

Justin P. Koeln

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POSITIONS	University of Texas at Dallas , Richardson, TX <i>Assistant Professor</i> , Department of Mechanical Engineering	Jan. 2018 - Present
	Air Force Research Laboratories , Dayton, OH <i>Summer Faculty Fellow</i> , Power and Control Division	May 2018 - July 2018
	Univ. of Illinois at Urbana-Champaign , Urbana, IL <i>Postdoctoral Research Associate</i> , Dept. of Mechanical Science and Engineering	Jan. 2017 - Dec. 2017
EDUCATION	Univ. of Illinois at Urbana-Champaign , Urbana, IL Ph.D., Mechanical Engineering Dissertation: "Hierarchical Power Management in Vehicle Systems" Advisor: Andrew G. Alleyne	Dec. 2016
	Univ. of Illinois at Urbana-Champaign , Urbana, IL M.S., Mechanical Engineering Thesis: "A Decentralized Control Design Approach to a Class of Large-Scale Systems" Advisor: Andrew G. Alleyne	Aug. 2013
	Utah State University , Logan, UT B.S., Mechanical and Aerospace Engineering	May 2011
RESEARCH INTERESTS	<ul style="list-style-type: none">• Dynamic Modeling and Control of Thermal Management Systems• Model Predictive Control• Hierarchical and Distributed Control for Electro-thermal Systems	
HONORS AND AWARDS	UIUC's List of Teachers Ranked as Excellent by Their Students	2016
	UIUC MechSE Teaching Fellowship	2016
	American Control Conference (ACC) Best Presentation in Session	2014
	National Science Foundation (NSF) Graduate Research Fellowship	2011
	Barry M. Goldwater Scholar	2010
	USU Mechanical and Aerospace Engineering (MAE) Department Outstanding Senior	2010
	USU MAE Department Undergraduate Researcher of the Year	2009
	USU NRC scholarship	2009
	Honorable Mention, Frank J. Redd International Student Scholarship Competition, 23rd Annual AIAA/USU Conference on Small Satellites	2009
	First Place, AIAA Region 6 Student Conference	2009
FUNDED RESEARCH PROJECTS	Project Title: <i>CRII: CPS: Hierarchical Control for Constrained Multi-timescale Energy Management</i> Sponsor: National Science Foundation , Grant Number: CNS-1849500 PI: Justin Koeln Total Award Amount: \$174,341 Period: July 2019 - June 2021	

PUBLICATIONS

Citation Indices (by Google Scholar, as of Nov. 2019)

Total: 272, h-index: 10, i10-index: 10

BOOK
CHAPTERS

1. **J. Koeln**, B. Keating, A. Alleyne, C. Price, B. Rasmussen, "HVAC System Modeling and Control: Multi-zone Temperature Modeling and Control," *Intelligent Building Control Systems*, John Wen and Sandipan Mishra (ed.), Springer, 2018.
2. B. Rasmussen, C. Price, **J. Koeln**, B. Keating, A. Alleyne, "HVAC System Modeling and Control: Vapor Compression System Modeling and Control," *Intelligent Building Control Systems*, John Wen and Sandipan Mishra (ed.), Springer, 2018.

JOURNAL
PUBLICATIONS**Peer-Reviewed Journal Articles**

1. **J. Koeln**, V. Raghuraman, "Set Operations and Order Reductions for Constrained Zonotopes," *Automatica*, (Submitted), 2019.
2. **J. Koeln**, V. Raghuraman, B. Hencsey, "Vertical Hierarchical MPC for Constrained Linear Systems," *Automatica*, (Under Review), 2019.
3. **J. Koeln**, H. Pangborn, M. Williams, M. Kawamura, A. Alleyne, "Hierarchical Control of Aircraft Electro-Thermal Systems," *IEEE Transactions on Control Systems Technology*, (Early Access), 2019.
4. H. Pangborn, **J. Koeln**, M. Williams, A. Alleyne, "Experimental Validation of Graph-based Hierarchical Control for Thermal Management," *Journal of Dynamic Systems, Measurement, and Control*, 140(10), 2018.
5. **J. Koeln**, A. Alleyne, "Robust Hierarchical Model Predictive Control of Graph-based Power Flow Systems," *Automatica*, 96: 127-133, 2018.
6. M. Williams, **J. Koeln**, H. Pangborn, A. Alleyne, "Dynamical Graph Models of Aircraft Electrical, Thermal, and Turbomachinery Components," *Journal of Dynamic Systems, Measurement, and Control*, 140(4), 2017.
7. **J. Koeln**, A. Alleyne, "Stability of Decentralized Model Predictive Control of Graph-based Power Flow Systems via Passivity," *Automatica*, 82: 29-34, 2017.
8. **J. Koeln**, A. Alleyne, "Optimal Subcooling in Vapor Compression Systems via Extremum Seeking Control: Theory and Experiments," *International Journal of Refrigeration*, 43: 14-25, 2014.
9. N. Jain, **J. Koeln**, S. Sundaram, A. Alleyne, "Partially-Decentralized Control of Large-Scale Variable-Refrigerant-Flow Systems in Buildings," *Journal of Process Control*, 24(6): 798-819, 2014.
10. K. McCarthy, P. McCarthy, N. Wu, A. Alleyne, **J. Koeln**, S. Patnaik, S. Emo, J. Cory, "Model Accuracy of Variable Fidelity Vapor Cycle System Simulations," *SAE Technical Paper* 2014-01-2140, 2014.
11. T. Munro, **J. Koeln**, A. Fassmann, R. Barnett, H. Ban, "Phase Change Heat Transfer and Bubble Behavior Observed on Twisted Wire Heater Geometries in Microgravity," *International Journal of Heat & Fluid Flow* 47: 21-30, 2014.
12. **J. Koeln**, J. Boulware, H. Ban, J.R. Dennison, "Observations on Braided Thin Wire Nucleate Boiling in Microgravity," *International Journal of Heat & Fluid Flow* 32(5): 973-981, 2011.

CONFERENCE
PUBLICATIONS**Peer-Reviewed Conference Papers**

1. V. Raghuraman, V. Renganathan, T. Summers, **J. Koeln**, "Hierarchical MPC with Coordinating Terminal Costs," *American Control Conference*, 2020, (Submitted).
2. **J. Koeln**, B. Hencsey, "Constrained Hierarchical MPC via Zonotopic Waysets," *American Control Conference*, 2019.

3. **J. Koeln**, A. Alleyne, "Two-Level Hierarchical Mission-Based Model Predictive Control," *American Control Conference*, 2018.
4. H. Pangborn, **J. Koeln**, A. Alleyne, "Passivity and Decentralized MPC of Switched Graph-Based Power Flow Systems," *American Control Conference*, 2018.
5. C. Aksland, **J. Koeln**, A. Alleyne, "A Graph-based Approach for Dynamic Compressor Modeling in Vapor Compression Systems," *Dynamic Systems and Control Conference*, 2017.
6. H. Pangborn, M. Williams, **J. Koeln**, A. Alleyne, "Graph-Based Hierarchical Control of Thermal Fluid Power Flow Systems," *American Control Conference*, 2017.
7. **J. Koeln**, M. Williams, H. Pangborn, A. Alleyne, "Experimental Validation of Graph-based Modeling For Thermal Fluid Power Flow Systems," *Dynamic Systems and Control Conference*, 2016.
8. **J. Koeln**, A. Alleyne, "Event-based Hierarchical Control of Power Flow in Vehicle Systems," *American Control Conference*, 2016.
9. **J. Koeln**, M. Williams, A. Alleyne, "Hierarchical Control of Multi-domain Power Flow in Mobile Systems - Part I: Framework Development and Demonstration," *Dynamic Systems and Control Conference*, 2015.
10. M. Williams, **J. Koeln**, A. Alleyne, "Hierarchical Control of Multi-domain Power Flow in Mobile Systems - Part II: Aircraft Application," *Dynamic Systems and Control Conference*, 2015.
11. B. Keating, **J. Koeln**, A. Alleyne, "Weiner Modeling of a Closed Loop Vapor Compression System for Extremum Seeking Controller Design," *Dynamic Systems and Control Conference*, 2015.
12. **J. Koeln**, A. Alleyne, "Scalable Model Predictive Control for Multi-Evaporator Vapor Compression Systems," *American Control Conference*, 2014.
13. **J. Koeln**, A. Alleyne, "Optimal Subcooling in Vapor Compression Systems via Extremum Seeking Control," *Dynamic Systems and Control Conference*, 2013.
14. **J. Koeln**, A. Alleyne, "Decentralized Controller Analysis and Design for Multi-Evaporator Vapor Compression Systems," *American Control Conference*, 2013.
15. **J. Koeln**, M. Kania, N. Jain, A. Alleyne, "Experimental Load Emulation for Multi-Evaporator Air Conditioning and Refrigeration Systems," *International Refrigeration and Air Conditioning Conference at Purdue*, 2012.
16. M. Kania, **J. Koeln**, A. Alleyne, K. McCarthy, N. Wu, S. Patnaik, "A Dynamic Modeling Toolbox for Air Vehicle Vapor Cycle Systems," *SAE Power Systems Conference*, 2012.
17. **J. Koeln**, J. Boulware, H. Ban, "Bubble Behavior in Nucleate Boiling Experiment Aboard the Space Shuttle," *AIAA International Student Conference at the 48th AIAA Aerospace Sciences Meeting*, 2010.
18. **J. Koeln**, "Thin Wire Nucleate Boiling of Water in Sustained Microgravity," *AIAA/USU Conference on Small Satellites*, 2009.

INVITED PRESENTATIONS

1. "Hierarchical Model Predictive Control: Bridging the Gap Between Theory and Practice," *Center for Control Science and Technology Seminar Series*, UT Dallas, Richardson, TX, October, 2019.
2. "Hierarchical Model Predictive Control for Energy Management," *Mechanical Engineering Graduate Seminar Series*, UT Dallas, Richardson, TX, September, 2018.
3. "Hierarchical Mission-based Model Predictive Control," *Air Force Research Lab (AFRL)*, Wright-Patterson Air Force Base, Dayton, OH, July, 2018.
4. "Hierarchical Control of Aircraft Electro-Thermal Systems," *Texas Systems Day*, UT Dallas, Richardson, TX, April, 2018.

5. "Boiling on NASAs Weightless Wonder: Exploring the Value of Undergraduate Research," *UT Dallas AIAA Lecture Series*, Richardson, TX, March, 2018.
6. "Hardware-In-The-Loop Testing of Electro-Thermal Control Systems," *Summer Meeting of the Center of Excellence for Integrated Thermal Management of Aerospace Vehicles (CITMAV)*, Purdue University, West Lafayette, IN, August, 2017.
7. "Advanced Control of Electro-Thermal Systems," *Utah State University, Department of Mechanical and Aerospace Engineering*, Logan, UT, March, 2017.
8. "Decentralized Modeling and Control of Energy Systems," *UC Berkeley, Department of Mechanical Engineering*, Berkeley, CA, February, 2017.
9. "Hardware-In-The-Loop Testing of Thermal Management Control," *Annual Meeting of the Center of Excellence for Integrated Thermal Management of Aerospace Vehicles (CITMAV)*, Honeywell, Torrance, CA, February, 2017.
10. "Advanced Control of Electro-Thermal Systems," *UT Dallas, Department of Mechanical Engineering*, Dallas, TX, February, 2017.
11. "Dynamic Aircraft Energy Management Optimization Tools," *Air Force Research Lab (AFRL)*, Wright-Patterson Air Force Base, Dayton, OH, May, 2015.
12. "Optimal Subcooling in VCS via Extremum Seeking Control," *GE Appliances and Lighting*, Louisville, KY, March, 2014.
13. "Vapor Compression Cycle Modeling and Validation using ATTMO Toolbox," *Air Force Research Lab (AFRL)*, Wright-Patterson Air Force Base, Dayton, OH, March, 2012.

TEACHING EXPERIENCE

Instructor, University of Texas at Dallas

MECH 3v95: System Dynamics Modeling and Control (Undergraduate)					
2019	Spring	12 students	Teaching Effectiveness: 4.9/5	Course Quality: 4.8/5	
2018	Fall	35 students	Teaching Effectiveness: 4.9/5	Course Quality: 4.7/5	
2018	Spring	43 students	Teaching Effectiveness: 4.5/5	Course Quality: 4.2/5	

Instructor, University of Illinois at Urbana-Champaign

ME 320: Heat and Mass Transfer (Undergraduate)					
2016	Spring	40 students	Teaching Effectiveness: 4.4/5	Course Quality: 4.2/5	

ADVISING AND MENTORING

University of Texas at Dallas:

PhD Students

1. **Wenqing (Wendy) Wang**, "Hierarchical Control for Constrained Multi-timescale Energy Management," Mechanical Engineering, August 2019 - Present.
2. **Daniel Dias Leister**, "Exploring Data Driven Algorithms to Model Nonlinear Systems for MPC Control," Mechanical Engineering, August 2019 - Present.
3. **Vignesh Raghuraman**, "Hierarchical Control for Constrained Multi-timescale Energy Management," Mechanical Engineering, August 2018 - Present.

Doctoral Dissertation Committee Member

1. **Yi Guo**, Mechanical Engineering, (Advisor: Prof. Tyler Summers).
2. **Jianping Lin**, Mechanical Engineering, (Advisor: Prof. Robert Gregg).
3. **Jonathan Horn**, Mechanical Engineering, (Advisor: Prof. Robert Gregg).

Undergraduate Senior Design Teams:

1. TEOS Delivery System, Texas Instruments, 2019.
2. Foot-Operated Virtual Reality Controller, Candora LLC, 2019.

UNIVERSITY/
DEPARTMENT
SERVICE

1. **Dynamic Systems and Control Standing Committee Member**, Department of Mechanical Engineering, UT Dallas, 2018 - Present.
2. **Undergraduate Program Standing Committee Member**, Department of Mechanical Engineering, UT Dallas, 2018 - Present.

SCHOLARLY
SERVICE

Invited Session Organizer

1. Energy Management in Aerospace Vehicles Invited Session, American Control Conference, 2019.
2. 5th Coordinated Science Laboratory Symposium on Emerging Topics in Control and Modeling, UIUC, 2013.

Session Chair

1. Aerospace Power Optimization Invited Session, Dynamic Systems and Control Conference, 2015.

Journal Reviewer: Automatica, Control Engineering Practice, IEEE Transactions on Control Systems Technology, IEEE Transaction on Automatic Control, IEEE Control Systems Letters, International Journal of Robust and Nonlinear Control, IEEE Robotics and Automation Letters, International Journal of Refrigeration, Journal of Energy Storage, Applied Thermal Engineering, Building and Environment, International Journal of Advanced Robotic Systems, ASHRAE, ASME Journal of Mechanical Design

Conference Reviewer: American Control Conference, ASME Dynamic Systems and Control Conference, IFAC World Congress

Review Panelist

National Science Foundation

2019

PROFESSIONAL
MEMBERSHIPS

- **Member** Institute of Electrical and Electronics Engineers (IEEE)
- **Member** IEEE Control Systems Society
- **Member** American Society of Mechanical Engineers (ASME)
- **Member** ASME Dynamic Systems and Control Division

OTHER
EXPERIENCE

- **NSF ERC Member:** Engineering Research Center for Power Optimization of Electro-Thermal Systems (POETS), UIUC, Champaign, IL, 2015-2017.
- **Research Consultant:** CU Aerospace, Champaign, IL, 2013-2017.
- **Research Intern:** Air Force Research Lab, Wright-Patterson Air Force Base, Dayton, OH, 2012.
- **Undergraduate Researcher:** Get Away Special (GAS) Space Research Team, Utah State University, Logan, UT, 2007-2011.