

SPE Hydraulic Fracturing Technology Conference and Exhibition 2021

Online
4 - 6 May 2021

Volume 1 of 2

ISBN: 978-1-7138-3000-9

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© (2021) by Society of Petroleum Engineers
All rights reserved.

Printed with permission by Curran Associates, Inc. (2021)

For permission requests, please contact Society of Petroleum Engineers
at the address below.

Society of Petroleum Engineers
P. O. Box 833836
Richardson, Texas 75083-3836

Phone: (800) 456-6863
Fax: (972) 952-9435

books@spe.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

COMPLETION OPTIMIZATION I

RESERVOIR QUALITY VERSUS COMPLETION INTENSITY: AN APPLICATION OF SUPERVISED FUZZY CLUSTERING ON WESTERN CANADIAN WELL DATA	1
<i>Tamer Moussa, Hassan Dehghanpour, Melanie Popp</i>	
PRACTICAL DESIGN CONSIDERATIONS FOR STAGE LENGTH, PERFORATION CLUSTERS AND LIMITED ENTRY PRESSURE INTENSITIES	13
<i>Paul Huckabee, Chris Ledet, Gustavo Ugueto, John Tolle, Somnath Mondal</i>	
HYDRAULIC FRACTURING DIAGNOSTICS UTILIZING NEAR AND FAR-FIELD DISTRIBUTED ACOUSTIC SENSING DAS DATA CORRESPONDENCES	34
<i>Yinghui Wu, Robert Hull, Andrew Tucker, Craig Rice, Peter Richter, Ben Wygal, Mahmoud Farhadiroushan, Kirk Trujillo, Craig Woerpel</i>	
MACHINE LEARNING AND ARTIFICIAL INTELLIGENCE PROVIDES WOLFCAMP COMPLETION DESIGN INSIGHT	50
<i>Robert Shelley, Oladapo Oduba, Howard Melcher</i>	
EMPLOYING A SUITE OF MACHINE LEARNING ALGORITHMS IN A HOLISTIC APPROACH TO TROUBLE STAGE RECOGNITION AND FAILURE DIAGNOSTICS	66
<i>Jessica Iriarte, Matthew McConnell, Sam Hoda, Emily Siegel, Carly Wolfbrandt</i>	
AN OPERATORS INVESTIGATION OF PERFORMANCE DRIVERS USING DIAGNOSTICS AND DATA ANALYTICS	84
<i>Trevor Klaassen, Jackson Haffener, Jarret Borell, Chad Senters</i>	
COMPARING AND COMBINING CAMERA, TRACER AND DISTRIBUTED TEMPERATURE AND ACOUSTIC SENSING DAS+DTS FOR A HOLISTIC UNDERSTANDING OF STIMULATION AND PRODUCTION PERFORMANCE	99
<i>Matthew Lawrence, Ahmed Attia</i>	

FRACTURE DIAGNOSTICS I

RAPID COMPLETION DESIGN CHANGES WITH FIBER OPTICS	112
<i>John-Bosco Tran, Matthew Mientka, Drew Mogck, Price Stark</i>	
UNIFIED PRESSURE AND RATE TRANSIENT ANALYSIS OF PRODUCTION AND SHUT-IN DATA FROM FRACTURED HORIZONTAL WELLS	121
<i>HanYi Wang, Mukul Sharma, Harold McGowen</i>	
NATURAL FRACTURE DOMINATED DISTRIBUTION OF SLURRY DURING A MULTI-CLUSTER HYDRAULIC FRACTURING STAGE: A MARCELLUS DAS/DTS CASE STUDY	139
<i>Eric Romberg, Andrew Adams, Jason Edwards, Taylor Levon</i>	
PRACTICAL APPLICATIONS OF WATER HAMMER ANALYSIS FROM HYDRAULIC FRACTURING TREATMENTS	150
<i>Nguyen Dung, Cramer David, Danielson Tom, Snyder Jon, Roussel Nico, Ouk Annie</i>	

HIGH FIDELITY FIBRE-OPTIC OBSERVATIONS AND RESULTANT FRACTURE MODELING IN SUPPORT OF PLANARITY	197
<i>Mojtaba Shahri, Andrew Tucker, Craig Rice, Zach Lathrop, Dave Ratcliff, Mark McClure, Garrett Fowler</i>	

A NOVEL METHOD AND ITS APPLICATION TO DEFINE MAXIMUM HORIZONTAL STRESS AND STRESS PATH	227
<i>Jianguo Zhang, Karthik Mahadev, Stephen Edwards, Alan Rodgeron</i>	

AN EAGLE FORD CASE STUDY: MONITORING FRACTURING PROPAGATION THROUGH SEALED WELLBORE PRESSURE MONITORING	240
<i>Kourtney Brinkley, Trevor Ingle, Jackson Haffener, Philip Chapman, Scott Baker, Eric Hart, Kyle Haustveit, Jon Roberts</i>	

KNOWLEDGE SHARING EPOSTERS

HIGH PRESSURE, HIGH TEMPERATURE BIOREACTORS AS A BIOCIDES SELECTION TOOL FOR HYDRAULICALLY FRACTURED RESERVOIRS	269
<i>Joseph Ferrar, Philip Maun, Kenneth Wunch, Joseph Moore, Jana Rajan, Jon Raymond, Ethan Solomon, Matheus Paschoalino</i>	

NOVEL DEPLOYMENT OF TRACERS LEADS TO HIGH-CONFIDENCE RESULTS	281
<i>Claudio R Ramos</i>	

SILICA GEL FRACTURING FLUIDS AN ALTERNATIVE TO GUAR SYSTEMS THAT ALLOWS THE USE OF WEST TEXAS PRODUCED WATER	301
<i>Carl Harman, Michael McDonald, Paul Short, William Ott</i>	

A MULTI-DISCIPLINARY APPROACH FOR WELL SPACING AND TREATMENT DESIGN OPTIMIZATION IN THE MIDLAND BASIN USING LATERAL PORE PRESSURE ESTIMATION AND DEPLETION MODELING	315
<i>Taylor Levon, Kit Clemons, Ben Zapp, Tim Foltz</i>	

THE EFFECTS OF FLUID VISCOSITY AND DENSITY ON PROPPANT TRANSPORT IN COMPLEX SLOT SYSTEMS	331
<i>Ashtiwi Bahri, Jennifer Miskimins</i>	

8070 MILES FROM THE FIELD TO THE LAB AND BACK: A PRAGMATIC SEQUENCING OF LABORATORY AND FIELD-BASED FLUID TESTING AND QAQC, A CASE HISTORY FROM SICHUAN REGION, CHINA	353
<i>A. Casero, A. Gooma, J. Ronderos, K. Cawiezel, W. J. Giffin</i>	

OPTIMIZATION OF COAL SEAM CONNECTIVITY VIA MULTI-SEAM PINPOINT FRACTURING OPERATIONS IN THE WALLOONS COAL MEASURES, SURAT BASIN	378
<i>Vibhas J. Pandey, Sameer Ganpule, Steven Dewar</i>	

DATA-DRIVEN CAUSAL ANALYSES OF PARENT-CHILD WELL INTERACTIONS FOR WELL SPACING DECISIONS	394
<i>Rohan Sakhardande, Deepak Devegowda</i>	

ANALYSIS OF PRESSURE INTERFERENCE TESTS IN UNCONVENTIONAL GAS RESERVOIRS: A GAS CONDENSATE EXAMPLE FROM MONTNEY FORMATION	409
<i>Behjat Haghshenas, Farhad Qanbari</i>	

IMPROVING FRACTURING OPERATIONS AND EFFICIENCIES

SIMULTANEOUS HYDRAULIC FRACTURING IMPROVES COMPLETION EFFICIENCY AND LOWERS COSTS PER FOOT	422
<i>David Russell, Price Stark, Sean Owens, Awais Navaiz, Russell Lockman</i>	
UTILIZATION OF HYDRAULIC COMPLETION UNITS IN THE DELAWARE BASIN	434
<i>J. H. Frantz Jr., M. L. Tourigny, J. M. Griffith</i>	
A SHOT IN THE DARK: HOW YOUR POST-FRACTURE PERFORATION IMAGING CAN BE MISLEADING AND HOW TO BETTER UNDERSTAND CLUSTER EFFICIENCY AND OPTIMIZE LIMITED ENTRY PERFORATING	448
<i>Blake Horton</i>	
TURNING PRODUCED WATER INTO AN ASSET: A DELAWARE BASIN CASE HISTORY	467
<i>Dustin Aro, Steven Fowler</i>	
INFILL WELL COMPLETION TECHNOLOGIES MITIGATE WELL INTERFERENCE AND OPTIMIZE PRODUCTION ON MULTIWELL PAD	481
<i>Foluke Ajisafe, Mark Reid, Hank Porter, Lydia George, Rhonna Wu, Kira Yudina, Alejandro Pena, Efe Ejofodomi, Pedro Artola</i>	
2000-2020: TWO DECADES OF EVOLUTION OF HYDRAULIC FRACTURING-INDUCED SEISMICITY IN THE WESTERN CANADA SEDIMENTARY BASIN	494
<i>Germán Rodríguez-Pradilla, David Eaton, Melanie Popp</i>	
IMPROVED TREATMENT DISTRIBUTION THROUGH ORIENTED PERFORATING	505
<i>Jon Snyder, David Cramer, Matt White</i>	

FRACTURE DIAGNOSTICS II

PROPPANT PLACEMENT IN THE BARNETT SHALE WHEN PERFORATIONS ARE SELECTED IN LIKE-ROCK	530
<i>Tracy Juarez, Caleb Francis, Stephanie Freels, Brian Sinosis, Kevin Wutherich</i>	
ADVANCEMENTS IN STEP DOWN TESTS TO GUIDE PERFORATION CLUSTER DESIGN AND LIMITED ENTRY PRESSURE INTENSITIES - LEARNINGS FROM FIELD TESTS IN MULTIPLE BASINS	555
<i>Somnath Mondal, Min Zhang, Paul Huckabee, Gustavo Ugueto, Raymond Jones, Sanjay Vitthal, David Nasse, Mukul Sharma</i>	

VOLUME 2

A SIGNAL PROCESSING APPROACH FOR ANALYSIS OF FRACTURE INJECTION TEST IN GEOTHERMAL RESERVOIRS: A CASE STUDY ON THE UTAH FORGE FORMATION	580
<i>Ibrahim Eltaleb, Ali Rezaei, M. Y. Soliman, Birol Dindoruk</i>	
A NOVEL COUPLED APPROACH TO INVESTIGATE THE SPATIOTEMPORAL EVOLUTION OF FRACTURING-INDUCED SEISMICITY: CASE STUDY	595
<i>Gang Hui, Shengnan Chen, Fei Gu</i>	

LOW-COST MEASUREMENT OF HYDRAULIC FRACTURE DIMENSIONS USING PRESSURE DATA IN TREATMENT AND OBSERVATION WELLS – A WORKFLOW FOR EVERY WELL	608
<i>A. Kirby Nicholson, Robert C. Bachman, R. Yvonne Scherz, Robert V. Hawkes</i>	

EVALUATING INFILL WELL PERFORMANCE AND FRACTURE DRIVEN INTERACTIONS USING INTERVENTION BASED DISTRIBUTED FIBER OPTICS	644
<i>Ahmed Attia, Matthew Lawrence</i>	

COMPLETION OPTIMIZATION II

APPLICATION OF DFIT-FBA TESTS PERFORMED AT MULTIPLE POINTS IN A HORIZONTAL WELL FOR ADVANCED TREATMENT STAGE DESIGN AND RESERVOIR CHARACTERIZATION	654
<i>Danial Zeinabady, Behnam Zanganeh, Sadeq Shahamat, Christopher R. Clarkson</i>	

AN EXPERIMENTAL STUDY OF COEFFICIENT OF DISCHARGE FOR CONSISTENT HOLE PERFORATING AND THE EFFECT ON LIMITED ENTRY DESIGNS	683
<i>Scott Thiessen, Oliver Han, Ramadan Ahmed, Rida Elgaddafi</i>	

VERTICAL GROWTH OF HYDRAULIC FRACTURES IN LAYERED FORMATIONS	710
<i>Vibhas J. Pandey, Vamegh Rasouli</i>	

TURNING A BREAKTHROUGH TECHNOLOGY INTO A SCALABLE PROCESS: SEALED WELLBORE PRESSURE MONITORING	740
<i>Jessica Iriarte, Samid Hoda, Ryan Guest, Mary Van Domelen</i>	

REDUCING THE PLACEMENT COST OF A POUND OF PROPPANT DELIVERED DOWNHOLE	766
<i>Jon Sochovka, Kyle George, Howard Melcher, Mike Mayerhofer, Leen Weijers, Ben Poppel, Joel Siegel</i>	

MULTI-WELL PRESSURE HISTORY MATCHING IN DELAWARE PLAY HELPS OPTIMIZING FRACTURING FOR SUBSEQUENT PADS	785
<i>Roberto Suarez-Rivera, Rohit Panse, Javad Sovizi, Egor Dontsov, Heather LaReau, Kirke Suter, Matthew Blöse, Thomas Hailu, Kyle Koontz</i>	

OPTIMIZING COMPLETION DESIGN AND WELL SPACING IN THE POWDER RIVER BASIN NIOBRARA OIL PLAY	803
<i>Blake Burget, Neal Dannemiller, Dylan Garrett, Erik Kling</i>	

FRACTURING FLUIDS & PROPPANT TRANSPORT

PROPPANT DISTRIBUTION IN NEWLY COMPLETED AND RE-FRACTURED WELLS - AN EAGLE FORD SHALE CASE STUDY	825
<i>Justin Allison, Glyn Roberts, Brad Hicks Hicks, Todd Lilly</i>	

LIMITED ENTRY PERFORATION CONFIGURATIONS EFFECT ON PROPPANT TRANSPORT AND DISTRIBUTION IN FRESH WATER	850
<i>Shabeeb Alajmei, Jennifer Miskimins</i>	

EARLY APPLICATIONS OF VISCOSIFYING FRICTION REDUCERS FOR HYDRAULIC FRACTURING OPERATIONS IN THE VACA MUERTA FORMATION, ARGENTINA	870
<i>Roberto Sentinelli, Leandro Moreno, Marcelo Pellicer, Mark Van Domelen</i>	

NOVEL LEARNINGS OF PROPPANT TRANSPORT BEHAVIOR IN UNCONVENTIONAL HYDRAULIC FRACTURES	882
<i>Amit Singh, Xinghui Liu, Jiehao Wang, Peggy Rijken</i>	

ACHIEVING PERFECT FLUID AND PROPPANT PLACEMENT IN MULTI-STAGE FRACTURED HORIZONTAL WELLS: A CFD MODELING APPROACH	907
<i>Xinghui Liu, Jiehao Wang, Amit Singh, Margaretha Rijken, Larry Chrusch, Dean Wehunt, Faraj Ahmad, Jennifer Miskimins</i>	

DRY POWDER DELIVER OF FRICTION REDUCERS: A STEP CHANGE IN SLICKWATER FRACTURING	933
<i>Blevins John, Mark Van Domelen, Zach West, Jason Rall, Drake Wakefield</i>	

FRACTURE & PRODUCTION MODELING

MODELING OF PROPPANT DISTRIBUTION DURING FRACTURING OF MULTIPLE PERFORATION CLUSTERS IN HORIZONTAL WELLS	945
<i>Konstantin Sinkov, Xiaowei Weng, Olga Kresse</i>	

MODELING WELLBORE PROPPANT TRANSPORT AND DISTRIBUTION ACROSS A SINGLE HYDRAULIC FRACTURING STAGE UNDER FIELD CONDITIONS USING COMPUTATIONAL FLUID DYNAMICS	971
<i>Brent Kebert, Abdulraof Almulhim, Jennifer Miskimins, William Hunter, Gage Soehner</i>	

ULTRA-FAST, PAD-SCALE MODELING OF HYDRAULIC FRACTURING AND DEPLETION FOR OPTIMIZING DEVELOPMENT PLANS IN THE EAGLE FORD PLAY	987
<i>Egor Dontsov, Roberto Suarez-Rivera, Rohit Panse, Christopher Quinn, Heather LaReau, Kirke Suter, Chris Hines, Ryan Montgomery, Kyle Koontz</i>	

JOINT PRESSURE AND PRODUCTION ANALYSIS TO UNDERSTAND INTER- AND INTRA-ZONE WELL INTERFERENCE: A MIDLAND BASIN CASE STUDY	1003
<i>Qin Ji, Geoff Vernon, Juan Mata, Shannon Klier, Matthew Perry, Allie Garcia, Erica Coenen</i>	

WELL SPACING AND STIMULATION DESIGN OPTIMIZATION IN THE VACA MUERTA SHALE: HYDRAULIC FRACTURE SIMULATIONS ON THE CLOUD	1026
<i>Sahil Malhotra, Alejandro Lerza, Sergio Cuervo</i>	

MODELING MULTISTAGE ACID FRACTURING TREATMENTS IN CARBONATE RESERVOIRS	1048
<i>Rencheng Dong, Mary F. Wheeler, Hang Su, Kang Ma</i>	

HYDRAULIC FRACTURE CHARACTERIZATION

FRAC CHARGE PERFORMANCE AT DOWNHOLE CONDITIONS: ASSESSMENTS AND IMPLICATIONS	1068
<i>Brenden Grove, Jacob McGregor, Rory DeHart, Ron Dusterhoft, Neil Stegent, Avrami Grader</i>	

PRESSURE DEPLETION MAPPING USING MULTI-WELL DFITS AND ITS APPLICATIONS IN HYDRAULIC FRACTURE CHARACTERIZATION AND PERMEABILITY ESTIMATION: EXAMPLES FROM MONTNEY FORMATION	1088
<i>Behjat Haghshenas, Farhad Qanbari</i>	

A DATA ANALYTICS FRAMEWORK FOR ANALYZING THE EFFECT OF FRAC HITS ON PARENT WELL PRODUCTION 1104
Yifei Guo, Pradeepkumar Ashok, Eric van Oort, Ross Patterson, Dandan Zheng, Matthew Isbell, Austin Riopelle

QUANTITATIVE HYDRAULIC-FRACTURE GEOMETRY CHARACTERIZATION WITH LF-DAS STRAIN DATA: NUMERICAL ANALYSIS AND FIELD APPLICATIONS 1119
Yongzan Liu, Ge Jin, Kan Wu, George Moridis

DIGITAL FRACTURE CHARACTERIZATION AT HYDRAULIC FRACTURING TEST SITE HFTS-MIDLAND: FRACTURE CLUSTERING, STRESS EFFECTS AND LITHOLOGIC CONTROLS 1135
Debotyam Maity, Jordan Ciezobka

Author Index