

16th International Conference on Multiphase Production Technology 2013

**Cannes, France
12-14 June 2013**

ISBN: 978-1-62993-295-8

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© (2013) by BHR Group
All rights reserved.

Printed by Curran Associates, Inc. (2014)

For permission requests, please contact BHR Group
at the address below.

BHR Group
The Fluid Engineering Centre
Cranfield, Bedfordshire MK43 0AJ
United Kingdom

Phone: +44 1234 750422
Fax: +44 1234 750074

contactus@bhrgroup.co.uk

Additional copies of this publication are available from:

Curran Associates, Inc.
57 Morehouse Lane
Red Hook, NY 12571 USA
Phone: 845-758-0400
Fax: 845-758-2634
Email: curran@proceedings.com
Web: www.proceedings.com

16th International Conference on
MULTIPHASE PRODUCTION TECHNOLOGY
Cannes, France: 12–14 June 2013

CONTENTS

FOREWORD	1
KEYNOTE ADDRESS	
Multiphase flow, flow assurance, dynamic modeling... why bother? <i>S Kashou, Chevron Inc., USA</i>	3
FIELD APPLICATIONS	
Modelling of topsides repressurisation for wet gas condensate systems for development of dry tree well start-up strategies <i>J Zhang, I Kopperman, MSi Kenny Pty Ltd., Australia</i>	7
Increasing production by applying simple/robust, field proven slug control technology <i>Y C Fong, Sarawak Shell Bhd, Malaysia; G A Groote, G Haandrikman, Shell Projects & Technology, The Netherlands</i>	23
Benchmark and optimization study of a deep water well restart in Gulf of Mexico <i>H Shi, BP America Production Co.; H Dong, Schlumberger Technology Corporation; R Berger, Manatee Inc., USA</i>	33
Prediction of liquid surge waves at Ormen Lange <i>K Holmås, G Gahr Lunde, G Setyadi, FMC Technologies; P Angelo, G Rudrum, Norske Shell, Norway</i>	45
HANDLING UNCERTAINTIES	
Managing flow assurance uncertainty through stochastic methods and life of field multiphase simulation <i>A E Johnson, T Bellion, T Lim, M Montini, FEESA Ltd, UK; A I Humphrey, BP Exploration, UK</i>	61
A structured approach for the evaluation of uncertainties in flow assurance systems <i>N Hoyer, M B Kirkedelen, D Biberg, SPT Group; G W Johnson, A Valle, P S Johansson, Statoil; J Nossen, IFE, Norway</i>	77

HIGH VISCOSITY FLUIDS

Heavy oil transportation as a slurry <i>A Brito, R Cabello, L Mendoza, PDVSA INTEVEP; H Salazar, UDO, Venezuela; J Trujillo, MSi Kenny, Australia</i>	95
Slug frequency in high viscosity liquid and gas flow in horizontal pipes <i>Y Zhao, H Yeung, L Lao, Cranfield University, UK</i>	105
Cold restart of viscous multiphase flowline by hot water flushing <i>Z Yang, Statoil ASA, Norway; J Velthuis, J Veltin, A Twerda, TNO, The Netherlands</i>	119
Improved holdup and pressure drop predictions for multiphase flow with gas and high viscosity oil <i>I Eskerud Smith, T Erling Unander, SINTEF Petroleum Research; J Nossen, Institute for Energy Technology, Norway</i>	133

HYDRATES

Hydrate inhibitor displacement experiments in jumper-like pipe configurations <i>E Dellecase, S Mele Solano, H Lu, M Volk, The University of Tulsa, USA</i>	151
Atlantic and Cromarty – A hydrate blockage and remediation case study <i>P D Molyneux, A R Williams, GL Noble Denton; D Tagg, ES175 Ltd, UK</i>	165
Practicalities of thermodynamic hydrate inhibitor distribution within hydrocarbon systems under steady state and dynamic operations <i>S Vahedi, T Wood, INTECSEA WorleyParsons Group, UK</i>	179
Fast-track flow assurance design for kinetic hydrate inhibitors without laboratory testing: A case study <i>E Luna-Ortiz, K Szklarczyk, M Healey, Xodus Group, UK; E Sørhaug, Talisman Energy Norge As, Norway</i>	191

MODELLING

Data processing of full 3D numerical simulation of slug flow to improve unit cell model <i>A Liné, LISBP-INSa Toulouse; R Belt, J-M Munoz, TOTAL; O Allain, D Guegan, LEMMA, Sophia-Antipolis, France</i>	203
Comparison and analysis of mechanistic models for gas-liquid flow in vertical and deviated wells <i>P Adames, SPT Group Canada; B Young, The University of Auckland, New Zealand</i>	213
CFD wall shear stress benchmark in stratified-to-annular transitional flow regime <i>D-J Peng, S Vahedi, T Wood, INTECSEA (UK) Ltd, UK</i>	229
Behaviour of slug flow and pressure force induced in a spool: numerical simulation of a Taylor bubble flowing in a liquid flow through a spool <i>C Gayet, M N'Diaye, Fluorem; A Liné, LISBP-INSa Toulouse, France</i>	255

Discretisation, characterisation, and complexification of multiphase pipeline elevation profiles 267
E Zakarian, J Morgan, Woodside Energy Ltd, Australia; H Holm, Statoil, Norway; D Larrey, Total, France

Mechanistic models for three-phase stratified and slug flows with dispersions 283
C Lawrence, J Nossen, R Skartlien, O Sendstad, O Skjæraasen, J Hua, L Liu, K Hald, T Sira, E Holm, B Hu, Institute for Energy Technology; D Biberg, P Andersson, G Staff, L Wollebæk, J Henriksson, T Wangensteen, Z G Xu, SPT Group, Norway

OPERATIONS

Field experience with by-pass pigging to mitigate liquid surge 299
G van Spronsen, R A W M Henkes, Shell Global Solutions International B.V., The Netherlands; A Entaban, K Mohamad Amin, Shell Global Solutions Sdn. Bhd., Malaysia; S Sarkar, Shell India Markets Pvt. Ltd, India

Liquid inventory and three phase surge wave data from the Midgard gas condensate fields in the North Sea 309
B H Pettersen, M Nordsveen, E Thomassen, Statoil ASA, Norway

OTHER CHALLENGES

Numerical sediment simulation using a continuous flow model 323
J C Goeree, C van Rhee, Delft University of Technology; H H Bugdayci, IHC Merwede, The Netherlands

Particle image velocimetry measurements in stratified air/water flow in a horizontal pipe 337
M Birvalski, M J Tummers, R Delfos, Delft University of Technology; R A W M Henkes, Delft University of Technology and Shell Projects & Technology, The Netherlands

Influence of drag reducing agents on interfacial wave characteristics in horizontal oil-water flow 353
L C Edomwonyi-Otu, A H Barral, P Angeli, University College London, UK

SLUGS

Simulation of hydrodynamic slug flow using the LedaFlow slug capturing model 365
J Kjølås, SINTEF Petroleum Research AS; A De Leebeeck, S T Johansen, SINTEF Materials and Chemistry, Norway

Measurement and simulation of slug flow in a large diameter three-phase pipeline 385
Y Fan, R Clausen, BP, USA; T Lockett, BP, UK; R Schutte, NANA WorleyParsons, USA

Experimental investigation of terrain slugging formation, evolution and potential for mitigation 399
B J Brasjen, W Schiferli, S P C Belfroid, TNO, The Netherlands and Qatar; J H Hansen, Maersk Oil Research and Technology Centre, Qatar

Prediction of liquid volume fraction in slugs in two-phase horizontal pipe flow with high viscosity liquid	415
<i>E Al-Safran, Kuwait University, Kuwait; C Kora, C Sarica, The University of Tulsa, USA</i>	

VALIDATION

Multiphase simulator performance in three-phase undulating pipeline	431
<i>G Ersoy, C Sarica, H-Q Zhang, The University of Tulsa, USA; E Al-Safran, Kuwait University, Kuwait</i>	
Expansion instabilities in long risers: small scale experiments and simulations	447
<i>T K Kjeldby, T Arnulf, O J Nydal, Norwegian University of Science and Technology, Norway</i>	
Modelling and validation of severe slugging in laboratory pipeline-riser systems	457
<i>P Wang, Cranfield University, UK and China University of Petroleum, China; Y Cao, H Yeung, L Lao, Cranfield University, UK; L Ma, J Gong, China University of Petroleum, China</i>	
Two-phase flow behaviour for a single flowline with a non-symmetric splitter to a dual riser	471
<i>P Prickaerts, Delft University of Technology; G Haandrikman, Shell Projects & Technology; R A W M Henkes, Delft University of Technology and Shell Projects & Technology, The Netherlands</i>	

AUTHOR INDEX