

# Christos T. Maravelias

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## EDUCATION

2004	<b>CARNEGIE MELLON UNIVERSITY</b> <b>PhD in Chemical Engineering</b>	<b>PITTSBURGH, PA</b>
1997	<b>LONDON SCHOOL OF ECONOMICS</b> <b>M.Sc. in Operational Research</b>	<b>LONDON, UK</b>
1996	<b>NATIONAL TECHNICAL UNIVERSITY OF ATHENS</b> <b>Diploma in Chemical Engineering</b>	<b>ATHENS, GREECE</b>

## PROFESSIONAL EXPERIENCE

08/04 – date	<b>UNIVERSITY OF WISCONSIN</b> <b>DEPARTMENT OF CHEMICAL AND BIOLOGICAL ENGINEERING</b> Paul E. Elfers Professor Executive Officer Vilas Distinguished Achievement Professor Professor Associate Professor Assistant Professor <b>GREAT LAKES BIOENERGY RESEARCH CENTER</b> Aim Lead	<b>MADISON, WI</b>           2017 – date 11/2015 – date 06/2015 – date 09/2014 – date 09/2010 – 08/2014 08/2004 – 08/2010  2017 – present
01/98 – 07/99	<b>GREEK ARMY TELECOMMUNICATIONS DEVISION</b> National defense telecommunication network supervisor	<b>ATHENS, GREECE</b>

## AWARDS & HONORS

Paul E. Elfers Professor	2017 – date
<i>Production and Operations Management Society Applied Research Challenge Award</i>	2016
2016 <i>Covestro Lecture</i> , Department of Chemical Engineering, Carnegie Mellon University	2016
2014 Best Paper Award, <i>Computes and Chemical Engineering</i>	2015
Vilas Distinguished Achievement Professor	2015
2013 Outstanding Young Researcher Award – CAST Division of AIChE	2013
2012 Best Paper Award, <i>Computes and Chemical Engineering</i>	2013
Vilas Associate, University of Wisconsin – Madison	2013-2015
2008 W. David Smith Jr. Graduate Student Paper Award – CAST Division of AIChE	2008
National Science Foundation CAREER Award	2006-2011
Inaugural Olaf A. Hougen Fellowship	2004-2007
Alexander S. Onassis Public Benefit Foundation Graduate Fellowship	1999-2001
Fulbright Graduate Fellowship (declined)	1999

## TEACHING

- Senior level *Process Design*.
- Senior level *Process Dynamics and Control*.
- Graduate: *Intermediate Problems in Chemical Engineering*.
- New graduate course on *Optimization Methods for Process Systems Engineering*.

## SELECTED PROFESSIONAL ACTIVITIES

### 1. PROFESSIONAL COMMITTEES:

- Great Lakes Bioenergy Research Center, Management Team, 2017 – date
- Great Lakes Bioenergy Research Center, Aim 1 Leader, 2017 – date
- *Computing and Systems Technology* (CAST) division of the *American Institute of Chemical Engineers* (AIChE), 2<sup>nd</sup> Vice Chair, 2017.
- CACHE Product and Process Design Task Force, Member, 2015 – date
- Optimization Theme, Wisconsin Institute for Discovery, Advisory Board Member, 2014 – date
- Computing and Systems Technology (CAST) division of American Institute of Chemical Engineers (AIChE), Director (2011 – 2014).
- Sustainable Manufacturing Advances in Research and Technology (SMART) Coordination Network, Steering Committee, Member.

### 2. JOURNAL SERVICE:

- *Computers and Chemical Engineering*, Editorial Advisory Board, 2017 – date.
- *AIChE Journal*, Consulting Editors Board, 2017 – date.
- *BioEnergy Research*, Guest Editor.
- *Energy Technology*, International Advisory Board member, 2017 – date.

### 3. CONFERENCE ORGANIZATION:

- *Foundations of Computer-aided Process Operations 2017*: Chair.
- *Pan American Advanced Studies: Process Modeling and Optimization for Energy and Sustainability*, 2011: Chair.
- *AIChE 2009 Annual Meeting*: Area 10C Program Coordinator.

### 4. PROPOSAL REVIEWER:

US National Science Foundation; American Chemical Society – Petroleum Research Fund; National Sciences and Engineering Research Council of Canada; Hellenic Ministry of Education; Dutch Technology Foundation STW; Swiss National Science Foundation; North Central Sun Grant Center; The Royal Society, UK.

### 5. MEMBERSHIPS:

American Institute of Chemical Engineers (AIChE)	2001 –
Institute for Operations Research and the Management Sciences (INFORMS)	2002 –
Texas-Wisconsin-California Control Consortium (TWCCC)	2004 –
American Chemical Society (ACS)	2006 –

## RESEARCH MENTORING

*Former PhD Students*: Charles Sung (2009), Matthew Colvin (2010), Arul Sundaramoorhty (2011), Carlos Henao (2012), Kaushik Subramanian (2012), Patricia Nason (2013), Sara Velez (2014), Murat Sen (2014), Andres Merchan (2016), Yachao Dong (2017).

*Current PhD Students*: Dhruv Gupta, Tony Wu, Michael Risbeck, Ho Jae Lee, Lingxun Kong, Xinyue Peng, Yifu Chen, Ranjeet Kumar, Venkatachalam Avadiappan, Yaqing Wu.

*Former Postdoctoral Scholars*: Pradeep Prasad (2005-06), Jiyong Kim (2009-13), Jeehoon Han (2012-14); Srinivas Rangarajan (2013-16), Jeff Herron (2013-2015), Kirti Yenkie (2015-17), Bruno Calfa (2015-17), Wangyun Won (2015-17).

*Current postdoctoral Scholars*: Rex Ng, Kefeng Huang, Gautham M. Ramapriya, Payman Fasahati.

## PUBLICATIONS

### JOURNAL PAPERS

- [1] Gupta, D.; Maravelias, C.T. A General State-Space Formulation for Online Scheduling. *Processes*, accepted.
- [2] Rangarajan, S.; Maravelias, C.T. Mavrikakis, M. Sequential Optimization-Based Framework for Robust Modeling and Design of Heterogeneous Catalytic Systems. *Journal of Physical Chemistry C*, accepted.
- [3] Rawlings, J.B.; Patel, N.R.; Risbeck, M.J.; Maravelias, C.T.; Wenzel, M.J.; Turney, R.D. Economic MPC and Real-time Decision Making with Application to Large-Scale HVAC Energy Systems. *Computers & Chemical Engineering*, accepted.
- [4] Martagan, T.; Krishnamurthy, A.; Leland, P.; Maravelias, C.T. Performance Guarantees and Optimal Purification Decisions for Engineered Proteins. *Operations Research*, accepted. (DOI: 10.1287/opre.2017.1661).
- [5] Huang, K.; Won, W.; Barnett, K.J.; Brentzel, Z.J.; Alonso, D.M.; Huber, G.W.; Dumesic, J.A.; Maravelias, C.T. Improving Economics of Lignocellulosic Biofuels: An Integrated Strategy for Coproducing 1,5-Pentanediol and Ethanol. *Applied Energy*, accepted. (DOI: 10.1016/j.apenergy.2017.11.002).
- [6] Ng, R.T.L.; Patchin, S.; Wu, W.; Sheth, N.; Maravelias, C.T. An optimization-based Web Application for Synthesis and Analysis of Biomass-to-fuels Strategies. *Biofuels, Bioproducts & Biorefining*, accepted. (DOI: 10.1002/bbb.1821).
- [7] Kong, L.; Wu, Y.; Maravelias, C.T. Simultaneous Utility and Heat Exchanger Area Targeting for Integrated Process Synthesis and Heat Integration. *Industrial & Engineering Chemistry Research*, 56, 11847-11859, **2017**.
- [8] Lee, H.-J.; Maravelias, C.T. Discrete-time Mixed-integer Programming Models for Short-term Scheduling in Multipurpose Environments. *Computers and Chemical Engineering*, 107, 171-183, **2017**.
- [9] Ng, R.T.L.; Maravelias, C.T. Economic and Energetic Analysis of Biofuel Supply Chains. *Applied Energy*, 205, 1571-1582, **2017**.
- [10] He, J.; Huang, K.; Barnett, K.J.; Krishna, S.; Martin Alonso, D.; Brentzal, Z.; Burt, S.P.; Walker, T.W.; Banholzer, W.; Maravelias, C.T.; Hermans, I.; Dumesic, J.A.; Huber, G.W. New Catalytic Strategies for alpha-omega Diol Production from Lignocellulosic Biomass. *Faraday Discussions*, 202, 247-267, **2017**.
- [11] Lee, H.-J.; Maravelias, C.T. Mixed-integer Programming Models for Simultaneous Batching and Scheduling in Multi-purpose Batch Plants. *Computers and Chemical Engineering*, 106, 621-644, **2017**.
- [12] He, J.; Liu, M.; Huang, K.; Walker, T.W.; Maravelias, C.T.; Dumesic, J.A.; Huber, G.W. Production of Levoglucosenone and 5-hydroxymethylfurfural from Cellulose in Polar Aprotic Solvent-water Mixtures. *Green Chemistry*, 19, 3642-3653, **2017**.
- [13] Won, W.; Maravelias, C.T. Thermal Fractionation and Catalytic Upgrading of Lignocellulosic Biomass to Biofuels: Process Synthesis and Analysis. *Renewable Energy*, 114, 357-366, **2017**.
- [14] Won, W.; Motagamwala, A.H.; Dumesic, J.A.; Maravelias, C.T. A co-solvent hydrolysis strategy for the production of biofuels: Process synthesis and technoeconomic analysis, *Reaction Chemistry and Engineering*, 2, 397-405, **2017**.
- [15] Huang, K.; Brentzel, Z.J.; Barnett, K.J.; Dumesic, J.A.; Huber, G.W.; Maravelias, C.T. Conversion of Furfural to 1,5-Pentanediol: Process Synthesis and Analysis. *ACS Sustainable Chemistry & Engineering*, 5, 4699-4706, **2017**.
- [16] Peng, X.; Root, T.W.; Maravelias, C.T. Storing Solar Energy with Chemistry: The Role of Thermochemical Storage in Concentrating Solar Power. *Green Chemistry*, 19, 2427-2438, **2017**.

- [17] Martin Alonso, D.; Hakim, S.; Zhou, S.; Won, W.; Hosseinaei, O.; Tao, J.; Garcia-Negron, V.; Motagamwala, A.H.; Mellmer, M.A.; Huang, K.; Houtman, C.J.; Labbé, N.; Harper, D.P.; Maravelias, C.T.; Runge, T.; Dumesic, J.A. Increasing the Revenue from Lignocellulosic Biomass: Maximizing Feedstock Utilization. *Science Advances*, 3 (5), e1603301, **2017**.
- [18] Yenkie, K.M.; Wu, W.; Maravelias, C.T. Synthesis and analysis of separation networks for the recovery of intracellular chemicals generated from microbial-based conversions. *Biotechnology for Biofuels*, 10:119, **2017**.
- [19] Risbeck, M.J.; Maravelias, C.T.; Rawlings, J.B.; Turney, R.D. A Mixed-Integer Linear Programming Model for Real-Time Cost Optimization of Building Heating, Ventilation, and Air Conditioning Equipment, *Energy and Buildings*, 142, 220-235, **2017**.
- [20] Brentzel, Z.J.; Barnett, K.J.; Huang, K.; Maravelias, C.T.; Dumesic, J.A.; Huber, G.W. Commodity Chemicals from Biomass: Combining Ring-opening Tautomerization and Hydrogenation Reactions to Produce 1,5-Pentanediol from Furfural, *ChemSusChem*, 10, 1351-1355, **2017**.
- [21] Dong, Y.; Velez, S.; Maravelias, C.T. Changeover Formulations for Discrete-time Mixed-integer Programming Scheduling Models. *European Journal of Operational Research*, 260 (3), 949-963, **2017**.
- [22] Dong, Y.; Sundaramoorthy, A.; Pinto, J.M.; Maravelias, C.T. Solution Methods for Vehicle-based Inventory Routing in the Chemicals Sector. *Computers and Chemical Engineering*, 101, 259-278, **2017**.
- [23] Kong, L.; Avadiappan, V.; Huang, K.; Maravelias, C.T. Simultaneous Chemical Process Synthesis and Heat Integration with Unclassified Hot/Cold Process Streams. *Computers and Chemical Engineering*, 101, 210-225, **2017**.
- [24] Herron J.A.; Vann, T.; Duong, N.; Resasco, D.E.; Crossley, S.; Lobban, L.L.; Maravelias, C.T. A Systems-level Roadmap for Biomass Thermal Fractionation and Catalytic Upgrading Strategies. *Energy Technology*, 5, 130-150, **2017**.
- [25] Wu, W.; Yenkie, K.; Maravelias, C.T. A Superstructure-based Framework for Bioseparation Network Synthesis. *Computers and Chemical Engineering*, 96, 1-17, **2017**.
- [26] Ng, R.T.L.; Maravelias, C.T. Design of Biofuel Supply Chains with Variable Regional Depot and Biorefinery Locations. *Renewable Energy*, 100, 90-102, **2017**.
- [27] Martagan, T.; Krishnamurthy, A.; Leland, P.A.; Maravelias, C.T. Optimal Purification Decisions for Engineer-to-Order Proteins at Aldevron. *Production and Operations Management*, 25(12), 2003-2005, **2016**.
- [28] Gupta, D.; Maravelias, C.T.; Wassick, J.M. From Rescheduling to Online Scheduling. *Chemical Engineering Research and Design*, 116, 83-97, **2016**.
- [29] Yenkie, K.M.; Wu, W.; Clark, R.L.; Pfleger, B.F.; Root, T.W.; Maravelias, C.T. A Roadmap for the Synthesis of Separation Networks for the Recovery of Bio-based Chemicals: Matching Biological and Process Feasibility, *Biotechnology Advances*, 34, 1362-1383, **2016**.
- [30] Motagamwala, A.H.; Won, W.; Maravelias, C.T.; Dumesic, J.A. An Engineered Solvent System for Sugar Production from Lignocellulosic Biomass Using Biomass Derived  $\gamma$ -valerolactone. *Green Chemistry*, 18, 5756-5763, **2016**.
- [31] Herron J.A.; Maravelias, C.T. Assessment of Solar-to-Fuels Strategies: Photocatalysis and Electrocatalytic Reduction. *Energy Technology*, 4, 1369-1391, **2016**.
- [32] Merchan A.F.; Lee, H-J.; Maravelias, C.T. Discrete-Time Mixed-integer Programming Models for Solution Methods for Production Scheduling in Multistage Facilities. *Computers & Chemical Engineering*, 94, 387-410, **2016**.
- [33] Gupta, D.; Maravelias, C.T. On Deterministic Rescheduling: Major Considerations, Paradoxes, and Remedies. *Computers and Chemical Engineering*, 94, 312-330, **2016**.

- [34] Wu, W.; Henao, C.A.; Maravelias, C.T. A Superstructure Representation, Generation, and Modeling Framework for Chemical Process Synthesis. *AIChE J.*, 62 (9), 3199-3214, **2016**.
- [35] Kong, L.; Sen, S.M.; Henao, C.A.; Dumesic, J.A.; Maravelias, C.T. A Superstructure-based Framework for Simultaneous Process Synthesis, Heat Integration, and Utility Plant Design. *Computers and Chemical Engineering*, 91, 68-84, **2016**.
- [36] Martagan, T.; Krishnamurthy, A.; Maravelias, C.T. Optimal Condition-Based Harvesting Policies for Biomanufacturing Operations with Failure Risks. *IIE Transactions*, 48(5), 440-461, **2016**.
- [37] Ng, R.T.L.; Maravelias, C.T. Design of Cellulosic Ethanol Supply Chains with Regional Depots. *Industrial and Engineering Chemistry Research*, 55, 3420-3432, **2016**.
- [38] Merchan A.F.; Maravelias, C.T. Preprocessing and Tightening Methods for Time-Indexed Mixed-integer Programming Models for Chemical Production Scheduling. *Computers & Chemical Engineering*, 84, 516-535, **2016**.
- [39] Velez, S.; Merchan, A.F.; Maravelias, C.T. On the Solution of Large-Scale Mixed-integer Programming Scheduling Models. *Chemical Engineering Science*, 136, 139-157, **2015**.
- [40] Han, J-H.; Sen, S.M.; Luterbacher, J.S.; Martin Alonso, D.; Dumesic, J.A.; Maravelias, C.T. Process Systems Engineering Studies for the Synthesis of Catalytic Biomass-to-Fuels Strategies. *Computers and Chemical Engineering*, 81, 57-69, **2015**.
- [41] Han, J-H.; Luterbacher, J.S.; Martin Alonso, D.; Dumesic, J.A.; Maravelias, C.T. A Lignocellulosic Ethanol Strategy via Nonenzymatic Sugar Production: Process Synthesis and Analysis. *Bioresource Technology*, 182, 258-266, **2015**.
- [42] Herron, J.A.; Kim, J.; Upadhye, A.A.; Huber, G.W.; Maravelias, C.T. A Generalized Framework for the Assessment of Solar Fuels Technologies. *Energy and Environmental Science*, 8, 126-157, **2015**.
- [43] Velez, S.; Maravelias, C.T. Theoretical Framework for the Formulation of MIP Scheduling Models with Multiple and Nonuniform Discrete-time Grids. *Computers and Chemical Engineering*, 72, 233-254, **2015**.
- [44] Dong, Y.; Sundaramoorthy, A.; Pinto, J.M.; Maravelias, C. T. A MIP Model for Inventory Routing in Industrial Gases Supply Chain. *Industrial & Engineering Chemistry Research*, 53(44), 17214-17225, **2014**.
- [45] Velez, S.; Maravelias, C.T. Advances in Mixed-integer Programming Methods for Chemical Production Scheduling. *Annual Review of Chemical and Biomolecular Engineering*, 5, 97-121, **2014**.
- [46] Merchan A. F.; Maravelias, C.T. Reformulations of Mixed-integer Programming Continuous-time Models for Chemical Production Scheduling. *Industrial & Engineering Chemistry Research*, 53(24), 10155-10165, **2014**.
- [47] Bond, J.Q.; Upadhye, A.A.; Olcay, H.; Tompsett, G.A.; Jae J.; Xing R.; Alonso, D.M.; Wang, D.; Zhang, T.; Kumar, R.; Foster, A.; Sen, S.M.; Maravelias, C.T.; Malina, R.; Barrett, S.R.H.; Lobo, R.; Wyman, C.E.; Dumesic, J.A.; Huber, G.W. Production of Renewable Jet Fuel Range Alkanes and Commodity Chemicals from Integrated Catalytic Processing of Biomass. *Energy and Environmental Science*, 7, 1500-1523, **2014**.
- [48] Nason, T.; Grabow, L.; Mavrikakis, M.; Biegler, L.; Maravelias, C.T. Advanced Solution Methods for Microkinetic Models of Catalytic Reactions: a Methanol Synthesis Case Study. *AIChE J.*, 60(4), 1336-1346, **2014**.
- [49] Subramanian, K.; Rawlings, J.B.; Maravelias, C.T. Economic Model Predictive Control for Inventory Management in Supply Chains. *Computers and Chemical Engineering*, 64, 71-80, **2014**.
- [50] Harjunkoski, I.; Maravelias, C.T.; Bongers, P.; Castro, P.; Engell, S.; Grossmann, I.E.; Hooker, J.; Mendez, C.; Sand, G.; Wassick, J. Scope for Industrial Applications of Production Scheduling Models and Solution Methods. *Computers and Chemical Engineering*, 62, 161-193, **2014**.

- [51] Luterbacher, J.S.; Rand, J.M.; Martin Alonso, D.; Han, J.; Youngquist, J.T.; Maravelias, C.T.; Pflieger, B.F.; Dumesic, J.A. Nonenzymatic Sugar Production from Biomass Using Biomass-derived  $\gamma$ -Valerolactone. *Science*, 343, 207, **2014**.
- [52] Han, J-H.; Sen, S. M.; Alonso, D.; Dumesic, J. A.; Maravelias, C. T. A Strategy for the Simultaneous Catalytic Conversion of Hemicellulose and Cellulose from Lignocellulosic Biomass to Liquid Transportation Fuels. *Green Chemistry*, 16, 653-661, **2014**.
- [53] Merchan, A.G.; Velez, S.; Maravelias, C.T. Tightening Methods for Continuous-time Mixed-Integer Programming Models for Chemical Production Scheduling. *AIChE J.*, 59(12), 4461-4467, **2013**.
- [54] Caes, B.R.; Van Oosbree, T.R.; Lu, F.; Ralph, J.; Maravelias, C.T.; Raines, R.T. Simulated Moving Bed Chromatography: Separation and Recovery of Sugars and Ionic Liquid from Biomass Hydrolysates. *ChemSusChem*, 6(11), 2083-2089, **2013**.
- [55] Kim, J.; Miller, J. A.; Maravelias, C. T.; Stechel, E.B. Comparative Analysis of Environmental Impact of S2P (Sunshine to Petrol) System for Transportation Fuel Production. *Applied Energy*, 111, 1089-1098, **2013**.
- [56] Velez, S.; Maravelias, C.T. A Branch-and-Bound Algorithm for the Solution of Chemical Production Scheduling MIP Models Using Parallel Computing. *Computers and Chemical Engineering*, 55, 28-39, **2013**.
- [57] Velez, S.; Maravelias, C.T. Multiple and Nonuniform Time Grids in Discrete-Time MIP Models for Chemical Production Scheduling. *Computers and Chemical Engineering*, 53, 70-85, **2013**.
- [58] Velez, S.; Maravelias, C.T. Reformulations and Branching Methods for Mixed-integer Programming Chemical Production Scheduling Models. *Industrial & Engineering Chemistry Research*, 52 (10), 3832-3841, **2013**.
- [59] Velez, S.; Maravelias, C.T. Mixed-integer Programming Model and Tightening Methods for Scheduling in General Chemical Production Environments. *Industrial and Engineering Chemistry Research*, 52 (9), 3407-3423, **2013**.
- [60] Kim, J.; Sen, S.M.; Maravelias, C.T. An Optimization-Based Assessment Framework for Biomass-to-Fuels Conversion Strategies. *Energy and Environmental Science*, 6 (4), 1093-1104, **2013**.
- [61] Subramanian, K.; Rawlings, J.B.; Maravelias, C.T.; Flores-Cerrillo, J.; Megan, L. Integration of Control Theory and Scheduling Methods for Supply Chain Management. *Computers and Chemical Engineering*, 51, 4-20, **2013**.
- [62] Velez, S.; Sundaramoorthy, A; Maravelias, C.T. Valid Inequalities Based on Demand Propagation for Chemical Production Scheduling MIP Models. *AIChE J.*, 59(3), 872-887, **2013**.
- [63] Sen, S. M.; Alonso, D.M.; Wettstein, S.G.; Gurbuz, E.I.; Henao, C.A.; Dumesic, J.A.; Maravelias, C.T. A Sulfuric Acid Management Strategy for the Production of Liquid Hydrocarbon Fuels via Catalytic Conversion of Biomass-derived Levulinic Acid. *Energy and Environmental Science*, 5(12), 9690-9697, **2012**.
- [64] Sen, S.M.; Gurbuz, E.I.; Wettstein, S.G.; Alonso, D.M.; Dumesic, J.A.; Maravelias, C.T. Production of Butene Oligomers as Transportation Fuels using Butene for Esterification of Levulinic Acid from Lignocellulosic Biomass: Process Synthesis and Technoeconomic Evaluation. *Green Chemistry*, 14 (12), 3289-3294, **2012**.
- [65] Subramanian, K.; Maravelias, C.T.; Rawlings, J.B. A State-space Model for Chemical Production Scheduling. *Computers and Chemical Engineering*, 47, 97-110, **2012**.
- [66] Kim, J.; Miller, J.A.; Johnson, T. Stechel, E.; Maravelias, C.T. Fuel Production from CO<sub>2</sub> Using Solar-Thermal Energy: System Level Analysis. *Energy and Environmental Science*, 5 (9), 8417 - 8429, **2012**.
- [67] Sen, S. M.; Binder, J.B.; Raines, R.T.; Maravelias, C.T. Conversion of Biomass to Sugars via Ionic Liquid Hydrolysis: Process Synthesis and Economic Evaluation. *Biofuels, Bioproducts & Biorefining*, 6(4), 444-452, **2012**.

- [68] Maravelias, C.T. A General Framework and Modeling Approach Classification for Chemical Production Scheduling. *AIChE J.*, 58 (6), 1812-1828, **2012**.
- [69] Maravelias, C.T. On the Combinatorial Structure of Discrete-time MIP Formulations for Chemical Production Scheduling. *Computers and Chemical Engineering*, 38, 204-212, **2012**.
- [70] Sen, M.; Henao, C.A.; Braden, D.J.; Dumesic, J.A.; Maravelias, C.T. Catalytic Conversion of Lignocellulosic Biomass to Fuels: Process Development and Technoeconomic Evaluation. *Chemical Engineering Science*, 67, 57-67, **2012**.
- [71] Kim, J.; Reed, J.L.; Maravelias, C.T. Large-scale Bi-level Strain Design Approaches and Mixed-integer Programming Solution Techniques. *PLoS ONE*, 6(9), e24162, **2011**.
- [72] Kim, J.; Henao, C.A.; Johnson, T.A.; Dedrick, D.E.; Miller, J.A.; Stechel, E.B.; Maravelias, C.T. Methanol Production from CO<sub>2</sub> Using Solar-Thermal Energy: Process Development and Techno-Economic Analysis. *Energy and Environmental Science*, 4, 3122-3132, **2011**.
- [73] Colvin, M.; Maravelias, C.T. R&D Pipeline Planning: Task Interdependencies and Risk Management. *European Journal of Operational Research*, 215, 616-628, **2011**.
- [74] Braden, D.J.; Henao, C.A.; Heltzel, J.; Maravelias, C.T.; Dumesic, J.A. Production of Liquid Hydrocarbon Fuels by Catalytic Conversion of Biomass-derived Levulinic Acid. *Green Chemistry*, 13, 1755-1765, **2011**.
- [75] Sundaramoorthy, A.; Maravelias, C.T. Computational Study of Scheduling Approaches for Batch Process Networks. *Industrial and Engineering Chemistry Research*, 50(9), 5023-5040, **2011**.
- [76] Henao, C.A.; Maravelias, C.T. Process Superstructure Optimization Using Surrogate Models. *AIChE J.*, 57(5), 1216-1232, **2011**.
- [77] Kopanos, G.; Puigjaner, L.; Maravelias, C.T. Production Planning and Scheduling of Parallel Continuous Processes with Product Family Considerations. *Industrial and Engineering Chemistry Research*, 50, 1369-1378, **2011**.
- [78] Sundaramoorthy, A.; Maravelias, C.T. A General Framework for Process Scheduling. *AIChE J.*, 57(3), 695-710, **2011**.
- [79] Colvin, M.; Maravelias, C.T. Modeling Methods and a Branch and Cut Algorithm for Pharmaceutical Clinical Trial Planning Using Stochastic Programming. *European Journal of Operational Research*, 203, 205-215, **2010**.
- [80] Maravelias, C.T.; Sung, C. Integration of Production Planning and Scheduling: Overview, Challenges and Opportunities. *Computers and Chemical Engineering*, 33 (12), 1919-1930, **2009**.
- [81] Maravelias, C.T.; Papalamprou, K. Polyhedral Results for Discrete-time MIP Formulations for Scheduling and Production Planning. *Computers and Chemical Engineering*, 33(11), 1890-1904, **2009**.
- [82] Sung, C.; Maravelias, C.T. A Projection-Based Method for Production Planning of Multiproduct Facilities. *AIChE J.*, 55 (10), 2614-2630, **2009**.
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- [84] Gimenez, D.M.; Henning, G.; Maravelias, C.T. A Novel Network-based Continuous-Time Representation for Process Scheduling: Part I. Main Concepts and Mathematical Formulation. *Computers and Chemical Engineering*, 33 (9), 1511-1528, **2009**.
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- [86] Sundaramoorthy, A.; Maravelias, C.T.; Prasad, P. Scheduling of Multi-stage Batch Processes under Utility Constraints. *Industrial and Engineering Chemistry Research*, 48 (13), 6050-6058, **2009**.

- [87] Colvin, M.; Maravelias, C.T. Scheduling of Testing Tasks and Resource Planning in New Product Development Using Stochastic Programming. *Computers and Chemical Engineering*, 33 (5), 964-976, **2009**.
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- [89] Sundaramoorthy, A.; Maravelias, C.T. Modeling of Storage Constraints in Batching and Scheduling of Multi-stage Processes. *Industrial and Engineering Chemistry Research*, 47 (17), 6648-6660, **2008**.
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- [92] Sung, C.; Maravelias, C.T. A Mixed-Integer Programming Formulation for the General Capacitated Lot-sizing Problem. *Computers and Chemical Engineering*, 32(1), 244-259, **2008**.
- [93] Sung, C.; Maravelias, C.T. An Attainable Region Approach for Effective Production Planning of Multi-product Processes. *AIChE J.*, 53 (5), 1298-1315, **2007**.
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- [4] Risbeck, M.J.; Maravelias, C.T.; Rawlings, J.B.; Turney, R.D. Cost Optimization of Combined Building Heating/Cooling Equipment via Mixed-Integer Linear Programming. In Proceedings: American Control Conference, Chicago, July 1-3, **2015**.
- [5] Sen, S.M.; Dumesic, J.A.; Maravelias, C.T. Superstructure-Based Framework for Simultaneous Process Synthesis, Heat Integration, and Utility Plant Design. In Proceedings: *12th Process Systems Engineering and 25th European Symposium in Computer-Aided Process Engineering Joint Event*. Copenhagen, Denmark, May 31 – June 4, **2015**.
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### WORKSHOP PRESENTATIONS

- [1] Maravelias, C.T. From Rescheduling to Online Scheduling: Major Considerations, Paradoxes, and Remedies, *LCCC Process Control Workshop*, Lund, Sweden, September 28-30, **2016**.
- [2] Maravelias, C.T. Integration of Production Planning and Scheduling: An Assessment of Bottlenecks Related to Production Plan Execution. *International Seminar on Production Planning and Scheduling*, Petrobras, Rio de Janeiro, Brazil, October 9-11, **2012**.
- [3] Rawlings, J.B.; Stewart, B.T.; Subramanian, K.; Maravelias, C.T. Cooperation-based optimization of industrial supply chains. *Workshop on Distributed Model Predictive Control and Supply Chains*, Lund University, Lund, Sweden, May 19-21, **2010**.
- [4] Maravelias, C.T. Mixed-integer programming methods for supply chain optimization. Pan American Advanced Studies Institute 2011: Process modeling and optimization for energy and sustainability. Angra dos Reis, RJ, Brazil, July 19-29, **2011**.

### PLENARY, KEYNOTE AND INVITED CONFERENCE PRESENTATIONS

- [1] Maravelias, C.T.; Rawlings, J.B. Optimization Methods for Real-time Decision Making in Large-scale Energy Systems. *Process Systems Engineering 2018*, San Diego, CA, July 1-5, **2018**.
- [2] Maravelias, C.T. (Invited). Discussions on Scheduling, (Re)optimization, Feedback, and Closed-loop Performance. *AIChE Annual Meeting*, In Honor of Jim Rawlings' 60<sup>th</sup> Birthday, Minneapolis, MN, October 29 – November 3, **2017**.
- [3] Maravelias, C.T.; Herron, J.A. (Invited). A Systems-Level View of Solar Fuels. *9th Sino-US Joint Conference on Chemical Engineering*, Beijing, China, October 15-19, 2017.
- [4] Maravelias, C.T. (Invited). A Systems-Level View of Solar Fuels. *Connaught Global Challenge Symposium: CO2 Chemistry Solutions to Climate Change*, University of Toronto, Toronto, ON, Canada, May 9 – 10, **2017**.
- [5] Maravelias, C.T. (Plenary). Process Systems Engineering for Biofuels and Biochemicals. *Great Lakes Bioenergy Research Center 2016 Annual Scientific Meeting*, Lake Geneva, WI, May 17-19, **2016**.
- [6] Risbeck, M.J.; Maravelias, C.T.; Rawlings, J.B.; Turney, R.D. (CAST Plenary Session). Mixed-Integer Model Predictive Control for Online Scheduling of HVAC Equipment in Commercial Buildings. *AIChE Annual Meeting*, Salt Lake City, UT, November 8-13, **2015**.
- [7] Herron, J. A.; Maravelias, C.T. (Invited). A Generalized Framework for the Assessment of Solar Fuels Technologies. In Honor of the 2014 Wilhelm Award Winner. *AIChE Annual Meeting*, Salt Lake City, UT, November 8-13, **2015**.
- [8] Maravelias, C.T. (Keynote). Process Systems Engineering for Biomass-to-Fuels/Chemicals Strategies. *3<sup>rd</sup> International Tailor-Made Fuels from Biomass Conference*, Aachen, Germany, June 23-25, **2015**.
- [9] Maravelias, C.T. (Keynote). Chemical Production Scheduling: From Models to Online Solution Methods. *12th Process Systems Engineering and 25th European Symposium in Computer-Aided Process Engineering* Joint Event. Copenhagen, Denmark, May 31 – June 4, **2015**.
- [10] Maravelias, C.T. (Invited). Recent Advances in Chemical Production Scheduling. In Honor of Ignacio Grossmann's 65<sup>th</sup> Birthday. *AIChE Annual Meeting*, Atlanta, GA, November 16-21, **2014**.
- [11] Maravelias, C.T. (Invited). On the Solution of Large Scale Chemical Production Scheduling Problems. Larry Evans's 80<sup>th</sup> birthday: How computing has changed chemical engineering. *AIChE Annual Meeting*, Atlanta, GA, November 16-21, **2014**.

- [12] Maravelias, C.T. (Keynote). Process Systems Engineering for Renewable Energy: Lessons Learned, Challenges, and Opportunities. *8<sup>th</sup> International Conference on Foundations of Computer-Aided Process Design*, Suncadia Resort, Cle Elum, WA, July 13-17, **2014**.
- [13] Velez, S.; Maravelias, C.T. (Invited). Solution Methods for MIP Production Planning and Scheduling Models. *11<sup>th</sup> International Conference on Computational Management Science*, Lisbon, Portugal, 29-31 May, **2014**.
- [14] Colvin, M.; Maravelias, C.T. (Invited). Stochastic Programming Models and Algorithms for Pharmaceutical R&D Planning. *13<sup>th</sup> International Conference on Stochastic Programming*, Bergamo, Italy, 8-12 July, **2013**.
- [15] Maravelias, C.T.; Rawlings, J.B.; Subramanian, K. (Invited). A State-space Model for Chemical Production Scheduling. *26<sup>th</sup> European Conference on Operations Research*, Rome, Italy, 1-4 July, **2013**.
- [16] Velez, S.; Maravelias, C.T. (Invited). Valid Inequalities Based on Demand Propagation for Chemical Production Scheduling MIP Models. *26<sup>th</sup> European Conference on Operations Research*, Rome, Italy, 1-4 July, **2013**.
- [17] Colvin, M.; Maravelias, C.T. (Invited). Pharmaceutical R&D Planning. *MathBio4: SCALE Symposium*, Wisconsin Institutes for Discovery, Madison, WI, October 18-19, **2012**.
- [18] Subramanian, K.; Rawlings, J.B.; Maravelias, C.T.; Flores-Cerrillo, J.; Megan, L. (Keynote) Integration of Control Theory and Scheduling Methods for Supply Chain Management. *Foundations of Computer-aided Process Operations & Chemical Process Control*, Savannah, GA, January 8 – 11, **2012**.
- [19] Zenner, S.; Maravelias, C.T. (CAST Plenary Session). Classification of chemical production scheduling problems and approaches, and a general solution framework. *AIChE Annual Meeting*, Minneapolis, MN, October 16-21, **2011**.
- [20] Maravelias, C.T. (Keynote). Integration of Production Planning and Scheduling. In Proceedings: *10<sup>th</sup> International Symposium on Process Systems Engineering*, Salvador, Brazil, August 16-20, **2009**.
- [21] Maravelias, C.T.; Sung, C. (Keynote). Integration of production planning and scheduling: Review, Challenges and Opportunities. In Proceedings: *Foundations of Computer-aided Process Operations* (Eds: Ierapetritou, M.; Bassett, M.; Pistikopoulos, S.), 13-22, Boston, MA, June 29 – July 2, **2008**.
- [22] Colvin, M.; Maravelias, C.T. (Invited). New Product Development Planning Using Stochastic Programming. *2009 INFORMS Annual Meeting*, San Diego, CA, October 11-14, **2009**.
- [23] Prasad, P.; Maravelias, C.T. (Invited) Task Selection, Assignment and sequencing in Multistage Batch Processes. *INFORMS Annual Meeting*, Pittsburgh, PA, November 5-8, **2006**.
- [24] Maravelias, C.T. (Invited). Resource Planning for R&D Portfolio Optimization. *Institute of Industrial Engineers Annual Conference and Exposition*, Orlando, FL, May 20-24, **2006**.

#### INVITED SEMINARS & PRESENTATIONS

- [1] *Chemical Production Scheduling and Supply Chain Optimization*, ASPEN Technology Inc, Houston, TX, October 24, **2017**.
- [2] *Process Systems Engineering for Renewable Energy*, School of Engineering, University of Edinburgh, Edinburgh, UK, September 29, **2017**.
- [3] *From Scheduling to Online Scheduling: Models, Solution Methods, Paradoxes, and Open Questions*, Center for Management Sciences, Technical University of Lisbon, Lisbon, Portugal, September 27, **2017**.
- [4] *Process Systems Engineering for Renewable Energy*, Department of Chemical and Biochemical Engineering, Technical University of Denmark, Lyngby, Denmark, September 25, **2017**.
- [5] *Optimization Methods for Catalyst Design, Chemical Process Synthesis and Operations*. ExxonMobil Research & Engineering Company, Annandale, NJ, August 4, **2017**.

- [6] *Process Systems Engineering for Solar Fuels*, Department of Mechanical Engineering, University of Minnesota, Minneapolis, MN, February 8, **2017**.
- [7] *Process Systems Engineering for Renewable Energy*, Department of Chemical Engineering, Massachusetts Institute of Technology, Cambridge, MA, December 2, **2016**.
- [8] *Process Systems Engineering for Solar Fuels*, Argonne-Northwestern Solar Energy Research Center, Northwestern University, Evanston, IL, November 3, **2016**.
- [9] *Process Systems Engineering for Renewable Energy*, Chemical and Biochemical Engineering, Rutgers University, Piscataway, NJ, October 20, **2016**.
- [10] *Process Systems Engineering for Renewable Energy*, The Bayer Lecture on Process Systems Engineering, Department of Chemical Engineering, Carnegie Mellon University, September 8, **2016**.
- [11] *From Scheduling to Online Scheduling: Models, Solution Methods, Paradoxes, and Open Questions*, Process Systems Engineering Seminar Series, Department of Chemical Engineering, Carnegie Mellon University, September 7, **2016**.
- [12] *Process Systems Engineering for Renewable Energy*, Department of Chemical and Biological Engineering, Tufts University, January 25, **2016**.
- [13] *Process Systems Engineering for Renewable Energy*, Department of Chemical and Biological Engineering, Princeton University, December 2, **2015**.
- [14] *Process Systems Engineering for Solar Fuels*, Institute of Energy Technology, Eidgenössische Technische Hochschule (ETH) Zurich, Switzerland, June 22, **2015**.
- [15] *Process Systems Engineering for Renewable Energy*, Institute for Chemical and Bio Engineering, Eidgenössische Technische Hochschule (ETH) Zurich, Switzerland, June 10, **2015**.
- [16] *Process Systems Engineering for Renewable Energy*, Mechanical Engineering, École Polytechnique Fédérale de Lausanne, Switzerland, June 9, **2015**.
- [17] *Advances in Chemical Production Scheduling*. AIChE CAST Division Webinar, January 27, **2015**.
- [18] *Process Systems Engineering for Renewable Energy*. The Bren School of Environmental Science & Management, University of California – Santa Barbara, January 20, **2015**.
- [19] *Chemical Production Scheduling: From Models to Online Solution Methods*. Center for Control, Dynamical-Systems, and Computation, University of California – Santa Barbara, May 23, **2014**.
- [20] *Process Systems Engineering for Renewable Energy*. Department of Chemical Engineering and Materials Science. University of Minnesota, Minneapolis, MN, March 27, **2014**.
- [21] *Chemical Production Scheduling: Notation, Problem Classes, Modeling Approaches, and Solution Methods*. Carnegie Mellon University, Enterprise-wide Optimization Seminar Series (webinar), February 27, **2014**.
- [22] *Process Systems Engineering for Renewable Energy*. Department of Chemical and Petroleum Engineering, University of Pittsburgh, Pittsburgh, PA, February 7, **2014**.
- [23] *Process Systems Engineering for Renewable Energy*. School of Chemical, Biological & Materials Engineering, University of Oklahoma, Norman, OK, December 5, **2013**.
- [24] *Advances in Mixed-integer Programming Methods for Chemical Production Scheduling*. Department of Automatic Control, Lund University, Lund, Sweden, October 11, **2013**.
- [25] *Chemical Production Scheduling: Overview and Future Directions*. 25th Anniversary McMaster Advanced Control Consortium Meeting and Workshop, McMaster University, Hamilton, Ontario, Canada, May 15, **2013**.
- [26] *Integration of Chemical Production Planning and Scheduling: An assessment of bottlenecks Related to Production Plan Execution*. Petrobras International Seminar on Production Planning and Scheduling, Rio de Janeiro, Brazil, October 11, **2012**.
- [27] *Integration of Chemical Production Planning and Scheduling*. TU Dortmund, Dortmund, Germany, June 28, **2012**.

- [28] *Chemical Production Scheduling: Notation, Problem Classes, Modeling Approaches, Theory, and Solution Methods*. Center for Process Systems Engineering, Imperial College, London, UK, June 25, **2012**.
- [29] *Modeling and Solution Methods for Stochastic Programming Problems under Endogenous Observation of Uncertainty*. Department of Computing, Imperial College, London, UK, June 21, **2012**.
- [30] *Integration of Simulation and Optimization Methods for Chemical Process Synthesis*. Wisconsin Institute for Discovery - Doing Optimization at Wisconsin Seminar Series, University of Wisconsin, Madison, WI, October 3, **2011**.
- [31] *Production Planning and Scheduling in the Chemical Industries*. Department of Mathematical Physical and Computational Sciences, Faculty of Engineering, Aristotle University, Thessaloniki, Greece, May 27, **2011**.
- [32] *Integration of Production Planning and Scheduling* Department of Chemical Engineering, Texas A&M University, College Station, TX, March 8, **2011**.
- [33] *Sunshine to Petrol - Reimagining Transportation Fuels: Systems-level Studies*. Sandia National Laboratories, Albuquerque, NM, February 23, **2011**.
- [34] *Integration of Production Planning and Scheduling*. Department of Chemical and Biological Engineering, Princeton University, 16 February, **2011**.
- [35] *Optimization Methods for Chemical Process Design and Operations*. ExxonMobil Research & Engineering Company, Annandale, NJ, January 31, **2011**.
- [36] *Mixed-integer Programming Methods in Process Systems Engineering*, ABB, Corporate Research Center, Ladenburg, Germany, June 16, **2010**.
- [37] *Integration of Production Planning and Scheduling*. Department of Chemical and Biological Engineering, Illinois Institute of Technology, Chicago, IL, January 13, **2010**.
- [38] *Integration of Production Planning and Scheduling in the Chemical Industry*. Department of Chemical Engineering, Carnegie Mellon University, Pittsburgh, PA, September 24, **2009**.
- [39] *Integration of Production Planning and Scheduling in the Chemical Industry*. Department of Chemical Engineering, University of Delaware, Newark, DE, September 18, **2009**.
- [40] *Modeling and Solution Methods for Production Planning and Scheduling*, Cervecería Cuauhtemoc Moctezuma, Monterrey, Mexico, August 31, **2009**.
- [41] *Integration of Production Planning and Scheduling in the Chemical Industry*. The Operations Research Society – Mathematical Programming Group, London, UK, May 27, **2009**.
- [42] *Modeling and Solution Methods for a Class of Stochastic Programming Problems under Endogenous Observation of Uncertainty*. Automatic Control Laboratory, Eidgenössische Technische Hochschule (ETH), Zurich, Switzerland, May 20, **2009**.
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