

# Matthew A. Williams

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## Education

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### **Ph.D. Mechanical Engineering**

University of Illinois at Urbana-Champaign, Urbana, IL

*Expected 2017*

*Dissertation Adviser:* Prof. Andrew Alleyne

*Field:* Control Systems, Dynamical Modeling, Stability Analysis

### **M.S. Mechanical Engineering**

University of Illinois at Urbana-Champaign, Urbana, IL

*May 2014*

*Thesis Title:* A Hierarchical Control Approach for Aircraft Thermal Systems

*Thesis Adviser:* Prof. Andrew Alleyne

### **B.S. Aerospace Engineering - summa cum laude**

University of Kansas, Lawrence, KS

*May 2012*

*Honors:* University of Kansas Honors, Aerospace Departmental Honors

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## Professional Experience

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### *Research Scientist*

CU Aerospace, Champaign, IL

*2013 – Present*

- Modeling of vapor compression energy systems for control oriented simulations.
- Developing advanced modeling and control tools for aircraft electro-thermal energy systems through a U.S. Air Force Small Business Innovation Research (SBIR) grant.

### *Contractor*

Air Force Research Lab, Wright-Patterson Air Force Base

*2015*

- Developed solutions for aircraft vehicle energy management of next-generation fighter aircraft.
- Analysis of hybrid and switching energy systems.

### *Undergraduate Researcher/Intern*

Wetzel Engineering, Lawrence, KS

*2010 – 2012*

- Designed asymmetric pitch control algorithms for loads reduction on utility scale wind turbines.
- Performed dynamic simulations with MATLAB/Simulink of wind turbines.
- Automated multiple design processes to greatly decrease component design timeframe.
- Analysis of wind turbine blade stress, fatigue and buckling.

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## Publications and Presentations

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### **Conference Proceedings with Full Paper**

- 1) Koeln, J. P., **Williams, M. A.**, Pangborn, H., Alleyne, A. G., "Experimental Validation of Graph-Based Modeling for Thermal Fluid Power Flow Systems," *Proc. of the 9<sup>th</sup> ASME Dynamic Systems and Control Conference*, Minneapolis, MN, USA, 2016. (*accepted*)
- 2) **Williams, M.**, Alleyne, A., Hency, B., "Hybrid Model Predictive Control of Multi-Compressor Vapor Compression Systems," *Proc. of the 2016 American Control Conference*, Boston, MA, USA, 2016.

- 3) Pollock, D., **Williams, M.**, Hency, B., "Model Predictive Control of Temperature-Sensitive and Transient Loads in Aircraft Vapor Compression Systems," *Proc. of the 2016 American Control Conference*, Boston, MA, USA, 2016.
- 4) Koeln, J. P., **Williams, M. A.**, Alleyne, A. G., "Hierarchical Control of Multi-Domain Power Flow in Mobile Systems – Part I: Framework Development and Demonstration," *Proc. of the 8<sup>th</sup> ASME Dynamic Systems and Control Conference*, Columbus, OH, USA, 2015.
- 5) **Williams, M. A.**, Koeln, J. P., Alleyne, A. G., "Hierarchical Control of Multi-Domain Power Flow in Mobile Systems – Part II: Aircraft Application," *Proc. of the 8<sup>th</sup> ASME Dynamic Systems and Control Conference*, Columbus, OH, USA, 2015.
- 6) **Williams, M.**, Sridharan, S., Banerjee, S., Mak, C., Pauga, C., Krein, P., Alleyne, A., Jacobi, A., D'Urso, S., "PowerFlow: a Toolbox for Modeling and Simulation of Aircraft Systems," *SAE AeroTech 2015*, Seattle, WA, USA, 2015.
- 7) **Williams, M. A.**, Alleyne, A. G., "Variable Fidelity Modeling in Closed Loop Dynamical Systems," *Proc. of the 7<sup>th</sup> ASME Dynamic Systems and Control Conference*, San Antonio, TX, USA, 2014.
- 8) **Williams, M. A.**, Alleyne, A. G., "Switched-Fidelity Modeling and Optimization for Multi-Physics Dynamical Systems," *Proc. of the 2014 American Control Conference*, Washington D.C., USA, 2014.
- 9) Sebes, J., VanSike, W., **Williams, M.**, McCandless, S., Worden, G., Brunkhorst, N., "Flight Testing and Evaluation of the Structural Response to Flight Loads of a Small Scale Unmanned Aerial System," AIAA 2012-2498, *AIAA Infotech Conference*, Garden Grove, California, 2012.
- 10) VanSike, W., **Williams, M.**, Statsny, T., Ghate, A., McCandless, S., Peckman, T. (2011), "Hawkeye UAV Dynamic Analysis," AIAA 2011-6520, *AIAA Modeling and Simulation Technologies Conference*, Portland, OR, 2011.

### Oral Presentations

- 1) "POETS Student Leadership Council Report," *POETS NSF ERC Annual Site Visit*, Urbana, IL, USA, 2016.
- 2) "Hierarchical Control of Thermal Systems," *NSF Power Optimization of Electro-Thermal Systems web seminar*, Urbana, IL, USA, 2016.
- 3) "Hierarchical Control of Multi-Domain Power Flow in Mobile Systems," *ASME Dynamic Systems and Control Conference*, Columbus, OH, USA, 2015.
- 4) "PowerFlow: a Toolbox for Modeling and Simulation of Aircraft Systems," *SAE AeroTech 2015*, Seattle, WA, USA, 2015.
- 5) "Hybrid Model Predictive Control for Multi-Compressor Vapor Compression Systems," *Air Force Research Lab Seminar Series*, Wright-Patterson Air Force Base, USA, 2015.
- 6) "Variable Fidelity Modeling in Closed Loop Dynamical Systems," *ASME Dynamic Systems and Control Conference*, San Antonio, TX, USA, 2014.
- 7) "A Hierarchical Control Strategy for Aircraft Thermal Systems," *University of Illinois at Urbana-Champaign, Mechanical Science and Engineering Qualifying Examination*, Urbana, IL, USA, 2014.
- 8) "Switched-Fidelity Modeling and Optimization for Multi-Physics Dynamical Systems," *American Control Conference*, Washington, D.C., USA, 2014.
- 9) "Jayhawk Jet 120," *Joint Propulsion Conference Undergraduate Team Engine Design Competition*, Atlanta, GA, USA, 2012.

- 10) "How Brazil Manages Energy Production with Environmental Stewardship," *University of Kansas, Senior SELF Capstone Lecture Series Part 2*, 2011.
- 11) "Automated Manufacturing Processes in Wind Turbine Blade Composites," *University of Kansas, Aerospace Engineering Materials and Manufacturing Processes*, 2011.
- 11) "The Development of the Brazilian Economy, Engineering and Energy Industries, and the Environmental Effects," *University of Kansas School of Engineering Dean's Advisory Board*, 2011.

### Poster Presentations

- 1) Pangborn, H., **Williams, M.**, Koeln, J., Alleyne, A., "Experimental Validation of Graph-Based Modeling for Thermal Management," *POETS Annual Site Visit*, 2016.
- 2) **Williams, M.**, Alleyne, A., "Hierarchical Control for Dynamic Energy Management," *University of Illinois, Mechanical Science and Engineering Research Poster Competition*, 2015.
- 3) **Williams, M.**, Alleyne, A., "Hierarchical Control for Dynamic Energy Management," *POETS NSF ERC Kick-Off*, 2015.
- 4) **Williams, M.**, "Automated Processes in Wind Turbine Blade Composites," *Aerospace Engineering Materials and Manufacturing Poster Session*, 2012.

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### Fellowships and Scholarships

National Science Foundation's Graduate Research Fellowship Program (NSF GRFP)	2013 – 2016
Mechanical Engineering Excellence Fellowship, University of Illinois	2012 – 2014
Tau Beta Pi National Fellowship	2012 – 2013
Phi Kappa Phi National Fellowship	2012 – 2013
Tau Beta Pi National Scholarship	2011 – 2012
Self Engineering Leadership Fellowship, University of Kansas, School of Engineering	2008 – 2012
University of Kansas Summerfield Scholar, University of Kansas	2008 – 2012
Engineering Dean's Scholar, University of Kansas, School of Engineering	2008 – 2012
Aerospace Engineering Department Fellowship, University of Kansas	2008 – 2012

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### Honors and Awards

2 <sup>nd</sup> Place University of Illinois Mechanical Science & Engineering Research Poster Competition	2015
National Science Foundation Graduate Research Fellowship Program	2013
Mechanical Engineering Excellence Fellowship, University of Illinois at Urbana-Champaign	2012
1 <sup>st</sup> Place AIAA/ASME Team Engine Design Competition, 2012 Joint Propulsion Conference	2012
Graduated with Highest Distinction from the University of Kansas (top 1% of graduating class)	2012
Graduated with Aerospace Engineering departmental honors	2012
Graduated with Honors from the University of Kansas	2012
1 <sup>st</sup> Place KU Engineering Student Council Senior Design Competition	2012
Phi Kappa Phi Fellow	2012
Tau Beta Pi Fellow	2012
KU Aerospace Engineering Outstanding Senior Award	2012
Phi Kappa Phi Honor Society, inducted	2011
KU Aerospace Engineering Outstanding Junior Award	2011
Tau Beta Pi Honor Society, inducted	2010

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## Leadership and Service

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### POETS Student Leadership Council

*President*

*2015 – Present*

- Currently presiding over the Student Leadership Council (SLC) for the Power Optimization of Electro-Thermal Systems (POETS), a National Science Foundation Engineering Research Center.
- Developing a webinar series for students to present their research to an audience with members from Stanford University, University of Illinois, University of Arkansas, Howard University, and industry.
- Developing new student orientation documents to help assimilate new students to the center.
- Planned and carried out the first annual POETS technical conference for students and industry – giving students the opportunity to present their POETS-related research to industry members and academics from multiple institutions.
- Presented a detailed Strengths, Weaknesses, Opportunities, and Threats report to members of NSF.

### ASME Energy Technical Committee

*Student Liaison*

*2014 – Present*

- Organized a student and professional networking lunch at the 2015 ASME Dynamical Systems and Control Conference.
- Organized a panel at the 2016 American Controls Conference for students interested in energy-related careers to seek advice from professionals in the energy fields.

### Engineering Graduate Student Advisory Committee

*2013 – 2014*

- Worked alongside other graduate students at the University of Illinois at Urbana-Champaign to help advise the College of Engineering on topics related to graduate student development and education.
- Helped develop a program to increase transparency in professor evaluations within the College of Engineering by allowing students to provide public feedback on courses in the College.

### Engineers without Borders Project Leader

*2009 – 2012*

- Project leader of international sanitation project in Azacilo, Bolivia.
- Organized an implementation team, arranged travel plans, and coordinated the building of eco-latrines for 27 families in Azacilo.
- Created cost estimates, secured funding, authored reports and made presentations for travel approval.
- Trained a subsequent project leader prior to my departure from the university and project.

### KU Self Engineering Leadership Fellows

*2008 – 2012*

- Actively participated in highly selective program to supplement curriculum and build skills in leadership, entrepreneurship, communication, interpersonal skills, management, business and engineering.
- Collaborated with other fellows in the planning, fund raising, and logistics of a project involving the in-country study of Brazil from an economic, energy, environmental and engineering point of view.

- Coordinated an event to showcase the School of Engineering on Family Weekend.
- Assisted in planning and organizing the KU School of Engineering annual High School Design competition for 45 teams.

KU School of Engineering Ambassador

2010 – 2012

- Provided potential incoming freshmen with tours, advice and tips to being a successful college student.
- Sat on question panels and help recruit students to the KU School of Engineering.
- Assisted with School of Engineering events such as High School Design, Scholars Day, & Senior Day.

Sigma Gamma Tau Honor Society

*President*

2010 – 2012

- President for 2011 – 2012 academic year.
- Set up tutoring sessions for Aerospace Engineering undergraduate students.
- Organized students to participate in community service activities around Lawrence.
- Planned presentations and activities about aerospace for elementary/middle school students.