Levi D. DeVries

United States Naval Academy
Annapolis, MD, USA
✉ *devries@usna.edu*

CURRICULUM VITAE

I have read the following and certify that this curriculum vitae is a current and accurate statement of my professional record.

Signature: Date: September 8, 2016

Personal Information

Department, Weapons and Systems Engineering, United States Naval Academy.

Current Rank, Assistant Professor.

Start Date of Appointment, August 12, 2014.

Education

8/09–5/14 **Ph.D.**, *University of Maryland*, College Park, MD.
Department of Aerospace Engineering
Advisor: Dr. Derek A. Paley
Major Concentration: Flight Dynamics, Stability, and Control
Minor Concentration: Space Systems

8/05–5/09 **B.A.**, *Concordia College*, Moorhead, MN.
Double Major in Physics and Mathematics, *summa cum laude*

Research

8/14-present **Assistant Professor**, *Department of Weapons and Systems Engineering*, *United States Naval Academy*, Annapolis, MD.

- Current research projects include:
  - Modeling, design and control synthesis of an appendage-free, flexible hull, autonomous underwater vehicle
  - Observability of multi-agent systems
  - Coordinated control of multi-vehicle systems across the air, sea, and ground domains
  - Event- and self-triggered control for coordination of multi-vehicle systems in communication limited environments

5/10–5/14 **Graduate Research Assistant**, *Collective Dynamics and Control Laboratory*, *University of Maryland, Department of Aerospace Engineering*, College Park, MD.

- Research topics include:

- Design of theoretically justified multi-vehicle feedback control algorithms for adaptive sampling and estimation of strong flow fields using autonomous systems.
- Optimization of distributed sensor placements for flow sensing by an unmanned underwater vehicle.
- Estimation of the underwater environment via bio-inspired hydrodynamic sensing for improved guidance and navigation, and increased autonomy of unmanned systems.

◦ Research disciplines include:

Nonlinear estimation	Nonlinear observability	Nonlinear control
Optimal control	Design optimization	Adaptive sampling
Dynamical systems	Multi-vehicle control	Autonomous systems

4/08 – 9/08 **Undergraduate Research Assistant**, *Entomology Department*, *North Dakota State University*, Fargo, ND.

4/07 – 9/07 **Undergraduate Research Assistant**, *Concordia College Hypervelocity Dust Accelerator*, *Concordia College*, Moorhead, MN.

Teaching

8/14–present **Instructor**, *Department of Weapons and Systems Engineering*, United States Naval Academy.

Courses taught include:

Fall 2016 **Linear Control Systems (ES305), Course Coordinator**.

ES305 is an introduction to classical control systems, which comprises the mathematical modeling, time and frequency response analysis, and design of PID compensators. Major topics include modeling physical systems with equations of motion, analysis of 1^{st} and 2^{nd} order systems, root locus, and compensator and gain design. Material is supported by a series of laboratory projects that incorporate classroom concepts to design and implement control algorithms on physical systems. At the completion of this course, students will be able to:

1. Model, identify, and verify a mathematical model of simple mechanical, electrical, and electro-mechanical systems
2. Analyze/predict the response of a linear system to a step input
3. Design and implement a linear control system to meet given specifications on the step response

Spring 2016: **Introduction to Mechatronics (ES202), Course Coordinator**.
ES202 is the second course in systems engineering and introduces concepts from control theory, instrumentation, and mechatronics, offering students a practical, hands-on introduction to these topics through the use of projects and laboratory exercises. Major topics include programming in MATLAB and C/C++, circuits, sensors, and actuators, and simple mechanisms. Upon completion of this course, students will be able to:

1. understand the tools and techniques of systems engineering
2. understand the differences between open and closed loop control systems
3. define terminology related to data, including accuracy, precision, sensitivity, resolution, linearity, error, deviation and uncertainty
4. design and build an operating circuit system using a breadboard and components
5. discuss the criteria for selecting a sensor for a particular measurement
6. understand and work with hardware and software related to:
   (a) standard laboratory and test equipment
   (b) MATLAB and Simulink
   (c) C programming language
   (d) microcontrollers
   (e) power supplies
   (f) analog sensors (resistive, inductive, capacitive)
   (g) integrated circuits

Fall 2015 **Linear Control Systems (ES305)**.
ES305 is an introduction to classical control systems, which comprises the mathematical modeling, time and frequency response analysis, and design of PID compensators. Major topics include modeling physical systems with equations of motion, analysis of 1^{st} and 2^{nd} order systems, root locus, and compensator and gain design. Material is supported by a series of laboratory projects that incorporate classroom concepts to design and implement control algorithms on physical systems. At the completion of this course, students will be able to:

1. Model, identify, and verify a mathematical model of simple mechanical, electrical, and electro-mechanical systems
2. Analyze/predict the response of a linear system to a step input
3. Design and implement a linear control system to meet given specifications on the step response

Spring 2015 **Introduction to Mechatronics (ES202)**.
ES202 is the second course in systems engineering and introduces concepts from control theory, instrumentation, and mechatronics, offering students a practical, hands-on introduction to these topics through the use of projects and laboratory exercises. Major topics include programming in MATLAB and C/C++, circuits, sensors, and actuators, and simple mechanisms. Topics Include:

1. To foster an understanding of the tools and techniques of systems engineering
2. Explain the fundamentals understanding of open and closed control systems
3. Define the terminology related to data, including accuracy, precision, sensitivity, resolution, linearity, error, deviation and uncertainty
4. Design and build an operating circuit system using a breadboard and components
5.
6. Discuss the criteria for selecting a sensor for a particular measurement
7. To provide and promote experience and proficiency with:
   (a) Standard laboratory and test equipment
   (b) MATLAB dynamic simulation capabilities
   (c) C programming language
   (d) Microcontroller hardware, firmware and software
   (e) Power supplies
   (f) Analog sensors (resistive, inductive, capacitive)

Fall 2014 **Linear Control Systems (ES305)**.
ES305 is an introduction to classical control systems, which comprises the mathematical modeling, time and frequency response analysis, and design of PID compensators. Major topics include modeling physical systems with equations of motion, analysis of 1^{st} and 2^{nd} order systems, root locus, and compensator and gain design. Material is supported by a series of laboratory projects that incorporate classroom concepts to design and implement control algorithms on physical systems.

9/13–12/13 **Instructor**, *University of Maryland*, Department of Aerospace Engineering.
ENAE 301: Dynamics of Aerospace Systems. Introduction to particle and rigid body dynamics with emphasis on Newtonian methods

1/10–5/10 **Graduate Teaching Assistant**, *University of Maryland*, Department of Aerospace Engineering.
ENAE 432, Control of Aerospace Systems. Duties include: grading assignments, providing guidance during weekly office hours, proctoring exams

8/09–12/09 **Graduate Teaching Assistant**, *University of Maryland*, Department of Aerospace Engineering.
ENAE 283, Introduction to Flight. Duties include: substitute lecturing, designing and grading homework assignments, and proctoring exams

1/09–5/09 **Undergraduate Teaching Assistant**, *Concordia College*, Physics Department.
PHYS 111-112, General College Physics I and II. Duties include: providing lab and homework assistance and leading supplementary review sessions.

Mentoring and Advising

8/13–present **Graduate Mentor**, *Collective Dynamics and Control Laboratory*, Provided academic guidance for undergraduate student completing research on dynamical systems project and assisted in preparation of a publication for the 2013 AIAA Region I Young Professional, Student, and Education Conference's student paper competition.

5/12 – 8/12 **Graduate Mentor**, *Miniature Robotics Research Experiences for Undergraduates (REU)*, Provided guidance for undergraduate research in miniature robotics.

Research Publications

Chapters in Books

[1] D. A. Paley, L. DeVries, and N. Sydney. Data-driven routing of autonomous vehicles for distributed estimation of spatiotemporal fields. [*Submitted*]

Articles in Refereed Journals

[6] L. DeVries and M. D. M. Kutzer. Bio-inspired, Shape-adapting Underwater Vehicle: Design, Modeling, and Speed Regulating Control via Shape Actuation. *Submitted*

[5] L. DeVries and D. A. Paley. Wake Sensing and Estimation for Control of Autonomous Aircraft in Formation Flight. *AIAA J. Guidance, Control, and Dynamics*, 39(1):32-41, 2015.

[4] L. DeVries, F. D. Lagor, H. Lei, X. Tan, and D.A. Paley. Distributed flow estimation and closed-loop control of an underwater vehicle with a multi-modal artificial lateral line. *Bioinspiration and Biomimetics*, 10(2):025002, 2015.

[3] F. D. Lagor, L. D. DeVries, K. M. Waychoff and D. A. Paley. Bio-inspired flow sensing and control: Autonomous rheotaxis using distributed pressure measurements. *Journal of Unmanned System Technologies*, 1(3):78–88, 2013.

[2] L. DeVries, S. J. Majumdar, and D. A. Paley. Observability-based optimization of coordinated sampling trajectories for recursive estimation of a strong, spatially-varying flowfield. *Journal of Intelligent and Robotic Systems*, 67(3–4), 2012.

[1] L. DeVries and D. A. Paley. Multi-vehicle control in a strong flowfield with application to hurricane sampling. *Journal of Guidance, Control, and Dynamics*, vol. 35, no. 3, pp. 794–806, May–June 2012.

Refereed Conference Papers

[8] K. S. Galloway and L. DeVries. State Observation and Parameter Estimation in Cyclic Pursuit Systems. Accepted for publication in Proc. of the *Conference on Decision and Control*, 2016.

[7] L. DeVries and M. D. M. Kutzer. Kernel design for coordination of autonomous, time-varying multi-agent configurations. In *Proc. of the American Control Conference (ACC)*, Boston, Massachusetts, July 2016.

[6] F. D. Lagor, L. DeVries, K. Waychoff, and D. A. Paley. Bio-inspired flow sensing and control for autonomous underwater navigation using distributed pressure measurements. In *Proc. 18th Int. Symp. Unmanned Untethered Submersible Tech.*, Portsmouth, New Hampshire, August 2013.

[5] L. DeVries and D. A. Paley. Wake Estimation and Dynamic Control for Autonomous Aircraft in Formation. In: *Proc. AIAA Conf. Guidance, Navigation, and Control*, Boston, Massachusetts, August 19–22, 2013.

[4] L. DeVries and D. A. Paley. Observability-based Optimization for Flow Sensing and Control of an Underwater Vehicle in a Uniform Flowfield. Invited Session on vehicle control and estimation in the undersea environment, *American Control Conference*, Washington, DC, June 17–19, 2013.

[3] L. DeVries and D. A. Paley. Dynamic Altitude Control for Motion Coordination in an Estimated Shear Flow. In: *Proc. AIAA Conf. Guidance, Navigation, and Control*, Minneapolis, Minnesota, August 13–16, 2012.

[2] L. DeVries, S. J. Majumdar, and D. A. Paley. Observability-based Optimization of Coordinated Sampling Trajectories for Flowfield Estimation. In: *Proc. International Conference of Unmanned Aircraft Systems*, Philadelphia, Pennsylvania, June 12–15, 2012.

[1] L. DeVries and D. A. Paley. Multi-vehicle Control in a Strong Flowfield with Application to Hurricane Sampling. In: *Proc. AIAA Conf. Guidance, Navigation, and Control*, number AIAA-2011-6478, Portland, Oregon, August 8–11, 2011.

Posters/Abstracts

Invited Talks

[2] L. DeVries and D. A. Paley. Observability-based Optimization of Controlled Sampling Formations for Flowfield Estimation. *Special Session on Data Assimilation Applied to Controlled Systems, 2014 Spring Eastern Sectional Meeting of the American Mathematical Society*, Baltimore, MD, 29-30 March 2014.

[1] L. DeVries. In air, water, and on land: Robotics research at the Collective Dynamics and Control Laboratory. *Robotics Workshop, 2013 American Controls Conference*, Washington, DC, 16 June 2013.

Invited Posters

[1] L. DeVries, F. D. Lagor, and D. A. Paley. Autonomous Underwater Vehicle Control using Bio-Inspired Flow Sensor Arrays. Invited workshop: "Biologically Inspired Strategies for Hybrid and Multi-model Locomotion", *IEEE/RSJ International Conference on Intelligent Robots and Systems*, Tokyo, Japan, 3 November 2013.

Posters

[3] L. DeVries, D. Koch, S. J. Majumdar, and D. A. Paley. Collaborative Research: Observability-based Optimization of Targeted Observations in Tropical Cyclones using Unmanned Aircraft. *NSF CMMI Research and Innovation Conference 2012*, Boston, Massachusetts, 9 July 2012.

[2] L. DeVries, A. Maki, D. Koch, S. J. Majumdar, and D. A. Paley. Targeting Observations of Tropical Cyclones using Cooperative Control of Unmanned Aircraft. *National Control Engineering Workshop 2011*, College Park, Maryland, 28 April 2011.

[1] L. DeVries, A. Maki, D. Koch, S. J. Majumdar, and D. A. Paley. Collaborative Research: Targeting Observations of Tropical Cyclones using Cooperative Control of Unmanned Aircraft. *NSF CMMI Research and Innovation Conference 2011*, Atlanta, Georgia, 5 January 2011.

Refereed Abstracts

[3] D. A. Paley, L. DeVries, and N. Sydney. Distributed control and optimization for spatiotemporal sampling. *SIAM Dynamical Systems Conference 2013*, Snowbird, Utah, May 19–23, 2013.

[2] L. DeVries and D. A. Paley. Bio-inspired sensing and control of an underwater vehicle in a Karman vortex street. *SIAM Dynamical Systems Conference 2013*, Snowbird, Utah, May 19–23, 2013.

[1] L. DeVries, A. Maki, D. Koch, S. J. Majumdar, and D. A. Paley. Improving Hurricane Forecasts Using Unmanned Aircraft: Motion Coordination in a Strong Flowfield. *SIAM Dynamical Systems Conference 2011*, Snowbird, Utah, May 22–26, 2011.

Unrefereed Abstracts

[5] L. DeVries, D. Koch, S. J. Majumdar, and D. A. Paley. Targeting observations of tropical cyclones using unmanned aircraft: Motion coordination in a strong flowfield. *2012 NSF Engineering Research and Innovation Conf.*, Boston, Mass., 9 July 2012.

[4] L. Devries, D. Koch, A. Maki, S. J. Majumdar, and D. A. Paley. New algorithms for targeting coordinated observations of hurricanes using multiple unmanned aircraft. Presented at the *16th Conf. on Integrated Observing and Assimilation Systems for Atmosphere, Oceans, and Land Surface*, New Orleans, Louisiana, 22, January 2012.

[3] D. Koch, L. DeVries, A. Maki, D. A. Paley, and S. Majumdar. Observing system simulation experiments for coordinated unmanned aircraft in hurricanes. Presented at the *16th Conf. on Integrated Observing and Assimilation Systems for Atmosphere, Oceans, and Land Surface*, New Orleans, Louisiana, 22, January 2012.

[2] D. A. Koch, A. Maki, L. DeVries, D. A. Paley, and S. J. Majumdar. Observing system simulation experiments for unmanned aircraft in an idealized hurricane model framework. *91st American Meteorological Society Annual Meeting*, Seattle, Washington, 23 January 2011.

[1] L. DeVries, A. Maki, D. Koch, S. J. Majumdar, and D. A. Paley. Targeting observations of tropical cyclones using cooperative control of unmanned aircraft. *2011 NSF CMMI Research and Innovation Conference*, Atlanta, Georgia, 5 January 2011.

Honors & Awards

- Doctoral Research Award, Department of Aerospace Engineering, University of Maryland, 2014
- Academic Merit Award, Department of Aerospace Engineering, University of Maryland, 2012, 2013
- Student Admission Awardee, 2013 Interdisciplinary Summer School: Data Assimilation in Geosciences, Center for Scientific Computation and Mathematical Modeling, University of Maryland
- Link Foundation Ocean Engineering and Instrumentation Fellow, The Link Foundation, 2013-2014
- Future Faculty Fellow, Clark School of Engineering, 2013
- Goldhaber Travel Award, University of Maryland, 2013
- International Conference Travel Award, University of Maryland, 2013
- Travel Grant, SIAM Conference on Dynamical Systems, 2013
- Recognized as "alumni to watch" for significant achievement in academics and community involvement after graduation, Concordia College, MN, 2012.
- Travel Grant, NSF CMMI Research and Innovation Conference, 2011
- Distinguished Teaching Award, University of Maryland Center for Teaching Excellence, 2010
- Academic All-America First Team, ESPN The Magazine/ College Sports Information Directors of America, 2008
- NCAA Postgraduate Scholar, 2009
- Semifinalist, Draddy Award, National Football Foundation, 2009. Recognizes individual football players for academic success, football performance, and exemplary community leadership
- Inductee, Hampshire Honor Society, National Football Foundation, 2009. Honors college football players who maintain a 3.2 GPA or better during their college careers

Hardware and Software skills

Analog and Digital Electronics

- Arduino hardware implementation and software development
- mbed hardware implementation and software development
- Iver III autonomous underwater vehicle
- Pixhawk autopilot for small UAS

Instrumentation, Control, Data Acquisition, Design, Test, and Measurement

- LabVIEW, Simulink, Solidworks
- Qualisys Aquos 3 underwater motion capture cameras and Track Manager software
- OptiTrack motion capture cameras, TrackingTools and Motive tracking software
- VectorMap, Iver III underwater vehicle control software
- Mission Planner flight control software

Computer Programming

- Java, C/C++, MATLAB, Mathematica

Version Control and Software Configuration Management

- Git, SVN

Professional Societies

Member SIAM, AIAA, IEEE Control Systems Society

Professional Service

Session Chair 2015 SIAM Conference on Control and its Applications, Paris, France

Session Chair 2013 AIAA Conference on Guidance, Navigation, and Control, Boston, MA

2012 AIAA Conference on Guidance Navigation, and Control, Minneapolis, MN

2011 AIAA Conference on Guidance Navigation, and Control, Portland, OR

2011 SIAM Conference on Applications of Dynamical Systems, Snowbird, UT

Reviewer Automatica

AIAA Conference on Guidance, Navigation, and Control (GNC)

IEEE American Control Conference (ACC)

International Conference on Unmanned Aircraft Systems (ICUAS)

Distributed Autonomous Robotic Systems (DARS) Conference

Grants and Funding

2015-present Office of Naval Research: Flexible, appendage-free underwater vehicle for agile operation in diverse underwater environments.

2015-2016 DARPA Service Academies Innovation Challenge: Hydrodynamic force estimation using using analysis of body deformation in a flexible hulled underwater vehicle.

2015-2016 PEO-IWS Capstone Grant, Co-PI: Michael D.M. Kutzer, AUVSI SUAS Competition

2014 Office of Naval Research equipment grant: Portable, 12 camera OptiTrack motion capture system

E&W Division Service

Division Service

2015–present Plebe advisor

2015 Session Chair, Capstone Day

Depertment Service

2015-present Referee, Weapons and Systems Engineering's annual Systems Ball

2016–present Course Coordinator ES202
2016–present Course Coordinator ES305
2016–present Member, Robotics Major Planning Committee
2015–present Advisor, Cyber building planning