

# Control of Complex Systems: An Integrated Perspective on Modern Power Grid Control

## American Control Conference Workshop

May 22-23, 2017

Sheraton Seattle Hotel, 1400 6<sup>th</sup> Avenue, Seattle, WA 98101

Redwood B Conference Room



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## Day 1

Monday, May 22, 2017

### Session 1: Introduction and Keynote Presentation

Chair: Dr. Michael Brambley

8:15 – 8:30 a.m.

#### Workshop Welcome and Introductions

*Dr. Michael Brambley, Pacific Northwest National Laboratory*

8:30 – 9:00 a.m.

#### Keynote Presentation: Challenges and Perspectives

*Dr. Sonja Glavaski, Advanced Research Projects Agency-Energy (ARPA-E)*

### Tutorial 1

Chair: Dr. Krishnamurthy Dvijotham

9:00 – 10:00 a.m.

#### Tutorial: The U.S. Electricity Industry in the 21<sup>st</sup> Century: Challenges and Opportunities

*Prof. Dalia Patiño-Echeverri, Nicholas School of the Environment, Duke University*

10:00 – 10:30 a.m.

#### Break

### Session 2: Industry Perspectives

Chairs: Mr. Paul Ehrlich, Dr. Karanjit Kalsi

10:30 – 11:00 a.m.

#### Hawaii's Clean Energy Transformation: Future Opportunities and Challenges

*Mr. Michael Champley, Former Commissioner, Hawaii Public Utilities Commission*

11:00 – 11:30 a.m.

#### Challenges and Opportunities of Applying Optimization and Analytics for Managing Modern Power Systems

*Dr. Kwok Cheung, GE Grid Solutions*

11:30 a.m. – 1:00 p.m.

#### Lunch Break

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### Session 2: Industry Perspectives (continued)

Chairs: Mr. Paul Ehrlich, Dr. Karanjit Kalsi

1:00 – 1:30 p.m.

**To Distribute or to Centralize: Architectures for Control of Power Systems**

*Dr. Holger Kley, SPIRAE*

1:30 – 2:00 p.m.

**Challenges of Technology Transfer from Research to an Electric Distribution Utility**

*Ms. Uzma Siddiqi, PE, Seattle City Light*

### Tutorial 2

Chair: Dr. Krishnamurthy Dvijotham

2:00 – 3:00 p.m.

**Tutorial: Modeling Frameworks to Enable New Opportunities in Grid Optimization and Control**

*Prof. Christopher DeMarco, Electrical and Computer Engineering, University of Wisconsin, Madison*

3:00 – 3:30 p.m.

**Break**

### Session 3: Lightning Talks

Chair: Mr. Thomas Edgar

3:30 – 3:45 p.m.

**High Level Modeling Language for Developing Co-simulations of Complex Systems**

*Mr. Thomas Edgar, Pacific Northwest National Laboratory*

3:45 – 4:00 p.m.

**Control System Evaluation Through Large-Scale Complex Interconnected Energy System Simulations**

*Mr. Jacob Hansen, Pacific Northwest National Laboratory*

4:00 – 4:15 p.m.

**VOLTTRON™ - An Open Source Distributed Control and Sensing Platform for Buildings, the Grid and More**

*Mr. Jereme Haack, Pacific Northwest National Laboratory*

4:15 – 4:30 p.m.

**Optimal Energy Storage Sizing and Residential Load Scheduling to Improve Reliability in Islanded Operation of Distribution Grids**

*Mr. Abdulelah Habib, University of California, San Diego*

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4:30 – 4:45 p.m.	<b>Assessing Demand Flexibility in Uncertain Frequency Responsive Loads</b> <i>Dr. Soumya Kundu, Pacific Northwest National Laboratory</i>
4:45 – 5:00 p.m.	<b>Transactive Energy Systems Using Double-auction Market: Example and Analysis</b> <i>Dr. Jianming Lian, Pacific Northwest National Laboratory</i>
5:00 – 5:15 p.m.	<b>Integration of Retail and Wholesale Electricity Markets: Modeling and Stability Analysis</b> <i>Dr. Thiagarajan Ramachandran, Pacific Northwest National Laboratory</i>
5:15 – 6:00 p.m.	<b>Poster Viewing and Networking Time</b>
6:00 p.m.	<b>Adjourn</b>

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## Day 2

Tuesday, May 23, 2017

### Introduction

Chair: Dr. Michael Brambley

8:00 – 8:05 a.m.

#### Welcome to Day 2

*Dr. Michael Brambley, Pacific Northwest National Laboratory*

### Session 4: Dynamics and Control

Chairs: Prof. Enrique Mallada, Dr. Soumya Kundu

8:05 – 8:35 a.m.

#### Design, Stability and Control of Ad-hoc Microgrids

*Prof. Konstantin Turitsyn, Department of Mechanical Engineering, MIT*

8:35 – 9:05 a.m.

#### Performance Tradeoffs of Dynamically Controlled Grid-connected Inverters in Low Inertia Power Systems

*Prof. Enrique Mallada, Department of Electrical and Computer Engineering, Johns Hopkins University*

9:05 – 9:35 a.m.

#### Realizing Virtual Power Plants

*Dr. Changhong Zhao, National Renewable Energy Laboratory*

9:35 – 10:05 a.m.

#### Predictive Dispatch and Demand Response for Commercial Buildings

*Prof. Colin Jones, École polytechnique fédérale de Lausanne*

10:05 – 10:30 a.m.

#### Break

10:30 – 11:00 a.m.

#### UTRC Buildings to Grid Research

*Dr. Veronica Adetola, United Technologies Research Center*

### Tutorial 3: Optimization and Analytics

Chair: Dr. Krishnamurthy Dvijotham

11:00 a.m. – 12:00 p.m.

#### Tutorial: Optimization and Control of Energy Systems

*Prof. Pascal Van Hentenryck, Industrial and Operations Engineering, University of Michigan, Ann Arbor*

12:00 pm – 1:30 p.m.

#### Lunch Break

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### Session 5: Optimization and Analytics

Chairs: Prof. Pascal Van Hentenryck, Dr. Draguna Vrabie

1:30 – 2:00 p.m.

#### **Optimal Control of Battery Storage Under Cycle-based Degradation Models**

*Prof. Baosen Zhang, Department of Electrical Engineering, University of Washington, Seattle*

2:00 – 2:30 p.m.

#### **Chance-constrained AC OPF with Probabilistic Guarantees and Scalable Performance**

*Dr. Maria Vrakopoulou, Electrical and Computer Engineering, University of Michigan, Ann Arbor*

### Session 6: Economics and Market Design

Chairs: Prof. Subhonmesh Bose, Dr. Draguna Vrabie

2:30 – 3:00 p.m.

#### **A Self-Reported Baseline Mechanism for Demand Response Programs**

*Dr. Deepan Muthirayan, Department of Electrical and Computer Engineering, Cornell University*

3:00 – 3:30 p.m.

#### **Break**

3:30 – 4:00 p.m.

#### **Call-options for Wholesale Electricity Markets**

*Prof. Subhonmesh Bose, Electrical and Computer Engineering, University of Illinois, Urbana-Champaign*

4:00 – 4:30 p.m.

#### **DER Coordination at Large Scales: From Mean-Field Games to Social Welfare Optimization**

*Prof. Wei Zhang, Electrical and Computer Engineering, Ohio State University*

### Session 7: Lightning Talks - Control and Optimization Under Uncertainty

Chairs: Dr. Draguna Vrabie, Prof. Wei Zhang

4:30 – 4:45 p.m.

#### **Model Decomposition Methods for Cyber-Physical Infrastructure Systems**

*Dr. Enoch Yeung, Pacific Northwest National Laboratory*

4:45 – 5:00 p.m.

#### **Robust Optimization of Infrastructure Systems**

*Dr. Krishnamurthy Dvijotham, Pacific Northwest National Laboratory*

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5:00 – 5:15 p.m.

**Submodular Optimization for Discovery of Key Entities in  
Complex Systems**

*Dr. Arun Sathanur, Pacific Northwest National Laboratory*

**Session 8: Workshop Closing**

5:15 – 5:30 p.m.

**Workshop Closing Remarks**

*Dr. Michael Brambley, Pacific Northwest National Laboratory*

5:30 p.m.

**Adjourn**

7:00 p.m.

**OPTIONAL: No-host Dinner**

Wild Ginger

1401 3rd Ave, Seattle, WA 98101