FOCAPO / CPC 2017

Bringing Research to Practice and Practice to Research

January 8 – January 12, 2017

Loews Ventana Canyon Hotel and Resort ◆ Tucson, Arizona

FINAL PROGRAM

FOCAPO Sessions are located in Kiva Ballroom A
CPC Sessions are located in Kiva Ballroom B
Joint Sessions are located in Kiva Ballroom B

Sunday, January 8

11:00 a.m. to 5:30 p.m.	**Conference & Workshop Registration** *(Outside Catalina Ballroom)* ***Pre-registration and payment is required for Workshops***
12:30 p.m. to 3:30 p.m.	**FOCAPO Workshop** *(Catalina Ballroom, Salon J)* Introduction to Chemical Process Operations and Optimization *Ignacio Grossmann (Carnegie Mellon University)* *Christos Maravelias (University of Wisconsin – Madison)*
12:30 p.m. to 3:30 p.m.	**CPC Workshop** *(Catalina Ballroom, Salon KL)* Introduction to Theory and Practice of MPC *Jay Lee (KAIST)* *Erik Ydstie (Carnegie Mellon University)* *Joseph Lu (Honeywell Process Solutions)*
3:30 p.m. to 4:00 p.m.	**Refreshment Break**
4:00 p.m. to 6:00 p.m.	**Joint Workshop** *(Catalina Ballroom, Salon JKL)* Introduction to Machine Learning *Lyle Ungar (University of Pennsylvania)*
6:00 p.m. to 8:30 p.m.	**Conference Registration** *(Outside Kiva Ballroom A)*
6:00 p.m. to 7:00 p.m.	**Dinner on Own**
7:00 p.m. to 8:30 p.m.	**OPENING SESSION** *(Kiva Ballroom B)*
7:00 p.m. to 7:30 p.m.	Opening Remarks *B. Wayne Bequette (Rensselaer Polytechnic Institute)* *Christos Maravelias (University of Wisconsin – Madison)* *Erik Ydstie (Carnegie Mellon University)*
7:30 p.m. to 8:30 p.m.	Keynote Address Community and Cloud Computing *J. Patrick Kennedy (OSIsoft)*
8:30 p.m. to 10:00 p.m.	**Welcome Reception** *(Kiva B)*

Monday, January 9 – FOCAPO *(Kiva A)*

6:30 a.m. to 5:00 p.m.	**Conference Registration** *(Outside Kiva Ballroom A)*
7:00 a.m. to 8:15 a.m.	**Continental Breakfast (Flying V Restaurant)**
8:15 a.m. to 8:30 a.m.	**Welcome & FOCAPO Overview** *Christos Maravelias (University of Wisconsin – Madison)* *John Wassick (The Dow Chemical Company)*
8:30 a.m. to 10:00 a.m.	**ENABLING TECHNOLOGIES I** *Chair: Ruth Misener (Imperial College London)* *Chair: John Siirola (Sandia National Laboratories)*
8:30 a.m. to 9:15 a.m.	First-principles Modeling for Optimization of Process Operations *Costas Pantelides (Process Systems Enterprise)*
9:15 a.m. to 10:00 a.m.	Machine Learning, ALAMO and Constrained Regression *Nick Sahinidis (Carnegie Mellon University)*
10:00 a.m. to 10:30 a.m.	**Refreshment Break**
10:30 a.m. to 12:00 p.m.	**ENABLING TECHNOLOGIES II** *Chair: Ruth Misener (Imperial College London)* *Chair: John Siirola (Sandia National Laboratories)*
10:30 a.m. to 11:15 a.m.	The Value of Discrete-Event Simulation in the Computer-Aided Process Operations *Ricki Ingalls (Texas State University) and Ron Morgan (Halliburton)*
11:15 a.m. to 12:00 p.m.	Optimization of Processes and Products from Historical (Un-designed) Data *John MacGregor and Mark John Bruwer (ProSensus, Inc.)*
12:00 p.m. to 1:15 p.m.	**Lunch** *(Flying V Restaurant)*
1:15 p.m. to 3:30 p.m.	**ENABLING TECHNOLOGIES III** *Chair: Karl Schnelle (DowAgro Sciences)* *Chair: Joseph Scott (Clemson University)*
1:15 p.m. to 2:00 p.m.	Overview of Mixed-integer Programming: Recent Advances, and Future Research Directions *Jeff Linderoth (University of Wisconsin – Madison)*
2:00 p.m. to 2:45 p.m.	Nonsmooth Differential-Algebraic Equations *Paul Barton and Peter Stechlinski (MIT)*
2:45 p.m. to 3:30 p.m.	Scenario Decomposition of Stochastic 0-1 Programs *Shabbir Ahmed (Georgia Institute of Technology)*
3:30 p.m. to 4:00 p.m.	**Refreshment Break**

Monday, January 9 – CPC *(Kiva B)*

6:30 a.m. to 5:00 p.m.	**Conference Registration** *(Outside Kiva Ballroom A)*
7:00 a.m. to 8:15 a.m.	**Continental Breakfast (Flying V Restaurant)**

8:15 a.m. to 8:30 a.m.	**Welcome & CPC Overview**
	  Erik Ydstie (Carnegie Mellon University)
	  Larry Megan (Praxair)

8:30 a.m. to 10:00 a.m.	**PERSPECTIVES ON PROCESS CONTROL**
	  Chair: Fernando Lima (West Virginia University)
	  Chair: John Hedengren (Brigham Young University)

8:30 a.m. to 9:15 a.m.	Plant-wide Dynamic Economic Optimization: Key Challenges & New Opportunities *Apostolos T. Georgiou and Kiran R. Sheth (ExxonMobil)*
9:15 a.m. to 10:00 a.m.	Perspectives on Feedback Control *Manfred Morari (University of Pennsylvania)*
10:00 a.m. to 10:30 a.m.	**Refreshment Break**

10:30 a.m. to 12:00 p.m.	**GRAND CHALLENGE-ENERGY AND SUSTAINABILITY**
	  Chair: Tom Badgwell (ExxonMobil)
	  Chair: Sigurd Skogestad (NTNU)

10:30 a.m. to 11:15 a.m.	Reaction Path Analysis for Thin-Film Deposition Processes *Ray Adomaitis (University of Maryland)*
11:15 a.m. to 12:00 p.m.	Sustainable Engineering – Challenges and Opportunities for Process Operation and Control *Bhavik Bakshi (Ohio State University)*
12:00 p.m. to 1:15 p.m.	**Lunch** *(Flying V Restaurant)*

1:15 p.m. to 3:30 p.m.	**DISTRIBUTED CONTROL AND MANUFACTURING & RISK MANAGEMENT**
	  Chair: Christopher Webb (Honeywell)
	  Chair: Jeff Kantor (University of Notre Dame)

1:15 p.m. to 2:00 p.m.	The Impact of Digitalization on the Future of Control and Operations *Alf Isaksson, Iiro Harjunkoski (ABB Corporate Research), and Guido Sand (Pforzheim University)*
2:00 p.m. to 2:45 p.m.	Process Integration, Automation and Discrete Decisions *Sebastian Engell (TU Dortmund)*
2:45 p.m. to 3:30 p.m.	Managing Risk in Complex Socio-Technical Systems: Modeling Challenges and Opportunities *Venkat Venkatasubramanian (Columbia University)*
3:30 p.m. to 4:00 p.m.	**Refreshment Break**

Monday, January 9 – Joint *(Kiva B)*

4:00 p.m. to 6:15 p.m.   **SMART MANUFACTURING AND ENERGY SYSTEMS**
Chair: Stephen Miller (Eastman Chemical Company)
Chair: Danielle Zyngier (Hatch)

4:00 p.m. to 4:45 p.m.   Smart Manufacturing – DOE Vision
Mark Johnson (Department of Energy)

4:45 p.m. to 5:30 p.m.   Smart Manufacturing and Energy Systems
Tom Edgar (University of Texas at Austin)
Efstratios Pistikopoulos (Texas A&M University)

5:30 p.m. to 6:15 p.m.   Smart Manufacturing in Energy Intensive Industries
Haresh Malkani (Arconic), Jose Pinto and Jesus Flores (Praxair)

6:15 p.m. to 6:30 p.m.   **Tribute in Memory of Christodoulos A. Floudas**

6:30 p.m. to 8:00 p.m.   **Dinner on own**

8:00 p.m. to 11:00 p.m.   **Poster Session A (Contributed Papers)** *(Kiva A)*

Tuesday, January 10 – FOCAPO *(Kiva A)*

6:30 a.m. to 5:00 p.m.	**Conference Registration** *(Outside Kiva Ballroom A)*
7:00 a.m. to 8:30 a.m.	**Continental Breakfast (Flying V Restaurant)**
8:30 a.m. to 10:00 a.m.	**PLANNING AND SCHEDULING** *Chair: Ana Barbosa-Póvoa (CEG-IST, University of Lisbon)* *Chair: Ben Weinstein (Procter and Gamble)*
8:30 a.m. to 9:15 a.m.	Expanding Scope and Computational Challenges in Process Scheduling *Ignacio Grossmann (Carnegie Mellon University), Pedro Castro (University of Lisbon) and Qi Zhang (BASF)*
9:15 a.m. to 10:00 a.m.	Strategies for the Unification of Refinery Planning and Scheduling – Challenges and Opportunities *Dimitrios Varvarezos (AspenTech)*
10:00 a.m. to 10:30 a.m.	**Refreshment Break**
10:30 a.m. to 12:00 p.m.	**SUPPLY CHAIN MANAGEMENT: ALTERNATIVE APPROACHES** *Chair: Ana Barbosa-Póvoa (CEG-IST, University of Lisbon)* *Chair: Ben Weinstein (Procter and Gamble)*
10:30 a.m. to 11:15 a.m.	Realistic Rescheduling: Is It Achievable? *Gabriela Henning (INTEC, Argentina)*
11:15 a.m. to 12:00 p.m.	Knowledge Discovery Through Multi-Objective Machine Learning Approaches for Process Design and Operations *Kalyanmoy Deb (Michigan State University)*
12:00 p.m. to 1:15 p.m.	**Lunch** *(Flying V Restaurant)*
1:15 p.m. to 3:30 p.m.	**SUPPLY CHAIN MANAGEMENT: INDUSTRIAL PRESPECTIVES** *Chair: Selen Cremaschi (Auburn University)* *Chair: Fengqi You (Cornell University)*
1:15 p.m. to 2:00 p.m.	Optimizing the Design of New and Existing Supply Chains *Matt Bassett (Dow AgroSciences)*
2:00 p.m. to 2:45 p.m.	Supply Chain Optimization and Logistics *Dimitri Papageorgiou (ExxonMobil)*
2:45 p.m. to 3:30 p.m.	Operations and Supply Chain Challenges Create Research Opportunities at Amazon *Russell Allgor (Amazon.com)*
3:30 p.m. to 4:00 p.m.	**Refreshment Break**

Tuesday, January 10 – CPC *(Kiva B)*

6:30 a.m. to 5:00 p.m.	**Conference Registration** *(Outside Kiva Ballroom A)*
7:00 a.m. to 8:30 a.m.	**Continental Breakfast (Flying V Restaurant)**

8:30 a.m. to 10:00 a.m. — **EMERGING TECHNOLOGIES**
    Chair: Brett Stewart (ExxonMobil)
    Chair: Victor Zavala (University of Wisconsin – Madison)

8:30 a.m. to 9:15 a.m. — Machine Learning: Overview of Recent Developments and Assessment of Its Potential for PSE
    Jay Lee and Joohyun Shin (KAIST) & Matthew Realff (Georgia Institute of Technology)

9:15 a.m. to 10:00 a.m. — Data Distillation, Analytics, and Machine Learning
    S. Joe Qin and Yining Dong (University of Southern California)

10:00 a.m. to 10:30 a.m. — **Refreshment Break**

10:30 a.m. to 12:00 p.m. — **EMERGING TECHNOLOGIES IN CONTROL**
    Chair: Jesus Flores (Praxair)
    Chair: Tom Edgar (University of Texas at Austin)

10:30 a.m. to 11:15 a.m. — Controlling Complex Plants: Perspectives from Network Theory
    Prodromos Daoutidis, Wentag Tang and Sujit Jogwar (University of Minnesota)

11:15 a.m. to 12:00 p.m. — Advanced Optimization Strategies for Integrated Dynamic Process Operations
    Larry Biegler (Carnegie Mellon University)

12:00 p.m. to 1:15 p.m. — **Lunch** *(Flying V Restaurant)*

1:15 p.m. to 3:30 p.m. — **NEXT GENERATION MPC**
    Chair: Bjarne Foss (NTNU)
    Chair: Don Chmielewski (Illinois Institute of Technology)

1:15 p.m. to 2:00 p.m. — Where is Technology Headed?
    Alex Kalafatis (AspenTech)

2:00 p.m. to 2:45 p.m. — Economic MPC and Real-time Decision Making
    Jim Rawlings (University of Wisconsin – Madison)

2:45 p.m. to 3:30 p.m. — Identification in Dynamic Networks
    Paul van Den Hof, Harm Weerts (TU Eindhoven) and Arne Dankers (University of Calgary)

3:30 p.m. to 4:00 p.m. — **Refreshment Break**

Tuesday, January 10 – Joint *(Kiva B)*

4:00 p.m. to 6:15 p.m.	**INTEGRATION OF SCHEDULING AND CONTROL** *Chair: Christos Georgakis (Tufts University)* *Chair: John Wassick (The Dow Chemical Company)*
4:00 p.m. to 4:45 p.m.	Vertical Integration of Production Scheduling and Process Control: Progress, Opportunities and Challenges *Marianthi Ierapetritou and Lisia Dias (Rutgers University) & Michael Baldea and Richard Pattison (University of Texas at Austin)*
4:45 p.m. to 5:30 p.m.	Online Scheduling and Model-based Optimization: A Candid Practitioner View *Philippe Hayot (The Dow Chemical Company)*
5:30 p.m. to 6:15 p.m.	Panel Discussion
6:15 p.m. to 8:00 p.m.	**Dinner on own**
8:00 p.m. to 11:00 p.m.	**Poster Session B (Contributed Papers)** *(Kiva A)*

Wednesday, January 11 – FOCAPO *(Kiva A)*

6:30 a.m. to 5:00 p.m.	**Conference Registration** *(Outside Kiva Ballroom A)*
7:00 a.m. to 8:30 a.m.	**Continental Breakfast (Flying V Restaurant)**

8:30 a.m. to 10:00 a.m. **EMERGING APPLICATIONS**
    Chair: Ajit Gopalakrishnan (Air Liquide)
    Chair: Matt Realff (Georgia Institute of Technology)

8:30 a.m. to 9:15 a.m. Process Systems Engineering in Pharmaceutical Operations
    Gintaras Reklaitis (Purdue University) and Salvador Garcia-Muniz (Eli Lilly)

9:15 a.m. to 10:00 a.m. On Applications of Stochastic Programming in Energy Systems
    Dave Morton (Northwestern University)

10:00 a.m. to 10:30 a.m. **Refreshment Break**

10:30 a.m. to 12:00 p.m. **YOUNG INVESTIGATORS**
    Chair: Ajit Gopalakrishnan (Air Liquide)
    Chair: Matt Realff (Georgia Institute of Technology)

10:30 a.m. to 11:00 a.m. Redesigning Decision-Making Architectures to Exploit Multi-Scale Electricity Markets
    Victor Zavala and Alexander Dowling (University of Wisconsin – Madison)

11:00 a.m. to 11:30 a.m. Advances in Robust Optimization and Opportunities for Process Operations
    Chrysanthos Gounaris (Carnegie Mellon University)

11:30 a.m. to 12:00 p.m. Integrating Mixed-Integer Optimisation and Satisfiability Modulo Theories: Application to Scheduling
    Ruth Misener and M. Mistry (Imperial College London)

12:00 p.m. to 1:15 p.m. **Lunch** *(Flying V Restaurant)*

1:15 p.m. to 3:15 p.m. **SELECTED CONTRIBUTED PAPERS**
    Chair: Matt Bassett (Dow AgroSciences)
    Chair: Carl Laird (Sandia National Laboratories)

1:15 p.m. to 1:45 p.m. A Framework for Modeling and Optimizing Dynamic Systems Under Uncertainty
    Bethany Nicholson and John Siirola (Sandia National Laboratories)

1:45 p.m. to 2:15 p.m. Advances in Global Optimization of Grey-Box Computational Systems and Applications to Highly Constrained Oil-Field Operations
    Fani Boukouvala (Georgia Institute of Technology) & Christodoulos Floudas, Burcu Beykal, Nadav Sorek, Hardikkumar Zalavadia and Eduardo Gildin (Texas A&M University)

2:15 p.m. to 2:45 p.m. Supply Risk Limits for the Integration of Production Scheduling and Real-Time Optimization at Air Separation Units
    Irene Lotero, Thierry Roba and Ajit Gopalakrishnan (Air Liquide)

2:45 p.m. to 3:15 p.m. Leveraging the Power of Big Data for Robust Process Operation Under Uncertainty
    Fengqi You and Chao Ning (Cornell University)

3:15 p.m. to 3:45 p.m. **Refreshment Break**

Wednesday, January 11 – CPC *(Kiva B)*

6:30 a.m. to 5:00 p.m. **Conference Registration** *(Outside Kiva Ballroom A)*

7:00 a.m. to 8:30 a.m. **Continental Breakfast (Flying V Restaurant)**

8:30 a.m. to 10:00 a.m. **GRAND CHALLENGE: BIO AND PHARMA**
Chair: Paul Maurath (Procter & Gamble)
Chair: Masoud Soroush (Drexel University)

8:30 a.m. to 9:15 a.m. Convergence and the Implications for Systems Engineering Research in the Life Sciences
Frank Doyle (Harvard University)

9:15 a.m. to 10:00 a.m. Challenges and Opportunities in Biopharmaceutical Manufacturing Control
Richard Braatz, Moo Sun Hong, Kristen Severson, Mo Jiang, Amos Lu and Christopher Love (MIT)

10:00 a.m. to 10:30 a.m. **Refreshment Break**

10:30 a.m. to 12:00 p.m. **YOUNG INVESTIGATORS**
Chair: Robert Parker (University of Pittsburgh)
Chair: Duncan Coffey (E. I. du Pont de Nemours and Company)

10:30 a.m. to 11:00 a.m. Optimization of a Hydraulic Fracturing Process to Enhance the Productivity of a Fractured Well in Ultra-Low Permeability Environment
Joseph Kwon, Prashanth Siddhamshetty (Texas A&M University) & Seeyub Yang (Seoul National University)

11:00 a.m. to 11:30 a.m. Perspectives on Stochastic Predictive Control with Autonomous Model Adaptation for Model Structure Uncertainty
Ali Mesbah and Tor Aksel Heirung (University of California – Berkeley)

11:30 a.m. to 12:00 p.m. Advances and Opportunities in Optimization of Electrical Grid Operations
Carl Laird (Sandia National Laboratories)

12:00 p.m. to 1:15 p.m. **Lunch** *(Flying V Restaurant)*

1:15 p.m. to 3:15 p.m. **SELECTED CONTRIBUTED PAPERS**
Chair: Jim Downs (Eastman)
Chair: Erik Ydstie (Carnegie Mellon University)

1:15 p.m. to 1:45 p.m. Framework for a Smart Process Data Analytics Platform
Sirish Shah, Wenkai Hu and Tongwen Chen (University of Alberta)

1:45 p.m. to 2:15 p.m. Scheduling, Optimization and Control of Power for Industrial Cogeneration Plants
Rahul Bindlish (The Dow Chemical Company)

2:15 p.m. to 2:45 p.m. Petroleum Production Optimization – A Static or Dynamic Problem?
Bjarne Foss, Brage Knudsen and Bjarne Grimstad (NTNU)

2:45 p.m. to 3:15 p.m. Concept and Applications of Extents in Chemical Reaction Systems
Dominique Bonvin, Sriniketh Srinivasan, Diogo Rodrigues, Julien Billeter and Michael Amrhein (EPFL)

3:15 p.m. to 3:45 p.m. **Refreshment Break**

Wednesday, January 11 – Joint *(Kiva B)*

3:45 p.m. to 6:15 p.m.	**ENABLING THE TRANSITION FROM RESEARCH TO PRACTICE** *Chair: Larry Megan (Praxair)*
3:45 p.m. to 4:15 p.m.	Dow's Strategic Partnerships: Building a Better Future Together *Shawn Feist (The Dow Chemical Company)*

4:15 p.m. to 4:35 p.m.	Leading Faculty Perspectives
	  Frank Doyle (Harvard University), Tom Edgar (University of Texas at Austin), Ignacio Grossmann (Carnegie Mellon University), Thomas Adams, (McMaster University)
	  Summarized by Larry Megan (Praxair)

4:35 p.m. to 5:00 p.m.	Global Developments in Doctoral Education *David Bogle (University College London)*
5:00 p.m. to 6:15 p.m.	Panel Discussion and Audience Q&A Capturing the Perspectives of Academia, Industry and Recent Graduates *David Bogle (University College London), Frank Doyle (Harvard University), Yu Jiao (Vitro Flat Glass), Bo Lu (The Dow Chemical Company), Costas Pantelides (PSE), Brett Stewart (ExxonMobil), Chris Swartz (McMaster University)*
6:15 p.m. to 7:00 p.m.	**Free Time** ☺
7:00 p.m. to 10:00 p.m.	**Conference Reception and Banquet**
7:00 p.m. to 7:45 p.m.	Reception *(Kiva Patio)*
7:45 p.m. to 10:00 p.m.	Dinner and Program *(Kiva A & B)*
	Master of Evening Ceremonies *B. Wayne Bequette (Rensselaer Polytechnic Institute)*

Thursday, January 12 – Joint *(Kiva B)*

7:00 a.m. to 8:30 a.m. **Continental Breakfast (Flying V Restaurant)**

8:30 a.m. to 12:00 p.m. **CHALLENGES AND FUTURE RESEARCH DIRECTIONS**
    Chair: John Wassick (The Dow Chemical Company)
    Chair: John Spero (Praxair)

8:30 a.m. to 9:00 a.m. Emerging Research Opportunities in Process Systems Engineering
    Triantafillos Mountziaris (National Science Foundation)

9:00 a.m. to 9:20 a.m. Summary of Identified Challenges
    John Wassick (The Dow Chemical Company)

9:20 a.m. to 11:45 a.m. Facilitated Discussion on Future Research Directions
    All Participants

11:45 a.m. to 12:00 p.m. Closing Remarks