OPERATIONS, UTAH.....	3645
<i>H. Maleki, C. Semborski, K. Fleck</i>	
UNDERGROUND EXCAVATION STABILITY ASSESSMENT IN SQUEEZING GROUND CONDITIONS USING NEURAL NETWORK CLASSIFIER	3657
<i>K. Sarsembayev, A.C. Adoko</i>	
UNDRAINED SHEAR BEHAVIOR OF RESEDIMENTED NILE SILTY CLAY	3664
<i>S.A.Y. Akl, H.I. Mohaisen, M.A. El-Khouly</i>	
UNIAXIAL STRAIN PORE VOLUME COMPRESSIBILITY TEST ON SHALE UNDER STRESS RELAXATION LOADING CONDITION	3670
<i>X. Zhou, A. Ghassemi</i>	
USING ARTIFICIAL INTELLIGENCE FOR ROOF FALL HAZARD IDENTIFICATION IN LIMESTONE MINES	3679
<i>E. Isleyen, H.S. Duzgun, R.M. Carter, T. Miller</i>	
USING GRIPPER FORCES OF AN OPEN GRIPPER TBM TO EVALUATE ROCK MASS STIFFNESS.....	3687
<i>T. Marcher, G. Sackl, C. Reinhold</i>	
USING HIGH-VISCOSITY FRICTION REDUCERS (HVFRS) TO ENHANCE SRVS IN HIGH TDS FORMATIONS: BAKKEN CASE STUDY.....	3694
<i>A. Ellafi, H. Jabbari, M.B. Geri, O.S. Tomomewo</i>	
UTILITY OF SEISMIC SOURCE MECHANISMS AND SOURCE PARAMETERS IN THE GEOMECHANICAL INTERPRETATION OF THE ROCKMASS STATE.....	3710
<i>S.G. Meyer</i>	

UTILIZING DISTRIBUTED FIBER OPTIC STRAIN SENSING TO MEASURE STRAIN HETEROGENEITY OF NODULAR LIMESTONES DURING UCS TESTING	3722
<i>S. Hegger, N. Vlachopoulos, M.S. Diederichs, T. Poles</i>	
VACA MUERTA FORMATION: FROM LABORATORY GEOMECHANICAL CHARACTERIZATION TO THE UNCONVENTIONAL RESERVOIR APPLICATION.....	3730
<i>A.P.S. Massaro, D.N. Espinoza, P.E. Benitez, M. Frydman</i>	
VARIATION IN COAL COMPRESSIBILITY DUE TO MICROBIAL BIOCONVERSION	3739
<i>R. Pandey, S. Harpalani</i>	
VELOCITY DISCONTINUITY MODELS DETERMINING FREQUENCY DEPENDENCE OF ROCK JOINT SHEAR STIFFNESS.....	3745
<i>H. Li, A. Gheibi, J.H. Deng, J.B. Zhu, A. Hedayat</i>	
VERIFICATION OF MODELING METHODOLOGY FOR INVESTIGATING STRESS REDISTRIBUTION AT DEEP WESTERN U.S. LONGWALL COAL MINES	3753
<i>H. Zhao, I.B. Tulu</i>	
VIRTUAL REALITY LEARNING ENVIRONMENTS FOR ROCK ENGINEERING, GEOLOGY AND MINING EDUCATION	3760
<i>M. Janiszewski, L. Uotinen, J. Merkel, J. Leveinen, M. Rinne</i>	
VOLUME FILTERING AND ITS IMPLICATIONS FOR ANALYZING ROCKFALL DATABASES	3767
<i>H.E. Schovanec, G. Walton</i>	
VORONOI BASED DISCRETE ELEMENT ANALYSES TO ASSESS THE INFLUENCE OF THE GRAIN SIZE ON THE APPARENT FRACTURE TOUGHNESS OF NOTCHED ROCK SPECIMENS	3777
<i>J. Justo, J. Castro, H. Konietzky</i>	
WATER BLOCKAGE IN TIGHT GAS SANDSTONE AND ITS MITIGATION METHOD	3786
<i>Y. Li, J. Wang, F. Zhou, E. Yao, D. Wei</i>	
WELL DESIGN FOR THE CONSTRUCTION AND OPERATION OF AN EXPERIMENTAL SALT CAVERN BUILT OFFSHORE IN ULTRA-DEEP WATER FOR CCS IN BRASIL	3792
<i>A.M. da Costa, P.V.M. Costa, A.C.O. Miranda, M.B.R. Goulart, A. Bergsten, J.R. Meneghini, K. Nishimoto, G.R.S. Assi, C.M. Sampaio, N.F.F. Ebecken, C. Brandao, A. Breda</i>	
WELLCBORE INTEGRITY AND UNLOADING STRESS PATH ANALYSIS FOR INJECTORS WITH FILTER CAKE	3808
<i>B. Luo, G.K. Wong, J. Guo</i>	
WELLCBORE STABILITY AND PREDICTED CUTTINGS VOLUME IN DEVIATED WELLCBORES AND BEDDED FORMATIONS.....	3817
<i>A. Tsopela, A. Bere, M. Dutko, J. Kato</i>	
WELLCBORE STABILITY EVALUATION FOR DEPLETED RESERVOIR	3828
<i>A. Manhalawi, A.S. Dahab, A.M. Abdulaziz, A.K. Abbas, N. Al-Husseini</i>	
WELLCBORE STABILITY RISK ANALYSIS BASED ON PROBABILISTIC METHODS.....	3835
<i>A. Strel, S.A.B. Fontoura, C.B. Morales-Monsalve, V. Marchesi, C.J. Goncalves, R. Dias</i>	
WHERE IS THE WATER? – A PHYSICS ANALYSIS TO IDENTIFY POSSIBLE PROCESSES IN HYDRAULIC FRACTURING.....	3845
<i>G.D. Couples</i>	

A WORKFLOW FOR PREDICTING THE EFFECT OF BEDDING AND DRILLING-INDUCED STRESSES ON BOREHOLE SONIC LOGGING, WITH APPLICATION TO THE MONTNEY FORMATION, NORTHEASTERN BRITISH COLUMBIA	3855
<i>S. Hendi, M. Gorjian, C.D. Hawkes</i>	
EFFECT OF PARTICLE SIZES ON MECHANICAL PROPERTIES OF TAILINGS UNDER HIGH PRESSURE	3867
<i>Z. Pan, C. Zhang, C. Ma, T. He</i>	
ESTIMATION OF GEOMECHANICAL PROPERTIES BY USE OF COMBINED CT-SCAN AND XRD ANALYSIS (DIGITAL ROCK PHYSICS)	3878
<i>B.K. Hosseini</i>	

Author Index