Jonathan A. DeCastro

CONTACT INFORMATION

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RESEARCH INTERESTS

Robotics · Generative Modeling · Formal Methods · Optimization · Cyber-Physical Systems · Control and Dynamical Systems

EDUCATION

Cornell University, Ithaca, NY
Ph.D., Mechanical and Aerospace Engineering — 2015–2017
Advisor: Prof. Hadas Kress-Gazit
Graduate Minors: Computer Science, Computational Science and Engineering
M.S., Mechanical and Aerospace Engineering — 2011–2014

Virginia Tech, Blacksburg, VA
B.S., M.S., Mechanical Engineering — 1997–2003

COURSES

Applied Math and Optimization: Linear Systems, Probability, Heuristic Methods for Optimization, Convex Optimization, Mathematical Programming
Controls and Systems: Hybrid Systems, Robust Control, Stochastic Control, Multivariable Control
Robotics and Dynamics: Intermediate Dynamics, Robot Learning, Autonomous Mobile Robots, Robotic Manipulation

INDUSTRY AND RESEARCH EXPERIENCE

Research Scientist, Toyota Research Institute, Cambridge, MA — July 2016–*Present*
Simulation and Tools

Graduate Research Assistant, Cornell University, Ithaca, NY — August 2011–February 2017
Verifiable Robotics Research Group

Lead Systems Engineer, Impact Technologies, LLC., Rochester, NY — July 2008–August 2011
Control and Prediction Group

Research Scientist, NASA Glenn Research Center, Cleveland, OH — July 2003–July 2008
Intelligent Control and Autonomy Branch

JOURNAL PUBLICATIONS

X. Huang, S. McGill, **J. DeCastro**, B. Williams, L. Fletcher, J. Leonard, G. Rosman. DiversityGAN: Diversity-Aware Vehicle Motion Prediction via Latent Semantic Sampling. *Robotics and Automation Letters*. Accepted, with oral presentation at IROS 2020.

J. Alonso-Mora, **J. DeCastro**, V. Raman, D. Rus and H. Kress-Gazit. Reactive Mission and Motion Planning while Avoiding Dynamic Obstacles. *Autonomous Robots*, 42(4):801–824, 2018.

J. DeCastro, R. Ehlers, M. Rungger, A. Balkan, and H. Kress-Gazit. Automated Generation of Dynamics-Based Runtime Certificates for High-Level Control. *Discrete Event Dynamic Systems Special Issue on Formal Methods in Control*, 27(2):371–405, 2017.

J. DeCastro and H. Kress-Gazit. Synthesis of nonlinear continuous controllers for verifiably-correct high-level, reactive behaviors. *International Journal of Robotics Research*, 34(3):378–394, 2015. doi:10.1177/0278364914557736

X. Zhang, L. Tang and **J. DeCastro**. Robust fault diagnosis of aircraft engines: a nonlinear adaptive estimation-based approach. *IEEE Trans. on Control Systems Technology*, 21(3):861–868, 2013. doi:10.1109/TCST.2012.2187057.

J. DeCastro. Rate-based model predictive control of turbofan engine clearance. *AIAA Journal of Propulsion and Power*. 23(4):804–813, 2007. doi:10.2514/1.25846
AIAA NOS Best Young Professional Paper

Refereed Conference Publications

C. Mavrogiannis, **J. DeCastro**, and S. S. Srinivasa. Implicit Multi-Agent Coordination at Unsignalized Intersections via Topological Inference. (Under review), 2020.

X. Huang, S. McGill, **J. DeCastro**, B. Williams, L. Fletcher, J. Leonard, G. Rosman. CARPAL: Confidence-Aware Intent Recognition for Parallel Autonomy. (Under review), 2020.

S. Shiroshita, S. Maruyama, D. Nishiyama, M. Ynocente Castro, K. Hamzaoui, G. Rosman, **J. DeCastro**, K. -H. Lee, and A. Gaidon. Behaviorally Diverse Traffic Simulation via Reinforcement Learning. *Proceedings of the IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS)*, (to appear) Virtual Conference, October 25–29, 2020.

J. DeCastro, K. Leung, N. Aréchiga, and M. Pavone. Interpretable Policies from Formally-Specified Temporal Properties. *Proceedings of the 23rd IEEE International Conference on Intelligent Transportation Systems (ITSC)*, (To appear) Virtual Conference, September 20–23, 2020.

D. Nishiyama, M. Ynocente Castro, S. Maruyama, S. Shiroshita, K. Hamzaoui, Y. Ouyang, G. Rosman, **J. DeCastro**, K. -H. Lee, and A. Gaidon. Discovering Avoidable Planner Failures of Autonomous Vehicles using Counterfactual Analysis in Behaviorally Diverse Simulation. *Proceedings of the 23rd IEEE International Conference on Intelligent Transportation Systems (ITSC)*, (To appear) Virtual Conference, September 20–23, 2020.

J. DeCastro, L. Liebenwein, C. I. Vasile, R. Tedrake, S. Karaman and D. Rus. Counterexample-Guided Safety Contracts for Autonomous Driving. *Proceedings of the 13th International Workshop on the Algorithmic Foundations of Robotics (WAFR)*, Mérida, Mexico, December 9–11, 2018.

L. Liebenwein, W. Schwarting, C. I. Vasile, **J. DeCastro**, J. Alonso-Mora, S. Karaman and D. Rus. Compositional and Contract-based Verification for Autonomous Driving on Road Networks. *International Symposium on Robotics Research (ISRR)*, Puerto Varas, Chile, December 11–14, 2017.

J. DeCastro and H. Kress-Gazit. Nonlinear Controller Synthesis and Automatic Workspace Partitioning for Reactive High-Level Behaviors. *Proceedings of the 19th ACM International Conference on Hybrid Systems: Computation and Control (HSCC)*, Vienna, Austria, April 12–14, 2016.

J. DeCastro, J. Alonso-Mora, V. Raman, D. Rus and H. Kress-Gazit. Collision-free reactive mission and motion planning for multi-robot systems. In: *Proceedings of the 17th International Symposium on Robotics Research (ISRR)*, Sestri Levante, Italy, September 12–15, 2015.

J. DeCastro, V. Raman and H. Kress-Gazit. Dynamics-driven adaptive abstraction for reactive high-level mission and motion planning. In: *Proceedings of the IEEE/RSJ International Conference on Robotics and Automation (ICRA 2015)*, Seattle, WA, USA, May 26–30, 2015.

J. DeCastro and H. Kress-Gazit. Guaranteeing reactive high-level behaviors for robots with complex dynamics. In: *Proceedings of the IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS 2013)*, Tokyo, Japan, November 3–8, 2013.

J. DeCastro, L. Tang, B. Zhang and G. Vachtsevanos. A safety verification approach to fault-tolerant aircraft supervisory control. In: *Proceedings of the AIAA Guidance, Navigation, and Control Conference*, Portland, OR, USA, August 8–11, 2011.

J. DeCastro, J. S. Litt, and D. K. Frederick. A modular aero-propulsion system simulation of a large commercial aircraft engine. In: *Proceedings of the 44th AIAA/ASME/SAE/ASEE Joint Propulsion Conference & Exhibit*, Hartford, CT USA, July 21–23, 2008.

Workshop Publications and Technical Reports

D. Jackson, **J. DeCastro**, S. Kong, D. Koutentakis, A. Leong Feng Ping, A. Solar-Lezama, M. Wang and X. Zhang. Certified Control for Self-Driving Cars. *4th Workshop on the Design and Analysis of Robust Systems (DARS)*, New York, NY, USA, 2019.

N. Aréchiga, **J. DeCastro**, S. Kong and K. Leung. Better AI through Logical Scaffolding. *2nd Workshop on Formal Methods for ML-Enabled Autonomous Systems (FoMLAS)*, New York, NY, USA, 2019. arXiv:https://arxiv.org/abs/1909.06965.

J. DeCastro, R. Ehlers, M. Rungger, A. Balkan, P. Tabuada, and H. Kress-Gazit. Dynamics-based reactive synthesis and automated revisions for high-level robot control. *CoRR*, abs/1410.6375, 2014. arXiv:http://arxiv.org/abs/1410.6375.

J. DeCastro. Mission possible: guaranteeing reactive missions for complex robots. In: *ICRA 2015 Ph.D. Forum*, Seattle, WA, USA, May 26, 2015.

Invited Talks

Formally-Specifiable Agent Behavior Models for Autonomous Vehicle Test Generation, *Automation and Test in Europe Conference (DATE 2020)*, March 9–13, 2020.

Simulation and Verification for Autonomous Vehicles in Traffic Scenarios, *NSF ExCAPE Annual Meeting*, U. Penn, June 15, 2017.

Generalized Collision-free reactive mission and motion planning for multi-robot systems, *NSF ExCAPE Annual Meeting*, MIT, June 20–21, 2015.

Abstractions and revisions for synthesis for non-linear robots, *NSF ExCAPE Annual Meeting*, U. C. Berkeley, March 10–11, 2014.

Reactive high-level robot controller synthesis: optimality, environment, and dynamics, *NSF ExCAPE Robotics Workshop*, Rice University, November 20–22, 2013.

Teaching and Mentoring Experience

Teaching Assistant, System Dynamics, Cornell University — Spring 2016

Teaching Assistant, Autonomous Mobile Robots, Cornell University — Spring 2015

Mentor, Undergraduate Research, Cornell University — Spring 2015

Instructor, System Modeling, Rochester Institute of Technology — Winter 2010–2011
- Administered, lectured and graded for senior undergrad and graduate students

Service and Outreach

Workshop Organizer, "Command Your Own Robot" — 2014, 2015

Voting Member, **Cornell Graduate and Professional Student Assembly** — 2013–2014

Program Committee
- Hybrid Systems Computation and Control (HSCC) — 2018, 2019
- Spring Simulation Conference (SpringSim) — 2020

Reviewer
- Robotics and Automation Letters (RA-L) — 2018, 2020
- Intelligent Vehicles Symposium (IV) — 2020
- Hybrid Systems Computation and Control (HSCC): Program Committee Member — 2018, 2019
- IEEE Transactions on Robotics (T-RO) — 2016, 2018
- International Conference on Intelligent Robots and Systems (IROS) — 2016, 2018, 2019
- International Conference on Cyber-Physical Systems (ICCPS) — 2015
- International Conference on Robotics and Automation (ICRA) — 2014, 2015, 2017, 2018, 2020
- American Control Conference (ACC) — 2014
- IEEE Transactions on Industrial Electronics — 2011, 2012, 2013
- ASME Turbo Expo — 2005, 2007, 2010

Honors and Awards

Travel Grant to ICRA in Seattle, WA; sponsored by IEEE RAS and NSF — 2015
Cornell MAE Fellowship, a merit-based award to incoming Ph.D. students — 2011–2012
ASME Propulsion Best Paper Award — 2009
NASA Group Achievement Award for outstanding group accomplishment (C-MAPSS Team) — 2009
NASA Space Act Award for an outstanding technical contribution — 2007
AIAA Best Young Professional Paper awarded by the Northern Ohio Section of AIAA — 2007