

Fuels and Petrochemicals Division 2013

**Core Programming Topic at the 2013 AIChE Spring Meeting &
9th Global Congress on Process Safety**

**San Antonio, Texas, USA
28 April – 2 May 2013**

Volume 1 of 2

ISBN: 978-1-62748-464-0

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 AIChE
All rights reserved.

Printed by Curran Associates, Inc. (2013)

For permission requests, please contact AIChE
at the address below.

AIChE
3 Park Avenue
New York, NY 10016-5991

Phone: (203) 702-7660
Fax: (203) 775-5177

www.aiche.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: 845-758-2634
Email: curran@proceedings.com
Web: www.proceedings.com

TABLE OF CONTENTS

VOLUME 1

Rebirth of Manufacturing in the U.S.: What are the Implications for Chemical Engineers?	1
<i>Dan Romasko</i>	
A Unified PID Control Methodology to Meet Plant Objectives	2
<i>Gregory McMillan, Hector Torres</i>	
Fundamentals of Model Based Loop Tuning	24
<i>James Beall</i>	
Detecting Loss of Flame in Oil Refinery Fired Heaters Using Advanced Pressure Diagnostics	39
<i>John P. Miller, Randy S. Stier</i>	
Abqaiq Plant Virtual Plant RTO Implementation	69
<i>Kuang-Yao Brian Peng, Saleh H. Al-Musallam</i>	
Optimization of An Industrial Power Plant	77
<i>Ravi Nath</i>	
Crude Unit Overhead Systems: Process Configurations to Mitigate Fouling	96
<i>Andrew W. Sloley</i>	
Importance of Field Testing Liquid Distributors	97
<i>German A. Luna-Mejias Sr.</i>	
Evaluating Individual Instrument Readings and Potential Errors in the Analysis of Monitoring Data	117
<i>G. T. Polley, Elvis K. Tamakloe, Yash-Vardhan Kapoor</i>	
How to Get the Best From Your Preheat Train – an UK Refinery Based Case Study	119
<i>Edward Ishiyama, Simon J. Pugh, G. T. Polley, James Kennedy, D. Ian Wilson, Alison Ogden-Quin, Graham Birch</i>	
Current Myths about LNG	131
<i>Christopher Caswell, David Coyle, Charles Durr, Heinz Kotzot, Jeffery Gaspard</i>	
Boil-off Gas System Design for Integrated Liquefaction and Regasification Facilities	132
<i>Bindupriya Bandari, Dipanjan Bhattacharya</i>	
Removal of Heavy Hydrocarbons from Lean Natural Gas	133
<i>Yu-Nan Liu, Gowri Krishnamurthy</i>	
From Zero to World No.1 LNG Exporter in Less Than 10 years, Qatar	134
<i>J. C. Kuo, Hao Dong, Marco Vaccaro, K. H. Wang</i>	
Sulphur Technology Tutorial – Conventional Wisdom and Innovative Frontiers	146
<i>David Stevens, Angela Slavens</i>	
Successful Sulfur Unit Startups	147
<i>Doug Cicerone</i>	
Sulfur Pit Explosion Protection by Deflagration Venting	159
<i>Bill Dewees, Angela Slavens, Shadi Al Adel, Vincent Yih, Dan Samani</i>	
Considerations of Temperature Measurement in the Claus Thermal Reaction Furnace	191
<i>Steve Croom</i>	
Understanding Today's Limiting Factors On Reaction Furnace Linings	204
<i>Andy Piper, Jeff Proctor</i>	
Pilot and Full-Scale Application of Technologies for Mercury Control	212
<i>Noah Meeks</i>	
Acid Tunneling Vs Acidizing : A Case Study of Rudatain Oilfield-Kuwait	213
<i>Adel Elsharkawy, Mohamed Al-Hadher</i>	
Sustained Casing Pressure Modeling and Well Integrity	214
<i>Tony Rocha-Valadez, A. Rashid Hasan, C. Shah Kabir, Sam M. Manman</i>	
Evaluation of Particle Growth in an Electrochemical Fluidised Bed Reactor	216
<i>Emmanuel Ehirim</i>	
Debottlenecking Gas Dryers and Desiccant Adsorbers	217
<i>Benjamin A. Schmitt, Michael Ekholm</i>	
Design Considerations for Effective Liquid Removal in Suction Drums	219
<i>Kanti Patel</i>	
Renewable Feedstock for Steam Crackers: Catalytic Upgrading of Crude Tall Oil (CTO) Into Bio-Naphtha	234
<i>Jinto Anthonykutty, Juha Linnekoski, Antero Laitinen, Ali Harlin</i>	
High Efficiency Ethylene Cracking Furnaces	236
<i>Rajaram Ramesh, Marco W. M. Van Goethem</i>	
Modernize Control Functionality, Easy Steps to Start Process Optimization	250
<i>Laurie Ben, James Beall</i>	

Paralleled Double-Effect Distillation: Simulative Case Studies	268
<i>Jinsheng Sun, Pei Wang, Hong Gao, Fan Wang, Leilei Dai, Ming Shi</i>	
In Situ Transesterification of Jatropha Curcas Seed Particles with Alkaline Phase Transfer Catalyst	282
<i>Subbarao Duvvuri, Shuhaimi Mahadzir, Sintayehu Hailegiorgis</i>	
Catalyzed-Assisted Manufacture of Olefins (CAMOL): Updated for Use in Naphtha Service	283
<i>Maximilian Walter, Suzanne Rech</i>	
Extending Furnace Run Length and Coil Life by Optimizing Decoking	284
<i>Vinod Mishra, James Brigman</i>	
Solving Operational Problems in Naphtha Splitter	285
<i>Giorgio Franceschetti, Patrick Lucas, Flavio Weissheimer, Rafael Henrique Camparin</i>	
Smartprocess® Application Strategy Achieves Faster and More Efficient Control of an Ethylene Complex	292
<i>Patrick Truesdale</i>	
Ethylene Furnace High Temperature Imaging Cameras to Monitor Burner Flames ,Tube Temperature and Tube Failure Detection	301
<i>Thomas Canty</i>	
Straighten up! Non-Linear Compensation Using Feed Forward Control	309
<i>Barbara Hamilton</i>	
Adsorption of CO₂ by Alkaline Activated Ca-Al₂O₃-SiO₂ Material	310
<i>Naim Faqir, Reyad Shawabkeh</i>	
Pressure Gauges: Hidden Danger or Visible Safety	311
<i>Jeff Placek</i>	
CFD Simulation of Laminar Liquid Film Condensation On the Entrance Region of Vertical Plate	320
<i>Bo Sun, Botan Liu, Chunjiang Liu</i>	
Improving Fired Heaters Using CFD	335
<i>Ashutosh Garg</i>	
Assesment of an Eulerian-Eulerian Multiphase CFD Framework for A Three Dimensional Modeling of A Trickle BED Reactor in Counter-Current Operation	360
<i>Sebastian Moreno Cardenas, Vivian Passos De Souza, Adriana De Souza Ferreira, Carlos Alberto Araujo Monteiro, José Roberto Nunhez, E. M. Matos</i>	
Use of Cold Flow Modeling and CFD for New Product Development	361
<i>Zhanping Xu, Pengfei Chen</i>	
Evaluation of the Dispersion Coefficient and Residence Time Distribution in Packed Bed Using Computational Fluid Dynamics	362
<i>Hadjira Iddir, Quan Yuan</i>	
Selection of Optimized Gas Monetization Option with FLNG or Fixed FLNG	363
<i>Joseph H. Cho</i>	
Smart Cargo Containment System Advanced (SCA) for LNG Carrier	364
<i>Dai Gil Lee, Munkuen Ha, Haeki Jang</i>	
LNG FPSRU and FPSO Pump Considerations for Ship Motion	365
<i>Gregory P. Wood</i>	
Determination of the Optimal Operating Condition of the Single Mixed Refrigerant Process for LNG FPSO	380
<i>Yeonmi Suh, Taeyeong Lee, Gyeongho Han, Kiil Nam, T. J. Kim</i>	
Constructability Issues for FLNG for Design and Project	389
<i>Herbert Moon, Paul Kim</i>	
Challenges in Syngas Preparation for Different Applications	392
<i>Vk Arora</i>	
Topsoe Tigas Technology for Conversion of Abundant Low Cost Resources Into High Value Synthetic Fuels	393
<i>Livia Sierra Llorens</i>	
Value Addition by Integrating C3 Derivatives with PDH Units	394
<i>Vk Arora</i>	
Opportunities for Modular Gtl in North America	395
<i>Jeff McDaniel</i>	
Compact Heat Exchange Reactors in Pilot Plants for Fischer-Tropsch Synthesis and Mixed Alcohol Production	396
<i>Hani Gadalla, Steven J. Vallee, Zhijun Jia</i>	
Performance Enhancement & Profitability Improvements of Refinery Operations Using 3-D Flow Modeling Techniques	397
<i>Praveen Kumar, Amarvir Chilka, Damodaran Vedapuri</i>	

Profitably Recover Refinery By-Product NGLS, Hydrogen and Ethylene/Propylene	405
<i>Guang Lee, Jie Yu, Sudhir Golikeri, Benjamin Klein</i>	
Exploiting Hydrogen Plant to Improve Refinery Margins	418
<i>Sanjiv Ratan</i>	
Optimized Combustion of Hydrocarbon and Hydrogen Fuel Mixtures Using Coriolis-Based Measurements	427
<i>Andrew J. Verdouw</i>	
Setting the Revamp Basis: What Is Current Operation?	428
<i>Andrew W. Sloley</i>	
The Design and Revamp of Cooling Water Networks	429
<i>Graham T. Polley, E. K. Tamakloe, M. Picon Nunez</i>	
Water / Wastewater Optimization Methods for Industrial Systems	460
<i>Joseph W Guida</i>	
Balancing Act - Simple Techniques for Steam Header Controls	461
<i>Barbara Hamilton</i>	
Thermal Fluids: The Key to Overall Site Integration	462
<i>Graham T. Polley, E. K. Tamakloe, M. Picon Nunez</i>	
Solid State Carbon Sequestration by Utilization of Agro-Wastes to Produce Value-Added Products	476
<i>Soh Fong Lim, M. O. Abdullah, A. R. H. Rigit</i>	
Ni-CaO-ZrO2 Nanocomposite Catalyst for CO2 Reforming of CH4	482
<i>Qingjun Chen, Jun Zhang, Tiejun Zhao, Yuhan Sun</i>	
Gas Cleanup Using Elastic Layered Metal-Organic Framework Adsorbents	485
<i>Francisco Sotomayor, Christian M. Lastoskie</i>	
Effect of Preparation Parameters On Mixed Amine Functionalized Silica Sorbents for CO2 Capture	486
<i>Adefemi Egbegi, Sonia Hammache, McMahan L. Gray</i>	
CO2 Reduction Efforts for Canadian Oil Sands Industry	487
<i>Oscar Aguilar, Ravishankara Subraya</i>	
Modeling Dataset Selection in Multivariate Statistical Process Control	488
<i>Zheng Li, M. Nazmul Karim</i>	
Continuous Data Mining to Sustain Advanced Process Control and Process Capability	489
<i>John Antanies</i>	
An Advanced Control Platform for Smaller Plants	490
<i>John Keenan</i>	
A Case Study of the Use of Integrators in Model Predictive Control	491
<i>Chad Segura</i>	
Non-Invasive Closed Loop Step Testing Technology for MPC Applications	492
<i>Quinn Zheng, Michael Harmse, Hong Zhao, John Campbell</i>	
An Affordable Non-Linear APC Technology for Distillation Columns Using First Principle Models	493
<i>Bert Pluymers, Edwin M. C. J. Weetink</i>	
Hydrocracking of Aromatics and Naphtheno-Aromatics	504
<i>Pedro Rojas, Gilbert F. Froment</i>	
Modeling and Simulation of Cyclic Operations Applied to Trickle Bed Hydrotreaters	505
<i>Jinwen Chen, Mohsen Hamidipour, Faical Larachi</i>	

VOLUME 2

Activation of Hydroprocessing Catalysts: an In-Depth Understanding of Dimethyldisulfide (DMDS) Decomposition Chemistry on Hdp Catalysts During Their Activation via Sulfiding	506
<i>Francis Humblot, Vijay Srinivas</i>	
Hydrotreating Reaction Optimisation Using Carbon Nanotubes Supported NiMo and Mo Based Catalysts in Refining Crude Oil	520
<i>Aman Dhanani</i>	
Overview of PE Licensing Process in United States	531
<i>William R. Parrish, Cory D. Jensen</i>	
Licensure--An Academic Perspective	534
<i>S. Ranil Wickramasinghe</i>	
Testing for Competency - the Professional Engineering Examination	535
<i>Anne Bertelsmann, Denise Chastain-Knight</i>	
The Current Hot Button Issues in Domestic Professional Licensing	550
<i>Amos Holt</i>	

The California Divide – And Why You Need To Engage Your Legislators	551
<i>Diane Spencer, Emmett Miller</i>	
Utilization of Low-Grade Heat and Process Integration in Oxy-Combustion Coal Based Power Plants	559
<i>R. Soundararajan, Truls Gundersen</i>	
Heat Exchanger Network (HEN) Retrofit for Energy Efficiency Optimization in Crude Oil Refining	561
<i>Abdulaziz Al-Najjar, Mahmoud Bahy Noureldin, Zeeshan Farooq</i>	
Adiabatic Compression As an Open Heat Pump for Process Integration within Oxy-Combustion Coal-Based Power Plants	573
<i>Chao Fu, Truls Gundersen</i>	
Identifying Heat Recovery Paths to Be Used in Improving the Energy Efficiency of Pre-Heat Trains	575
<i>G. T. Polley, Elvis K. Tamakloe</i>	
Energy and Capital Savings in DME Process Design and Integration	593
<i>Mansour Entir, Elmahboub Edreder</i>	
Development of Heat Exchangers for Use As Replacement Plates In Distillation Columns: Proof of Concept and Collection of Design Information	594
<i>G. T. Polley, Enrique Vasquez Ramirez, Antonio Alberto Aguilar Moreno, Jose Manuel Riesco Avila, Carlos Omar Rios Orozco</i>	
Simulation and Optimization of Tubular Fixed-Bed Fischer-Tropsch Synthesis Reactor with Recycle	616
<i>Bo Liao Sr., Luhaibo Zhao, Xiaoquan Wang, Xiaohao Liu, Yuhan Sun</i>	
Fischer-Tropsch Cobalt Catalyst Improvements with the Presence of	617
<i>Jennifer L. Klettlinger</i>	
Enhanced Fischer-Tropsch Catalysts for Conversion of Biomass and Coal to Transportation Fuels	618
<i>Gokhan Alptekin, Ambalavanan Jayaraman, Douwe Bruinsma, Ewa Muteba, Alex Wickham</i>	
Aqueous-Phase Fischer-Tropsch Synthesis by Using Ruthenium Nanoparticle Catalyst	619
<i>Venkat Ramana Rao Pendyala, Wilson D. Shafer, Burtron H. Davis</i>	
Explosion and Fire At Caribbean Petroleum Tank Terminal in Bayamòn, Puerto Rico	620
<i>Vidisha Parasram, Maria Mazzocchi</i>	
Use Dynamic Simulation to Reduce Startup Flare Emissions for Ethylene Plants	621
<i>Jian Zhang, Meiqian Wang, Jie Fu, Chuanyu Zhao, Ha Dinh, Shujing Zhang, Qiang Xu, Kuyen Li</i>	
Development of Novel Reducing Agents for NOx Reduction by SnCR Method	622
<i>Maoqi Feng, Reggie Zhan</i>	
Rotating Zigzag Bed Industrial Application Research On Ammonia Stripping	623
<i>Zhi-Chao Xu, Xiao-Hua Li, Guang-Quan Wang, Jian-Bing Ji</i>	
World Scale Boil-off Gas Reliquefaction	627
<i>Heinz C. Bauer, Hans Mattsson, Sven-Erik Brink</i>	
Tuning and Optimization of Compressor Controls Using Dynamic Simulation	634
<i>Sanjay Ganjam, Mohit Thakur</i>	
Considerations in Designing a Closed Loop Heating Medium System	635
<i>Benjamin Gross, Debby Sielegar</i>	
How Glycols Affect the Acid Gas Removal Process	645
<i>Georg Sieder, Torsten Katz, Justin Hearn, Jay Habayeb</i>	
Condensate Stabilization: How to Get the Most for Your Money	646
<i>Mahdi Nouri, John Rizopoulos</i>	
Simulation and Optimization of Internal-Loop Airlift Slurry Reactor Design Using Computational Fluid Dynamics	660
<i>Luhaibo Zhao, Bo Liao Sr.</i>	
Tunable Polyimide and Resulting Carbon Molecular Sieve Membranes for Gas Separation	661
<i>Wulin Qiu, William J. Koros</i>	
Post-Spinning Infusion of Poly(ethyleneimine) Into Polymer/Silica Hollow Fiber Sorbents for CO₂/N₂ Gas Separation	662
<i>Ying Labreche, Ryan P. Lively, Fateme Rezaei, Grace Chen, David S. Sholl, Christopher W. Jones, William Koros</i>	
Strategies for Acid Gas Enrichment and Tail Gas Treatment:	663
<i>Tofik K. Khanmamedov</i>	
Synthesis of Ion-Exchanged SAPO-34 Zeolite Membrane for CO₂/CH₄ Separation	664
<i>Yanfeng Zhang, Meng Li, Yuhan Sun</i>	
An Experimental Study of Effect of Cyclone Separator On Transmission of Pressure Fluctuation in a CFB	667
<i>Chen Yong, Zhang Qiong, Yan Chaoyu, Wei Yaodong</i>	
Dynamic Real-Time Optimization of an Alkylation Unit	668
<i>James Jones</i>	
Nonlinear APC Solution for Polypropylene Plants	669
<i>Brian Lines, Hanif Poorkar, Mohammad Ali Al-Zahrani, Kambiz Sefidrou</i>	

Two-Level Algorithm for Gasoline Blend Planning Using Inventory Pinch Points to Reduce Number of Blend Recipes	679
<i>Pedro Castillo Castillo, Vladimir Mahalec</i>	
Hydrotreater Optimization by Direct Online Control of the Accumulated Product Tank Sulphur	681
<i>Bhaskar V Iyer, John Macgowan, Huang Shu, Vimal Doraj, Pradeep Appasani</i>	
Real-Time Monitoring of Trace Gas Concentrations in Syngas	682
<i>Gerald Sprachmann, Rene Gutmann, Jens Herbig, Klaus Winkler, Armin Hansel</i>	
Real-Time Optimization of a Gasoline Run-Down Header Blending Operation	683
<i>Shashi Mistry, Craig Mangan, Jim Eshpeter, Sanjay Sharma</i>	
Challenges and Opportunities in Oil Fields Produced Water Treatment	701
<i>Rafique Janjua</i>	
Sustainability in Industrial Water Treatment System	702
<i>Vina Arjomandnia</i>	
Overview of Boiler Water Treatment and Associated Wastes	703
<i>William Moore</i>	
Genetic Algorithm Approach for Optimal Control of Air Emissions from an Oil Refinery	704
<i>Mohammad S. Ba-Shammakh</i>	
Pretreatment Study On High Concentration Caustic Sludge Wastewater from Catalytic Gasoline Process Unit in Refiner	712
<i>Qiu Li-Ping</i>	
Hydrocracker Reactor Temperature Controls for Greater Safety, Reliability and Profitability	721
<i>Allan G. Kern</i>	
Hydrogen Generation From Residuum	729
<i>Girish Srinivas, Steven Gebhard, Robert Copeland, Jeff Martin</i>	
Heavy Oil Upgrading Via Slurry Hydrocracking	737
<i>Andy Towarnicky</i>	
Tools to Maximize Residuum Conversion	738
<i>Stephen Warnock, Eloy Flores III, Hsiang Yee Lai</i>	
Optimizing Catalyst Performance of Continuous Catalyst Regeneration in Reforming Process	739
<i>Ka Lok, Mary J. Wier</i>	
A General Model for Estimating Air Emissions in Petroleum Refineries Using Emission Factors Technique	740
<i>Mohammad S. Ba-Shammakh</i>	
Benefits From Educated Selection of Advanced Materials for Radiant Coils	741
<i>Dietlinde Jakobi, Jorg Weigandt</i>	
Effect of Supercritical Hexanes Reaction Medium and H₂/CO Molar Ratio On the Synthesis of Higher Alcohols From Syngas Over a K-Promoted Cu-Co-Zn Catalyst	742
<i>Charlotte Stewart, Rui Xu, Sihe Zhang, David Roe, Christopher B. Roberts</i>	
Small and Mid-Scale LNG Pumps for an Evolving Market	743
<i>Steve Rush</i>	
Relative Benefits Between Various Drivers for the Main Refrigeration Compressors for LNG Application	748
<i>Patrice Bardon</i>	
Boil-off-Free LNG Transfer Between Floating and On-Shore LNG Storage Tanks	749
<i>Hans E. Kimmel</i>	
LNG Technology Development at Air Products	750
<i>Yu-Nan Liu</i>	
Production of Middle Distillate Range Liquid Fuels From Syngas Using Fischer-Tropsch Synthesis and Associated Upgrading Technology Under Supercritical Phase Conditions and Multiple Reactor Configurations	751
<i>David Roe, Sihe Zhang, Rui Xu, Charlotte Stewart, Christopher B. Roberts</i>	
Quench Oil Viscosity Monitoring by Virtual Analyzer. Is It Possible and Useful?	752
<i>Emerentino B. Quadro</i>	
A Novel Biosorption Resin for the Removal of Radioactive Cesium From Waste Water	753
<i>E. B Naidoo</i>	
Vapor-Liquid Equilibrium of Trioxane-Formaldehyde-Water Mixtures—New Division of Components in Unifac Groups	754
<i>Guizhen Li, Chunfeng Shi, Yufeng Hu, Yansheng Liu</i>	
FCC Riser Hydrodynamics Improvement Using Simulation Tools	762
<i>Lev Davydov, Reza Mostofi</i>	

Molecular Based Assays for the Practical Correlation and Prediction of Crude Oil and Petroleum Fraction Properties	764
<i>Chau-Chyun Chen, Stephen Dziuk</i>	
Petrobras in-House Process Simulator As a Strategic Advantage	766
<i>Renato A. Barbosa, Jacques Niederberger, Letícia C. Santos, Carlos A. D. Moura, Joyce S. S. Aires, Lara S. S. Teixeira, Victor R. R. Ahon, Vinicius M. Silva, Carmen E. Vargas, José A. Silva, Anna E. B. Zobolli, Cláudio A. S. Aquino, Ellen P. Silva</i>	
Reliability & Availability Modeling As a Design Tool	768
<i>Peter Nick</i>	
Effect of Process Conditions On Film Temperature in Fired Heaters	810
<i>Arturo Morales-Fuentes, Martín Picón-Núñez, C. E. Gallegos-Buendia, S. Mendez-Diaz, F. Sanchez-Cruz</i>	
Trouble-Shooting and Optimizing Ethylene Plant Cooling Water Networks by Using Advanced Process Simulation	818
<i>Swapnil Pathak, James Brigman</i>	
Proesa® Technology: The Platform to Enable Biomass Based Industry	831
<i>Dario Giordano, Delane Richardson</i>	
Composite Fuels Production for Combustion	832
<i>Harold N. Knickle, Adam Duszkievicz</i>	
Alcohol to Jet Fuel	840
<i>Geoffrey Fichtl</i>	
Transportation Fuels From the Catalytic Hydrodeoxygenation of Biomass Pyrolysis Oil	841
<i>Lance Baird, Tim Brandvold, Steve Lupton, Tom N. Kalnes, Stanley Frey</i>	
Detailed Hydrocarbon Characterization of Diesel Fractions From Co-Hydroprocessing Canola Oil and HVG0 Blends	842
<i>Jinwen Chen, Rafal Gieleciak, Hena Farooqi</i>	
Key Findings of Experimental and Theoretical Studies On Forced Mitigation System for an LNG Spill Emergency	853
<i>Byung Kyu Kim, Ray A. Mentzer, M. Sam Mannan</i>	
A View of the Evolving LNG Regulations and Associated Exclusion Zones from an Industry Perspective	861
<i>Alfonso F. Ibarreta, Ryan J. Hart, Delmar "trey" Morrison, Harri K. Kytomaa</i>	
From LNG Imports to LNG Exports: Process Safety and Regulatory Challenges	872
<i>Jack Chosnek, Victor H. Edwards</i>	
The Mitigation Conundrum: When Reducing One Hazard May Increase Another	886
<i>Filippo Gavelli, Scott G. Davis</i>	
Operational Excellence-Essential for Success in the 21st Century	895
<i>John Mitchell</i>	
APM/Asset Performance Management: More Than the Sum of Its Parts	935
<i>Paula Hollywood</i>	
Going Beyond Asset Monitoring for Improved Reliability: Remote Asset Monitoring and Alerts	936
<i>Aaron Crews, Nikki Bishop</i>	
Effective and Optimized Asset Strategies Through Combining Condition Data and Diagnostics	942
<i>John Renick</i>	
Reliability Monitoring for Advanced Process Control Implementations	943
<i>J. Ben Rodin</i>	
Remaining Life Assessments of Refinery Cokgr Furnace Tubes Using Omega Simulations	951
<i>Gerald Wilks</i>	
Catalytic Conversion Wood Syngas to 'Wide Cut' Diesel Over A Multifunctional Catalyst	967
<i>Qiangyu Yan, Fei Yu</i>	
Mathematical Model for Measurement of Carbon Permittivity	968
<i>Manuel Guillermo Peña Benavides, Dairo Andrés Vidal Teherán</i>	
Novel Warm Gas Multi-Contaminant Removal System	977
<i>Gokhan Alptekin, Ambalavanan Jayaraman, Margarita Dubovik, Mike Cesario</i>	
"Clean" and "Dirty" Tar Reforming of Biomass Gasification Gas	978
<i>Klas J. Andersson, Poul Erik Højlund Nielsen</i>	
CFD-Based Probabilistic Explosion Hazard Analysis As an Early Tool to Improve FLNG Design	979
<i>Scott G. Davis, Remi Martini, Filippo Gavelli</i>	
Forced Dispersion Analysis of LNG Vapor Mitigation Using Fire Dynamic Simulator	986
<i>Wilson Y. Molina-Torres, Byung Kyu Kim, Ray A. Mentzer, M. Sam Mannan</i>	
HSE Evolution in Conversion of LNG Import Terminals to Export	994
<i>Jack Chosnek, Filippo Gavelli, Victor H. Edwards</i>	

Guidelines for Relative Hazard Ranking of Refrigerants and Siting Considerations for LNG	
Liquefaction Units	1005
<i>Ryan J. Hart, Delmar R. Morrison, Alfonso F. Ibarreta, Harri K. Kytömaa</i>	
Author Index	