

Justin M. Bradley

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curriculum vitae

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1 EDUCATION AND EMPLOYMENT HISTORY

1.1 Education History

University of Michigan Ann Arbor, MI
Ph.D., Aerospace Engineering August 2014
Thesis: Toward Co-Design of Autonomous Aerospace Cyber-Physical Systems
Adviser: Dr. Ella M. Atkins
Area of Study: Cyber-physical systems, dynamics and control

University of Michigan Ann Arbor, MI
M.S., Aerospace Engineering December 2012
Area of Study: Cyber-physical systems, dynamics and control

Brigham Young University Provo, UT
M.S., Electrical Engineering August 2007
Thesis: Particle Filter Based Mosaicking for Forest Fire Tracking
Adviser: Dr. Clark Taylor
Area of Study: Computer vision, UAS applications for fire tracking

Brigham Young University Provo, UT
B.S., Computer Engineering August 2005
Emphasis: embedded systems, electrical engineering

1.2 Employment History

University of Nebraska Lincoln, NE
• **Assistant Professor** August 2015–current
Computer Science and Engineering Department
• **Assistant Professor** Jan 2017–current
Mechanical and Materials Engineering Department (by courtesy)
• **Co-Director** August 2015–current
[Nebraska Intelligent MoBile Unmanned Systems \(NIMBUS\) Lab](#)

University of Michigan Ann Arbor, MI
• **Research Fellow (Postdoc)** August 2014–July 2015
Department of Aerospace Engineering

Lawrence Livermore National Laboratory Livermore, CA
• **Control System Software Engineer** September 2007–December 2009

2 RESEARCH ACCOMPLISHMENTS

2.1 Publication Record

The following subscripts are used to indicate student and other co-authors under my supervision:

1: Undergraduate student

2: Masters student

3: Ph.D. student

4: Postdoctoral researcher

2.1.1 Peer Reviewed Journal Publications in Print

- [1] R. D. Eubank, **J. M. Bradley**, and E. M. Atkins, “Energy-Aware Multi-Flight Planning for an Unattended Seaplane - Flying Fish,” *AIAA Journal of Aerospace Information Systems*, pp. 1–19, Dec 2016, (**Contribution: 50%**)
- [2] **J. M. Bradley** and E. M. Atkins, “Optimization and Control of Cyber-Physical Vehicle Systems,” *Sensors*, vol. 15, p. 23020, Sep 2015, (**Contribution: 70%**)
- [3] **J. M. Bradley** and E. M. Atkins, “Coupled Cyber-Physical System Modeling and Coregulation of a CubeSat,” *IEEE Transactions on Robotics*, vol. 31, pp. 443–456, April 2015, (**Contribution: 95%**)
- [4] **J. M. Bradley** and E. M. Atkins, “A Cyber-Physical Optimization Approach to Mission Success for Unmanned Aircraft Systems,” *Journal of Aerospace Information Systems*, vol. 11, pp. 48–60, January 2014, (**Contribution: 90%**)
- [5] **J. M. Bradley** and E. M. Atkins, “Toward Continuous State-Space Regulation of Coupled Cyber-Physical Systems,” *Proceedings of the IEEE*, vol. 100, pp. 60–74, January 2012, (**Contribution: 70%**)
- [6] **J. M. Bradley** and C. N. Taylor, “Georeferenced Mosaics for Tracking Fires Using Unmanned Miniature Air Vehicles,” *Journal of Aerospace Computing, Information, and Communication*, vol. 8, pp. 295–309, October 2011, (**Contribution: 70%**)

2.1.2 Peer Reviewed Journal Publications Submitted for Review

- [7] T. Shen, C. A. Nelson, and **J. M. Bradley**, “Design of a model-free cross-coupled controller for a notes robot,” *Journal of Intelligent and Robotic Systems*, Sep 2016, (**Contribution: 20%**)

2.1.3 Conference Proceedings: Peer Reviewed

- [1] X. Zhang³, S. Doebbeling², and **J. Bradley**, “Co-Regulation of Computational and Physical Effectors in a Quadrotor UAS (*accepted*),” in *2018 IEEE/ACM International Conference on Cyber-Physical Systems (ICCPS)*, April 2018, (**Contribution: 50%**)
- [2] A. Shankar, S. Doebbeling², and **J. Bradley**, “Toward a cyber-physical quadrotor: Characterizing trajectory following performance,” in *2017 International Conference on Unmanned Aircraft Systems (ICUAS)*, pp. 133–142, June 2017, (**Contribution: 30%**)
- [3] E. Foruzan², S. Asgarpoor, and **J. M. Bradley**, “Hybrid system modeling and supervisory control of a microgrid,” in *2016 North American Power Symposium (NAPS)*, pp. 1–6, Sept 2016. Denver, CO, (**Contribution: 30%**)

- [4] **J. M. Bradley**, M. L. Clark, E. M. Atkins, and K. G. Shin, “Mission-Aware Cyber-Physical Optimization on a Tabletop Satellite,” in *AIAA Infotech@Aerospace*, (Boston, MA), August 2013, (**Contribution: 80%**)
- [5] E. M. Atkins and **J. M. Bradley**, “Aerospace Cyber-Physical Systems Education,” in *AIAA Infotech@Aerospace*, (Boston, MA), August 2013, (**Contribution: 30%**)
- [6] **J. M. Bradley** and E. M. Atkins, “Multi-Disciplinary Cyber-Physical Optimization for Unmanned Aircraft Systems,” in *AIAA Infotech@Aerospace*, (Garden Grove, CA), June 2012, (**Contribution: 70%**)
- [7] **J. M. Bradley** and E. M. Atkins, “Computational-Physical State Co-Regulation in Cyber-Physical Systems,” in *ACM/IEEE Conference on Cyber-Physical Systems*, (Chicago, IL), ACM/IEEE, April 2011, (**Contribution: 70%**)
- [8] **J. M. Bradley** and C. N. Taylor, “Particle Filter Based Mosaicking for Tracking Forest Fires,” in *AIAA Conference on Guidance, Navigation, and Control*, (Hilton Head, SC), August 2007, (**Contribution: 70%**)
- [9] A. Rodriguez, E. Andersen, **J. M. Bradley**, and C. N. Taylor, “Wind Estimation Using an Optical Flow Sensor on a Miniature Air Vehicle,” in *AIAA Conference on Guidance, Navigation, and Control*, vol. 6614, (Hilton Head, SC), August 2007, (**Contribution: 30%**)
- [10] **J. Bradley**, B. Prall, R. Beard, and C. Taylor, “An Unmanned Aerial Vehicle Project For Undergraduates,” in *The Forty-Second Annual International Telemetry Conference and Technical Exhibition*, vol. 42, (San Diego, CA), pp. 563–572, International Foundation for Telemetry, October 2006, (**Contribution: 60%**)
- [11] R. Holt, J. Egbert, **J. Bradley**, R. Beard, C. Taylor, and T. McLain, “Forest Fire Monitoring Using Multiple Unmanned Air Vehicles,” in *The Eleventh Forest Service Remote Sensing Applications Conference*, vol. 1, (Salt Lake City, UT), pp. 54–66, American Society for Photogrammetry and Remote Sensing, April 2006, (**Contribution: 20%**)

2.1.4 Conference Proceedings Under Review

- [12] U. Acharya, S. Kunde, L. Hall¹, B. Duncan, and **J. Bradley**, “Inference of User Qualities in Shared Control (*under review*),” in *2018 IEEE International Conference on Robotics and Automation*, April 2018, (**Contribution: 70%**)

2.1.5 Invited Talks/Keynote Speeches

1. “A Cyber-Physical Quadrotor,” University of Nebraska - Lincoln Department of Mathematics Continuum Mechanics Seminar. Lincoln, NE. Sponsor: Petronela Radu. Sept 21, 2017
2. “A Cyber-Physical Quadrotor,” Colorado State University Computer Science Department BMAC Colloquium. Fort Collins, CO. Sponsor: Hamidreza Chitsaz. April 3, 2017

2.1.6 Other Publications

- [1] **J. M. Bradley** and E. M. Atkins, “Position Paper: Cyber-Physical Systems,” tech. rep., NIST Foundations for Innovation in Cyber-Physical Systems Workshop, Chicago, IL, March 2012
- [2] **J. M. Bradley** and E. M. Atkins, “Co-Regulation of Cyber Physical Systems,” tech. rep., 2011 Automotive CPS Workshop, Troy, MI, February 2011

2.2 Grantsmanship Record

2.2.1 Internally Funded Research Grants

1. UNL Undergraduate Creative Activities and Research Experiences Program (UCARE), *Integration of Unmanned Aircraft System Vehicles of UNL's NIMBUS Lab into a commercial simulator*, Sept 2016 - April 2017, \$2,400, PI: Bradley, Student PI Shreya Rawal.

2.2.2 Externally Funded Research Grants

1. National Strategic Research Institute. *Proposal to Support the United States Strategic Command: Detection of Nuclear Threats Using Deployable Sensors*, Total: \$469,293 (Direct Funds: \$18,480), Feb 2017 - Sep 2017, PI: Detweiler, Co-PI: Bradley, Elbaum, Duncan, NSRI #17-FU903-00, SAP WBS: 26-0511-0162-001

Description: Development of a mechanism to emplace sensors using a sUAS, as well as testing and demonstration of the system.

2. USDA National Institute of Food and Agriculture (National Robotics Initiative) *NRI: RUI: Collaborative Research: At the Water's Edge - Installation and Optimization of Robotic Sensing Systems*, Total: \$949,716, UNL: \$635,230 (Direct Funds: \$259,959), Sept 2016 - Aug 2019, PI (UNL): Detweiler, PI (University of the Pacific): Basha, Co-PI (UNL): Bradley, USDA-NIFA #2017-67021-25924, SAP WBS: 25-0511-0157-010

Description: Robot systems currently lack the capabilities required to collect the needed information in complex environments such as wetlands systems. This work addresses this through the development of techniques to optimize selection of the robot systems and sensors based on environmental and system constraints, which is broadly applicable to many heterogeneous robot-sensor systems.

3. National Science Foundation (National Robotics Initiative), *NRI: Enabling UAS Fire Ignitions in Complex Firefighting Contexts*, Total: \$995,470 (Direct Funds: \$203,277), Sept 2016 - Aug 2019, PI (UNL): Elbaum, Co-PIs (UNL): Bradley, Detweiler, Duncan, Twidwell, NSF-1638099, SAP WBS: 25-0511-0152-004.

Description: Development of a sUAS for igniting prescribed burns through exploration of five activities, of which she will focus on the motion-based languages that communicate UAS intention and knowledge to operators and bystanders. Broader Impacts: A group of approximately 50 fire managers will be exposed to the technology, trained through field trials; the work will also reach a broader community through the planned participation in workshops and the curation of the collected data and experiences, which will be made available online.

4. NASA Nebraska Space Grant, *Strengthen NASA Collaborations for EPSCoR Proposal, NASA Nebraska Space Grant Mini-Grant*, Total: \$1,410 (Direct Funds: \$1,410), PI: Bradley, January 1, 2016 - February 29, 2016, SAP WBS: 26-0511-0137-001

Description: This proposal was to obtain funding to travel to NASA Ames to strengthen collaborations for the NASA EPSCoR proposal to be submitted in March 2016.

2.2.3 Externally Funded Research Grants Submitted

1. National Strategic Research Institute. *Proposal to Support the United States Strategic Command: COTS Autonomous Tracking and Indicating Prototype*, Total: \$625,249, Dec 2017 - Dec 2018, PI:

Detweiler, Co-PI: Bradley, Elbaum, Duncan, NSRI #17-FU903-00, SAP WBS: 26-0511-0162-001
Recommended for funding

Description: Increasing endurance, decreasing perception, and developing novel deployment mechanisms for the sUAS sensor emplacement system.

2. Amazon Research Awards, *CORECON: CO-REGulating CONsensus for Multi-Robot Motion Control*, Total: \$80,000, Jan 2018 - Dec 2018, PI: Bradley
3. National Science Foundation. *REU Site: Undergraduate Research Opportunities in Unmanned Systems Foundations and Applications*. Total: \$352,665, Jun 2018 - Jun 2021, PI: Elbaum, Co-PI: Detweiler, Duncan, Bradley, **Recommended for funding**.

Description: Attract, train, and retain the next generation of computer science, computer engineering, and robotics researchers by providing a Research Experience for Undergraduates.

2.2.4 Externally Research Grants Submitted but not Funded

1. National Science Foundation, *NRI: INT: Intelligent multi-robot framework (iMRF) development for the deployment of field usable heterogeneous Un-manned Agricultural Ground Vehicle (UAGV) Swarm*, Total: \$1,196,061, Aug 2017 - July 2020, PI (UNL): Pitla, Co-PIs (UNL): Bradley, Ge, Luck, Nemala
2. National Science Foundation, *NRI: INT: We're All Getting Older: Integrating Co-robots into Medical Care Environments for Aging Populations*, Total: \$598,385, July 2017 - June 2021, PI (UNL): Duncan, Co-PIs (UNL): Bradley, Co-PIs (UNMC): Wolfson
3. NASA EPSCoR, *CubuloNIMBUS: Developing Cyber-Physical CubeSat Capabilities in Nebraska*, \$750,000, Sept 2017 - Aug 2020, PI (UNL): Bradley, Co-PI (UNL): Detweiler, March 21, 2017
4. National Science Foundation EXPERIMENTAL EXPEDITIONS pre-proposal, *Collaborative Research: An Expedition to Mars: Clean Slate Design for an Extraterrestrial Internet of Everything*, Requested: \$1,980,739, PI (UNL): Ramamurthy, Co-PI (UNL): Bradley, Submitted: May 2, 2016
5. National Science Foundation, *CPS: Breakthrough: Improving Users' Trust in and Adoption of CPS via User-Infused Co-Design*, Requested: \$499,566 (Direct Funds: \$249,783), Jan 2017 - Dec 2020, PI (UNL): Bradley, Co-PI (UNL): Duncan, Submitted Jun 7, 2016.
6. NASA EPSCoR, *A Cyber-Physical Earth-Observing CubeSat: CubuloNIMBUS*, Requested: \$750,000 (Direct Funds: \$612,035), Sept 2016 - Aug 2019, PI (UNL): Bradley, Co-PI (UNL): Wang, Nguyen, Co-I (UNO): Nero, Submitted: March 21, 2016.
7. National Science Foundation, *CRII: CPS: Co-Design of Cyber-Physical Systems: Focus on Co-Regulation*, Requested: \$174,998 (Directed Funds: \$174,998), Jun 2016 - May 2017, PIs: Bradley, Submitted: Sept 30, 2016
8. UNL Laymen Seed, *A Cyber-Physical CubeSat: CubuloNIMBUS*, Requested: \$20,000, PI: Bradley, Submitted: Nov 13, 2015.
9. National Science Foundation, *CPS: Synergy: Strongly Coupled Cyber-Physical Systems for Unmanned Aircraft Systems*, \$650,814, Jan 1, 2016 - Dec 31, 2019, PI (UNL): Bradley, Co-PI (UNL): Elbaum, PI (Michigan): Atkins, Submitted: May 4, 2015.

2.3 Research Patents and Awards

2.3.1 Regional and Local Research Awards and Recognition

1. Selected to participate in 2015–2016 Research and Development Fellows Program

2.4 Other Research Accomplishments

2.4.1 Infrastructure Available to Community

- **Nebraska Intelligent MoBile Unmanned Systems (NIMBUS) Lab**

The NIMBUS Lab has the systems and facilities to develop and prototype hardware and algorithms on Unmanned Aircraft Systems (UASs) as well as other robot platforms. These facilities are highlighted on department tours and are used by a number of faculty and students (<http://nimbus.unl.edu>).

3 TEACHING ACCOMPLISHMENTS (OTHER THAN CLASSROOM INSTRUCTION)

3.1 PhD Students

3.1.1 PhD Students Currently in Progress

1. William (Mike) Turner Aug 2017–current
 - Computer Engineering
 - Co-advised with Brittany Duncan
 - 50% funding
 - Expected graduation: Aug 2021
2. Xinkai Zhang July 2017–current
 - Electrical Engineering
 - 100% funding
 - Expected graduation: Aug 2019
3. Chandima Fernando Jan 2017–current
 - Computer Science
 - Co-advised with Carrick Detweiler
 - 100% funding
 - Expected graduation: May 2021
4. Adam Plowcha Jun 2016–current
 - Computer Science
 - Co-advised with Carrick Detweiler
 - 50% funding
 - Expected graduation: Aug 2021

3.2 MS Students

3.2.1 MS Students (thesis option)

1. Seth Doebbeling Nov 2015–Jun 2017
 - Mechanical Engineering
 - 100% funding
 - Graduation: Aug 2017

3.2.2 MS Students (thesis option) Currently in Progress

1. Marc Lussier Oct 2017–current
 - Mechanical Engineering

- Co-advised with Carrick Detweiler
 - 100% funding
 - Expected graduation: Aug 2020
2. Zhexiong Shang Aug 2017–current
- Computer Science (PhD student in Architecture)
 - 0% funding
 - Expected graduation: Aug 2018
3. Balaji Balasubramaniam Aug 2016–current
- Computer Science
 - Co-advised with Sebastian Elbaum
 - 50% funding
 - Expected graduation: Aug 2018

3.3 Undergraduate Students

3.3.1 Undergraduate Students Supervised in Independent Research Study

1. Brady Klein Jan 2018–current
- 10 hours per week during semesters, 40 hours per week during summer
 - Funded by Bradley
2. Lucas Hall Jan 2017–current
- 10 hours per week during semesters, 40 hours per week during summer
 - Funded by Bradley
3. Liam Kruse Jan 2017–current
- 10 hours per week during semesters, 40 hours per week during summer
 - Funded by Bradley
4. Shreya Rawal May 2016–current
- Funded by UNL UCARE Award for Fall 2016 - Spring 2017

3.4 Other Student Mentoring

3.4.1 Regular Informal Mentoring

1. Ajay Shankar (control, real-time systems, 2015–current)
2. Nishant Sharma (control, real-time systems, 2015–current)

3.4.2 Dissertation and Thesis Committees

- Fujuan Guo, PhD Student, Computer Science and Engineering, UNL (PhD in progress)
- Lizhi Qu, PhD Student, Electrical and Computer Engineering, UNL (PhD in progress)
- Tyler Troyer, MS Student, Biological Systems Engineering, UNL (MS Fall 2017)
- Willie Wells, MS Student, Computer Science and Engineering, UNL (MS Fall 2016)

4 TEACHING ACCOMPLISHMENTS (IN CLASSROOM)

4.1 Courses Developed

CSCE 936: Cyber-Physical Systems (formerly CSCE 990)

This course introduces students to the research, design, and analysis of cyber-physical systems - the tight integration of computing, control, and communication. Applications for CPS research are far reaching and span medical devices, smart buildings, vehicle systems, and mobile computing. The application domain for this course will be cyber-physical (aerospace) vehicle systems though techniques are more broadly applicable. Control theory, real-time systems, automata, guidance, and planning will be discussed.

CSCE 496/896: Real-Time Systems

This course introduces students to the design of real-time computing systems and corresponding theory. Real-time systems applications typically involve safety or mission critical systems where timing guarantees must be maintained. Real-time task design, dependability, communication, power and energy awareness, scheduling, and real-time control are some of the topics that will be covered. The course will be biased toward real-time system design including the interactions between the physical and real-time systems - dubbed “cyber-physical systems.”

4.2 Courses Taught

- CSCE 496/896: Real-Time Systems Spring 2018
 17 students
 Instructor Effectiveness Rating: (in progress)
- CSCE 936: Cyber-Physical Systems Fall 2017
 7 students (1 MECH, 1 ELEC, 1 CENG, 4 COMP)
 Instructor Effectiveness Rating: mean 4.64/5.00, std. dev 0.59
- CSCE 496/896: Real-Time Systems Spring 2017
 13 students (3 MECH, 1 HUMS, 5 CENG, 3 COMP, 1 ELEC)
 Instructor Effectiveness Rating: mean 4.93/5.00 std. dev. 0.26
- CSCE 990: Cyber-Physical Systems Fall 2016
 13 students (1 MECH, 1 HUMS, 2 CENG, 10 COMP)
 Instructor Effectiveness Rating: mean 4.49/5.00, std. dev 0.71
- CSCE 496/896: Real-Time Systems Spring 2016
 14 students (1 MECH, 3 ELEC, 2 CENG, 7 COMP, 1 ABSE)
 Instructor Effectiveness Rating: mean 4.62/5.00, std. dev 0.63
- CSCE 990: Cyber-Physical Systems Fall 2015
 9 students (3 MEAM, 1 ELEC, 3 ENGR, 2 COMP)
 Instructor Effectiveness Rating: mean 4.77/5.00, std. dev. 0.50

4.3 Teaching Innovations

- Introduced new course: “Cyber-Physical Systems” Computer Science and Engineering 936 University of Nebraska, Fall 2015.
- Transitioned two research projects started in CSCE 990 into publications.
- Developed labs to help students develop real-time systems programming skills using a small mobile robot. These new labs were introduced Spring 2017 semester.

5 SERVICE ACCOMPLISHMENTS

5.1 Professional Service

5.1.1 *Journal Paper Reviewer*

1. IEEE Transactions on Wireless Communications (2016, 2017)
2. MDPI Sensors (2017)
3. IEEE Access (2017)
4. AIAA Journal of Aerospace Information Systems (2014, 2015)
5. MDPI Applied Sciences (ISSN 2076-3417) (2016)

5.1.2 *Conferences Paper Reviewer*

1. AIAA SciTech (2018)
2. IEEE/ACM International Conference on Cyber-Physical Systems (2017, 2018)
3. IEEE International Conference on Robotics and Automation (ICRA) (2016, 2017, 2018)
4. IEEE International Conference on Intelligent Robots and Systems (IROS) (2016, 2017)
5. AIAA Infotech@Aerospace (2015)

5.1.3 *Leadership Positions in International and National Organizations*

1. Technical Program Committee, ACM/IEEE International Conference on Cyber-Physical Systems, 2017, 2018
2. Intelligent Systems Technical Committee, AIAA, 2017–current

5.1.4 *Memberships in Professional Organizations*

1. ACM Member, since 2015
2. IEEE Senior Member, since 2011
3. AIAA Senior Member, since 2007
4. Member, Eta Kappa Nu (HKN) Electrical Engineering Honor Society, since 2005

5.1.5 *Research Review Panels*

1. National Science Foundation Review Panel, 2017
2. National Institute of Health Review Panel, 2017
3. National Science Foundation Review Panel, 2016

5.2 College Service

5.2.1 *Leadership Positions on College Wide Committees*

1. Robotics Minor Committee, 2016–current, Chair

5.2.2 *Membership Positions on College Wide Committees*

1. Robotics Minor Committee, 2015–current, member

5.3 Unit Service

5.3.1 Leadership Positions on Unit Committees

1. ACM Programming Contest, Fall 2016–current, Chair

5.3.2 Membership Positions on Unit Committees

1. Graduate Admissions Committee, 2015–2017, member
2. Graduate Recruiting and Outreach Committee, 2015–2016, member

5.4 Other Service Accomplishments

- Organized National Robotics Week where public can come tour robotics labs at UNL, April 2016
- Judge for College of Engineering Graduate Poster Competition, University of Nebraska - Lincoln, Spring 2016
- Faculty Panelist, CSE Graduate Recruitment Day, University of Nebraska, Lincoln, NE, USA, November 5, 2016.
- Faculty Panelist, Ama-CSE-ing Race (Spring Recruitment), University of Nebraska, Lincoln, NE, USA, March, 12, 2016.
- Faculty Panelist, CSE Graduate Recruitment Day, University of Nebraska, Lincoln, NE, USA, November 14, 2015.
- Student travel grant reviewer, University of Nebraska - Lincoln, Spring 2016

5.5 Other Accomplishments

- 2017-2018 Sponsored a Design Studio project in which the team developed a testbed for a fleet of virtual and real CubeSats in which cooperative control algorithms could be tested.