

# Thomas A. Berrueta

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EDUCATION	Northwestern University, Evanston, IL Ph.D. Candidate in Mechanical Engineering	Harvey Mudd College, Claremont, CA B.S. Engineering, Graduated with Honors
HONORS	<ul style="list-style-type: none"><li>• Microsoft Ada Lovelace Fellowship Finalist (top 20 of 600+ applicants) 2019</li><li>• Walter P. Murphy Fellowship (Northwestern University) 2017-2018</li><li>• Harvey S. Mudd Merit Scholarship (Harvey Mudd College) 2013-2017</li><li>• Dean's List (Harvey Mudd College) 2013-2017</li></ul>	
RESEARCH	<b>Center for Robotics and Biosystems</b> <ul style="list-style-type: none"><li>• I am interested in the study of complex, often multi-agent, systems and their self-organized behaviors. I design tools for learning and exploiting emergent structure in complex systems.</li><li>• I develop algorithms that identify emergent simplicity and discrete structure arising from the interactions of many agents in robot swarms and human-machine systems.</li><li>• I derive control methods based on knowledge of the statistical physics and information theory of self-organization.</li></ul>	
PUBLICATIONS	<i>Journal Papers</i> <ul style="list-style-type: none"><li>• P. Chvykov, <b>T. A. Berrueta</b>, A. Vardhan, W. Savoie, A. Samland, T. D. Murphey, K. Wiesenfeld, D. I. Goldman, J. L. England "Low rattling: A predictive principle for self-organization in active collectives." <i>Science</i>, (Accepted).</li><li>• W. Savoie, <b>T. A. Berrueta</b>, Z. Jackson, A. Pervan, R. Warkentin, S. Li, T. D. Murphey, K. Wiesenfeld, D. I. Goldman "A robot made of robots: Emergent transport and control of a smarticle ensemble." <i>Science Robotics</i>, vol. 4, no. 34 (2019).</li><li>• <b>T. A. Berrueta</b>, A. Pervan, K. Fitzsimons, T. D. Murphey, "Dynamical system segmentation for information measures in motion." <i>IEEE Robotics and Automation Letters</i>, 4 (1), 169-176 (2019).</li></ul> <i>Conference Papers</i> (* indicates equal authorship) <ul style="list-style-type: none"><li>• A. Q. Nilles*, A. Pervan*, <b>T. A. Berrueta*</b>, T. D. Murphey, S. M. LaValle, "Information requirements of collision-based micromanipulation." <i>Proceedings of the Workshop on the Algorithmic Foundations of Robotics (WAFR)</i> (2020).</li><li>• A. Kalinowska, <b>T. A. Berrueta</b>, T. D. Murphey, "Data-driven gait segmentation for walking assistance in a lower-limb assistive device." <i>IEEE International Conference on Robotics and Automation (ICRA)</i> (2019).</li></ul> <i>Book Chapters</i> <ul style="list-style-type: none"><li>• <b>T. A. Berrueta</b>, I. Abraham, T. D. Murphey, "Experimental applications of the Koopman operator in active learning for control." <i>The Koopman Operator in Systems and Control</i>, Springer (2020).</li></ul> <i>Workshop Papers</i> <ul style="list-style-type: none"><li>• A. Taylor, <b>T. A. Berrueta</b>, T. D. Murphey, "Optimizing the locomotion of a robotic active matter system of smarticles." <i>Bulletin of the American Physical Society</i>, (2021).</li><li>• A. Q. Nilles, A. Pervan, <b>T. A. Berrueta</b>, T. D. Murphey, "Controlling active Brownian particles with "active billiard" particles." <i>Bulletin of the American Physical Society</i>, (2020).</li><li>• <b>T. A. Berrueta</b>, A. Pervan, T. D. Murphey, "Towards robust motion planning for synthetic cells in a circulatory system." <i>Workshop on Robust Task and Motion Planning at Robotics: Science and Systems</i>, (2019).</li></ul>	
EXPERIENCE	<b>Northwestern University</b> ME314: Theory of Machines - Dynamics Co-teacher 2019, Grader 2018 <ul style="list-style-type: none"><li>• Lectured large senior-level course (~70 students) on rigid body dynamics and Lagrangian mechanics.</li><li>• Redesigned class content and homeworks as it pivoted to an online-friendly format.</li></ul> <b>Harvey Mudd College</b> Kaia Corporation Capstone 2016-2017 <ul style="list-style-type: none"><li>• Designed a MEMS-based laser diode burn-in platform for the testing of optical transceivers.</li><li>• Implemented embedded temperature and current control for 30 microscopic laser diodes in parallel.</li></ul>	

- Amazon Lab126 Capstone 2016
- Designed hardware testbench for the Amazon Echo with the goal of automatically maneuvering the device around a room while avoiding obstacles.
  - Programmed embedded microcontroller to control a ceiling mounted cart along rails, as well as a linear actuator to vary the device height for flexible testing.

#### **Northrop Grumman**

- IR and Visual Control Systems Intern: Survivability Group 2016
- Developed an IR signature estimator model in C++ for aircraft, and optimized aircraft trajectory to minimize IR exposure in real-time.

#### **SpaceX**

- Vehicle Engineering Intern: Engine Dynamics Group 2014-2015
- Modelled and characterized flight environments experienced by M1D and MVacD rocket engines.

### **LEADERSHIP**

#### **Northwestern University**

- Board member of the Northwestern Mechanical Engineering Graduate Student Society (2017-2019).
- Organizer of recruitment activities for incoming mechanical engineering graduate students (2018).
- Mentor to 8 Ph.D. and Masters students through the department mentorship program (2017-current).

#### **Harvey Mudd College**

- Member of the Harvey Mudd College Entrepreneurial Network (2017).
- Mentor in the Harvey Mudd College mentorship program (2016-2017).

### **SKILLS**

#### **Technical**

- Professional experience in Python, C++, and MATLAB.
- Expertise in control theory and analysis of dynamical systems, as well as machine learning, information theory, statistical physics, and optimization.

#### **Other**

- Natively fluent in Spanish, English, and conversational in French.
- Played jazz guitar/bass for 11 years.
- I enjoy music composition and production.
- I love to run, and ran competitively in college.