Aaron D. Ames

266 Gates-Thomas	Email: ames@caltech.edu
California Institute of Technology	Phone: 626-395-8750
1200 East California Boulevard	AMBER Lab: `http://www.bipedalrobotics.com`
Pasadena, CA 91125	YouTube: `http://www.youtube.com/ProfAmes`

Education

Ph.D.	Electrical Engineering	University of California, Berkeley	2006
	Dissertation: A Categorical Theory of Hybrid Systems Advisor: Shankar Sastry		
M.A.	Mathematics	University of California, Berkeley	2006
B.S.	Mechanical Engineering	University of St. Thomas	2001
B.A.	Mathematics	University of St. Thomas	2001

Appointments

Bren Professor — Mechanical and Civil Engineering, Control and Dynamical Systems, Caltech, January 2017 to present

Associate Professor — Woodruff School of Mechanical Engineering, School of Electrical & Computer Engineering, Georgia Institute of Technology, July 2015 to December 2016

Associate Professor & Morris E. Foster Faculty Fellow II — Mechanical Engineering, Electrical & Computer Engineering, Computer Science & Engineering, Texas A&M University, Sept. 2014 to June 2015

Assistant Professor — Mechanical Engineering, Texas A&M University, August 2008 to Aug. 2014
Electrical & Computer Engineering, Texas A&M University, May 2011 to Aug. 2014
Computer Science & Engineering, Texas A&M University, Dec. 2013 to Aug. 2014

Postdoctoral Scholar — Control and Dynamical Systems, California Institute of Technology, August 2006 to August 2008. Advisor: John Doyle.

Graduate Student Researcher — Electrical Engineering and Computer Sciences, University of California, Berkeley, Spring 2002 to Spring 2006. Advisor: Shankar Sastry.

Research Interests

Areas of Interest — *Nonlinear Control, Robotics, and Hybrid Systems*: Theoretical foundations of nonlinear control and hybrid systems, including Lyapunov-based methods, control barrier functions, optimization-based control. Applications to robotic systems, with an emphasis on walking and legged robots, along with dynamic robots in general including: ground robots, aerial robots, heterogeneous multi-robot systems. Applications domains include: cyber-physical and autonomous systems, embedded and networked systems, validation and verification, test and evaluation. Robotic applications center around robotic assistive devices, from prostheses to exoskeletons, with a special focus on restoring mobility.

Honors and Awards

- **Leon O. Chua Award**, UC Berkeley (2005), for "outstanding achievement in an area of nonlinear science from any discipline, including biological, engineering, mathematical, physical and social sciences."
- **Bernard Friedman Memorial Prize in Applied Mathematics**, UC Berkeley (2006), for "demonstrated ability to do research in applied mathematics."
- **National Science Foundation CAREER Award**, 2010, for the project: "Closing the Loop on Walking: From Hybrid Systems to Bipedal Robots to Prosthetic Devices and Back."
- **Plenary Speaker**, *Robotic Motion and Control (RoMoCo)*, 2011.
- **Plenary Speaker**, *Hybrid Systems: Computation and Control (HSCC)*, 2013.
- **Best Paper Award**, *IEEE International Conference on Cyber-Physical Systems, Networks, and Applications (CPSNA),* 2013.
- **Best Paper Award Finalist**, *International Conference on Cyber-Physical Systems (ICCPS),* 2014.
- **DENSO Best Student Paper Award**, as advisor, with students Ayonga Hereid and Shishir Kolathaya, *Hybrid Systems: Computation and Control (HSCC),* 2014.
- **Morris E. Foster Faculty Fellow II**, Texas A&M University, 2014, for "many accomplishments and future potential."
- **Donald P. Eckman Award**, American Automatic Control Council (AACC), 2015, "For fundamental contributions to the dynamic walking of bipedal robots, including foundational results for hybrid and nonlinear systems, together with the experimental realization of formal results on novel robotic platforms."
- **Best Paper Award Finalist**, *International Conference on Robotics and Automation (ICRA),* 2016.
- **Plenary Speaker**, *American Control Conference (ACC),* 2016.
- **Best Student Paper Award Finalist**, as advisor, with students Vahid Azimi (visiting student), Tony Shu (undergraduate), Huihua Zhao, Eric Ambrose, *American Control Conference (ACC),* 2016.
- **Best Conference Paper Award Finalist**, *International Conference on Robotics and Automation (ICRA),* 2017.
- **Best Medical Robotics Paper Award Finalist**, *International Conference on Robotics and Automation (ICRA),* 2017.
- **Best Multi-Robot Systems Paper Award**, *International Conference on Robotics and Automation (ICRA),* 2017.
- **Okawa Foundation Research Grant**, for "Safety Critical Autonomy in Robotic Locomotion," 2017.
- **Earnest C. Watson Lecture**, "Toward the Robots of Science Fiction," California Institute of Technology, 2017.
- **Google Research Award**, Machine Learning and Data Mining, 2017.
- **Plenary Speaker**, *Southwest Robotics Symposium,* 2018.
- **Best Theory Paper Award Finalist**, *International Conference on Cyber-Physical Systems (ICCPS)*, 2018.

- **Invited Speaker**, *National Academy of Engineering (NAE), Mechanical Engineering Section*, 2018.
- **Best New Application Paper Award**, *IEEE Transactions on Automation Science and Engineering*, 2019.
- **RoboCup Best Paper Award**, *IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS)*, 2019.
- **IEEE Antonio Ruberti Young Researcher Prize**, *IEEE Control Systems Society*, 2019, "For fundamental contributions to the nonlinear control of hybrid and safety-critical systems, with application to walking robots and robotic assistive devices that restore mobility."
- **Invited Speaker**, *TEDx* Manhattan Beach, 2019.
- **Best Conference Paper Award**, *International Conference on Robotics and Automation (ICRA)*, 2020.
- **Best Paper Award on Human-Robot Interaction (HRI)**, *International Conference on Robotics and Automation (ICRA)*, 2020.

Funding

Current Projects

Robotic Inspection of Distillation Column Trays Proposal , Dow Chemical, PI: A. Ames (joint project with JPL), 1/1/2020-12/31/2023, $2,128,415.

Formal Methods for V&V and T&E of Autonomous Systems , AFOSR, PI: R. Murray; Co-PI: A. Ames,6/6/2019-9/5/2022, $1,500,000.

Collaborative Research: Intelligent and Agile Robotic Legged Locomotion in Complex Environments: From Hybrid Systems to Planning, Safety, and Robust Control , NSF, PI: A. Ames (Collaborative with Virginia Tech, PI: Kaveh Hamed), 9/1/2019-8/31/2022, $341,940.

NRI: FND: COLLAB: Cooperative Legged Robots for Manipulation in Complex Environments: A Hybrid Systems Approach to Safe and Distributed Control, NSF, PI: A. Ames (Collaborative with Virginia Tech, PI: Kaveh Hamed), 9/1/2019-8/31/2022, $375,000.

CPS: Medium: Safety-Critical Cyber-Physical Systems: From Validation & Verification to Test & Evaluation, NSF, PI: A. Ames, Co-PI: R. Murray, 10/1/2019-9/30/2022, $1,199,209.

Safety-Critical Planning for Heterogenous Multi-Agent Robot Teams with Humans in the Loop, Raytheon, PI: A. Ames, 12/1/2018-11/30/2021, $450,000.00.

Specification-guided and Capability-aware Autonomy for Long-endurance Situational Awareness in Subterranean Environment, JPL (prime sponsor: DARPA), PI: J. Burdick (Co-PI: A. Ames), 10/01/2018-09/30/2021, $1,044,000.00.

Dynamic Crutch Free Walking for Paraplegics with the Wandercraft Exoskeleton, Wandercraft, PI: A. Ames, 1/1/18-12/31/2020., $352,959.00.

Gift Funding

Robots in the Wild: Unifying Learning and Control for Robust Locomotion, Google Faculty Research Awards Program, $150,000.00.

Miso Robotics, $50,000.00.

Safety-Critical Autonomy in Robotic Locomotion, Okawa Foundation Research Grant, $10,000.00.

Cheetah Mobile, *Graduate Student Fellowship*.

Gregg Zietlin Discovery Fund.

MCE Big Idea Fund.

Past Projects

A Robotic Bouncing Ball, Disney, PI: A. Ames, 8/1/2017-7/31/2020., $450,000.00.

CPS: TTP Option: Synergy: Safe and Secure Open-Access Multi-Robot Systems, NSF, PI: M. Egerstedt, Co-PIs, A. Ames, R. Beyah, E. Feron, 10/1/15-9/30/19, $1,000,000. Award Number: 1544332. (Co-PIs Ames' component, $237,216).

CPS: Synergy: Learning to Walk - Optimal Gait Synthesis and Online Learning for Terrain-Aware Legged Locomotion, NSF, PI: P. Vela, Co-PIs, A. Ames, D. Goldman, E. Verriest, 10/1/15-9/30/19, $800,000. Award Number: 1544857. (Co-PIs Ames' component, $250,376).

NRI: Collaborative Research: Unified Feedback Control and Mechanical Design for Robotic, Prosthetic, and Exoskeleton Locomotion, NSF, PI: A. Ames, 9/1/15-8/31/19, $712,010.00. Award Number: 1526519. (Collaborative proposal with Michigan, PI: J. Grizzle, CMU, PI: K. Sreenath, and Northwestern/RIC, PI: L. Hargrove. Total award 1.8M$.)

Adaptive Verifiable Autonomy for Space Missions: Concurrent Control and Model Adaptation under Uncertainty, JPL, PI: A. Ames (Co-PI R. Murray), 06/24/2018-06/30/2019, $95,000.00.

Physics-infused Learning for Autonomous Dynamic Robots, DARPA, PI: A. Animeshree (Co-PIs A. Ames, J. Burdick, S-J. Chung, Y. Yue), 09/24/2018-03/23/2020, $1,000,000.00.

Safety-critical control of power networks, BATTELL (PNNL), PI: S. Low (Co-PIs A. Ames), 9/1/2018-8/31/2019, $144,000.00.

Dynamic Locomotion in Diverse and Natural Terrain, JPL (NASA), PI: A. Ames, 5/1/2018-4/30/2019, $76,200.00.

CPS: Frontier: Collaborative Research: Correct-by-Design Control Software Synthesis for Highly Dynamic Systems, NSF, PI: A. Ames, 2/15/13-2/14/18, $1,100,000. Award Number: 1239055. (Collaborative proposal with Michigan, PI: J. Grizzle, Award number: 1239037, UCLA, PI: P. Tabuada, Award number: 1239085, and CMU, PI: H. Geyer, Award number: 1239143. Total award 4M$.)

Safety-critical Autonomy and Verification for Space Missions, JPL, PI: A. Ames (Co-PI R. Murray), 06/24/2018-06/30/2019, $180,000.00.

CPS Medium: Collaborative Research: A CPS Approach to Robot Design, NSF, PI: A. Ames, 9/25/11-8/31/16, $317,573. Award number: CNS-1136104. (Collaborative proposal with Rice University, PI: W. Taha, co-PI's: C. Cartwright and M. O'Malley, 1.4M$. Award number: CNS-1136099.)

CAREER: Closing the Loop on Walking: From Hybrid Systems to Bipedal Robots to Prosthetic Devices and Back, NSF, PI: A. Ames. 06/01/10-05/31/16, $400,000. Supplement for NSF Workshop on Formal Composition of Motion Primitives: $10,300. Award number: CNS-0953823.

DRC Consortium: Next Generation Humanoid Robot for Disaster Response, Texas Emerging Technology Fund, Fiscal Agent: A. Ames, 10/1/13-9/31/18, $1,000,000. (Additional cost-sharing and matching funds from TAMU of $276,700.) Joint project with NASA, UT Austin and the DRC Consortium.

Efficient Bipedal Robotic Walking: SLIP Model based Human-Inspired Control, SRI International, PI: A. Ames, 8/15/13-6/31/15, $236,790. (Representing work on M3A project, funded by DARPA, $4*M*.)

Human-Like Walking Controller for NASA's Robonaut 2, NASA, PI: A. Ames, 8/01/11-7/31/14, $90,000. Grant number: NNX11AN06H.

Next Generation Humanoid for Disaster Response, NASA, PI: A. Ames, 8/31/12-1/15/14, $100,000. Grant number: NNX12AQ68G. (Representing work as a Key Investigator for the NASA JSC DRC Team, funded by DARPA, $3*M*.)

Achieving Bipedal Locomotion with Robonaut through Human-Inspired Control, NASA, PI: A. Ames, 12/31/11-12/31/12, $90,000. Grant number: NNX12AB58G.

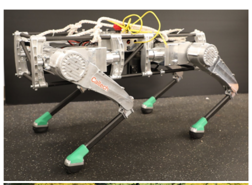
MRI: Acquisition of Mobile, Distributed Instrumentation for Response Research (RESPOND-R), NSF, PI: R. Murphy, Co-PI: A. Ames, R. Stoleru, D. Song, R. Gutierrez-Osuna, 9/01/09-9/01/13, $2*M* (with $307,239 allocated to co-PI Ames). Award number: CNS-0923203.

Norman Hackerman Advanced Research Program Award, THECB, PI: A. Ames, 8/01/10-5/31/13, $196,691, Project number: 000512-0184-2009.

Robots

The theoretic methods developed have been realized on over 20 different robot platforms: R – Index = 21

Quadrupeds



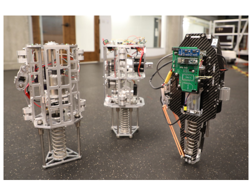
Quadrupedal robots are studied from the perspective of achieving dynamic and robust walking behaviors, wherein they are decomposed into collaborative bipedal robots. This allows for the methods from the lab developed for bipedal robots to be applied to their quadrupedal counterparts. The specifics robots pictured are the Vision 60 series built by Ghost Robotics.

V3. *Coupled Control Systems: Periodic Orbit Generation, with application to quadrupeds* [J4], February 2020. `https://youtu.be/GlpgSXMinoU`

V2. *From Bipedal Walking to Quadrupedal Locomotion: Full-Body Dynamics Decomposition for Rapid Gait Generation* [C9], May 2020. `http://ames.caltech.edu/ma2019bipedal.mp4`

V1. *First steps towards full model based motion planning and control of quadrupeds: A hybrid zero dynamics approach* [C28], September 2019. `http://ames.caltech.edu/ma2019first.mp4`

Hopping Robots

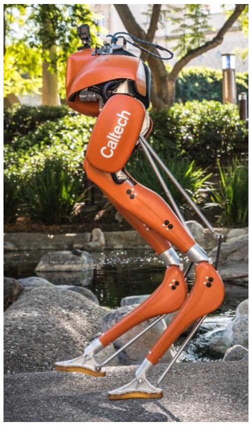


Hopping robots are used to studying the generating of dynamic behaviors on robotic systems. These ideas are demonstrated on custom-built hopping robots.

V2. *Moving-Mass Hopping Robots with Parallel Elasticity* [C2], 2020. `http://ames.caltech.edu/ambrose2019improved.mp4`

V1. *Design and Comparative Analysis of 1D Hopping Robots* [C21], 2019. `http://ames.caltech.edu/ambrose2019design.mp4`

Cassie



Cassie is a bipedal robot developed and built by Agility Robotics. At Caltech, custom walking algorithms were developed and implemented to achieve robust walking including walking outdoors. Additionally, advanced dynamic behaviors were achieved including jumping.

V4. *An inverse dynamics approach to control Lyapunov functions* [C13], June 2020. https://vimeo.com/362721158

V3. *Cassie Jumping* [C49], Feburary 2018. https://youtu.be/qANxY3AhTm8

V2. *Cassie walking on uneven terrain (with custom onboard walking controllers)* [C32], April 2019. https://youtu.be/NYooAyACOkA

V1. *Cassie walking around Caltech (with Agility Robotics walking controller)*, October 2017. https://youtu.be/wXvzlTPAkMo

Exoskeleton

The ATALANTE exoskeleton was designed and built by Wandercraft, a French robotics company. Dynamic walking on the exoskeleton, i.e., the first example of exoskeleton walking without crutches, was achieved using the same mathematical framework that was realized on DURUS. Gaits are generated using the methods developed by the lab, collaboratively with Wandercraft and University of Michigan.

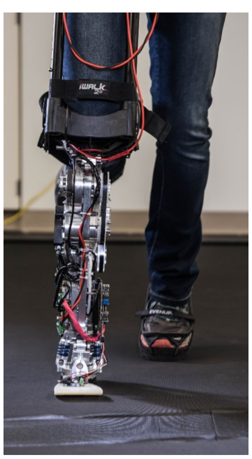
V4. *Towards Variable Assistance for Lower Body Exoskeletons* [J10], 2020. http://ames.caltech.edu/gurriet2019towards.mp4

V3. *Preference-Based Learning for Exoskeleton Gait Optimization* [C18], 2019. https://youtu.be/-27sHXsvONE

V2. *First dynamic walking on an exoskeleton for paraplegics* [C40], May 2018. https://youtu.be/V30HsyUD4fs

V1. *Exoskeleton in AMBER Lab*, April 2019. https://youtu.be/S55PeYWBBRI

AMPRO 3



AMPRO 3 is the third generation powered transfemoral prosthesis custom designed and built by AMBER lab. It includes series elastic actuators at the knee and ankle, along with a 2 degree of freedom ankle with compliance. Differenti assistive gaits have been realized, including walking on flat ground and up and down slopes. It was demoed in front of Congress in 2016.

V5. *Recurrent Neural Network Control of a Hybrid Dynamical Transfemoral Prosthesis* [C6], 2020. http://ames.caltech.edu/gao2020recurrent.mp4

V4. *Model-Based Adaptive Control of Transfemoral Prostheses* [J15], 2020. http://ames.caltech.edu/azimi2019model.mp4

V3. *AMPRO 3 walking in the lab*, 2018. https://youtu.be/DbhHyJ0QjaQ

V2. *AMPRO 3 walking outdoors*, 2018. https://youtu.be/9CjBgSP_MwU

V1. *AMPRO 3 demo in DC*, July 2016. https://youtu.be/8kRGBT_iHpk

Modified Segway

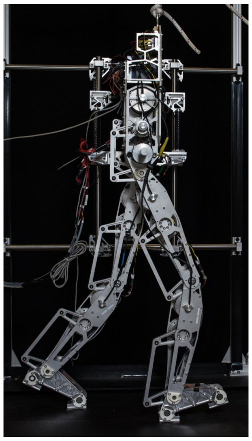
A segway type robot was modified from the ground up, with completleley new onboard electronics, control, sensing and computation. This allows for the real-time control and implementaiton of safety-critical control algorithms, i.e., control barrier functions.

V3. *Learning for safety-critical control with control barrier functions* [C17], 2020. `https://vimeo.com/380798276/f37b003db3`

V2. *Autonomous Navigation* [C48], 2018. `https://youtu.be/Nxb1MwX8Plo`

V1. *Safe behavior through control barrier functions* [C42], May 2017. `https://youtu.be/RYXcGTo8Chg`

AMBER 3M



AMBER 3M is the 3rd generation bipedal robot custom built and designed by AMBER lab. It is planar robot that has multiple leg configurations that can be used to test different walking behaviors.

V4. Walking on slippery surfaces [C29], 2019. `https://youtu.be/G9dhcgyvcyI`

V3. *AMBER 3 walking in AMBER Lab*, October 2018. `https://youtu.be/v4egr2VDhGk`

V2. *Testing the efficiency of different leg configurations* [C51], December 2016. `https://youtu.be/sHA2Bwjij7Y`

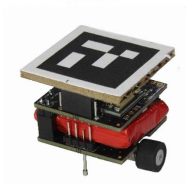
V1. *AMBER 3M: Walking with Mechanics Based Control* [C80], July 2016. `https://youtu.be/xw8jaDz8XTc`

Quadrotors

Quadrotors are used, with custom controllers, to test concepts realted to multi-robot systems and collision avoidance (collaboratively with Georgia Tech).

V1. *Barrier Certificates for Safe Quad Swarm* [C62], July 2016. `https://youtu.be/rK9oyqccMJw`

Ground Vehicles



Ground vehicles, i.e., wheeled vehicles, are used to demonstrate concepts related to swarm robotics and automotive systems, and specifically control barrier functions. Platforms include the Kepler robotics and Gritsbots.

V3. *Safety Barrier Certificates for Collision-Free Multi-robot Systems: Experiments* [J27], 2017. `https://youtu.be/-WUkzik1_VQ`

V2. *Multi-objective compositions for collision-free connectivity maintenance in teams of mobile robots* [C83], 2016. `https://youtu.be/LXzgxCzZIsM`

V1. *Robotarium Algorithm Development: Safety Barrier Certificates* [C59], September 2016. `https://youtu.be/PWJk-oMcgn4`

DURUS

DURUS is a 23 degree of freedom humanoid robot with onboard processing and power. It was developed through a DARPA funded collaboration between SRI international, Ames' AMBER lab and OSU. Importantly, it has a passive spring at the ankle allowing energy to be stored and released during locomotion. This necessitated the use of hybrid zero dynamics (HZD) for the walking gait generation, in which a new paradigm for generating HZD gaits was introduced utilizing direction collocation based optimization. The end result was the most efficient locomotion realized on a bipedal humanoid robot, which was demonstrated at the DRC finals. Videos of DURUS walking gait be found at:

V4. *DURUS Walks like a Human* [B1], 2016. `https://youtu.be/1fC7b2LjVW4`

V3. *3D Flat-Footed Walking Gait*, [J19] 2015. `https://youtu.be/zpWmKQzexSQ`

V2. *DURUS: SRI's Ultra-Efficient Walking Humanoid Robot*, Spectrum, June 2015. `https://youtu.be/HyqT9Bdamt8`

V1. *Dynamic Walking on DURUS at the 2015 DRC Finals* , [C82] June 2015. `https://youtu.be/a-R4H8-8074`

AMPRO

AMPRO is an intelligent powered prosthesis with 2 degrees of actuation—at the knee and ankle–that was designed and built in AMBER Lab at Texas A&M University. Controllers will developed by translating formal controller synthesis for bipedal robots to prosthesis, including online optimization-based controllers, and the result has been stable robotic assisted locomotion both in the lab and outside a laboratory setting. Videos of the resulting robotic assisted walking can be seen at:

V4. *Realization of stair ascent and motion transitions on prostheses* [C96], 2015. `https://youtu.be/oNZxkiiCnUg`

V3. *Multi-Contact Prosthesis Walking with AMPRO* [J32, C95], 2015. `https://youtu.be/K6mKYrVYVwE`

V2. *AMPRO: Realizing Nonlinear Controllers on Prosthesis* [J29, C98], October 2014. `http://youtu.be/NxJ7nMsJ63o`

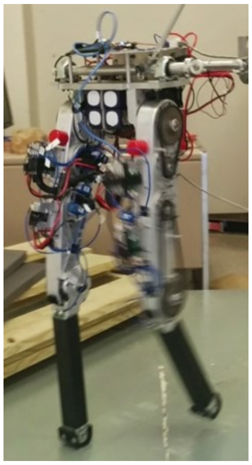
V1. *Introducing AMPRO: Translating Robotic Locomotion to Powered Transfemoral Prosthesis* [C97, C110], October 2014. `http://youtu.be/EzOIb0CP_pU`

Autonomous Cars

Autonomous cars modified by AMBER Lab from commercially available scale-model cars to include onboard processing, sensing and power. This testbed allows for the testing of advanced controllers experimentally—including online optimization-based controllers. A video can be found at:

V1. *Adaptive Cruise Control: Experimental Validation of Advanced Controllers on Scale-Model Cars* [C90], October 2014. `http://youtu.be/9Du7F76s4jQ`

2D DURUS



2D DURUS is a planar (2D) robot designed and built by SRI International, with control algorithms that result in locomotion designed and implemented by and at AMBER Lab at Texas A&M University. This robot has served as a testbed in achieving highly efficient locomotion, e.g., through the implementation of online optimization-based control methods, and has resulted in walking with a electrical specific cost of transport of 0.63 (nearing a humans metabolic cost of transport of 0.20). Additionally, running was achieved on this robot. Videos can be seen at:

V5. *Online Gait Generation* [C71], March 2016. `https://youtu.be/pvH3c2G2Pj4`

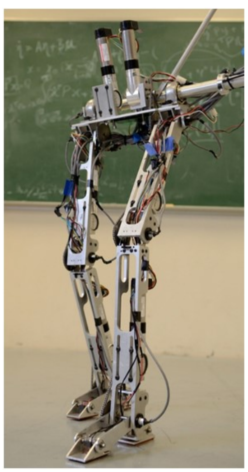
V4. *Bipedal Robotic Running on DURUS-2D* [C58], March 2015. `https://youtu.be/3XQOO6kvHFY`

V3. *CLF based QP Control on DURUS-2D* [C87], January 2015. `http://youtu.be/hYaUzE2lZN4`

V2. *Model Predictive Control on DURUS-2D* [C92], 2015. `https://youtu.be/OG-WIfWMZek`

V1. *Introducing: DURUS-2D* [C88], August 2014. `http://youtu.be/V3Ax08x6s28`

AMBER 2



AMBER 2 is a 2D fully actuated bipedal walking robot that was designed and built in AMBER Lab at Texas A&M University. Locomotion was achieved using human-inspired control, implemented through torque control. In addition, walking with multiple heel-toe behavior has been demonstrated. Videos can be seen at:

V4. *Robustness Tests on the Bipedal Robot AMBER 2*, April 2014. `http://youtu.be/q0FThc1fe_U`

V3. *Dynamic Robotic Dancing* [B3], March 2014. `http://youtu.be/IwR9XvojXWo`

V2. *Human-Like Multi-Contact Walking with AMBER 2* [J28, C108], October 2013. `http://youtu.be/VvkIdCKlL54`

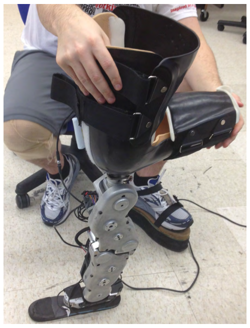
V1. *Robotic Walking with AMBER 2.0* [C105], August 2013. `http://youtu.be/d6oM5sLI9vA`

ATRIAS

ATRIAS is a compliant underactuated 2D robot developed and built by Oregon State University (OSU). Through collaboration between AMBER Lab and OSU, multi-domain walking was achieved using SLIP based optimization coupled with human-inspired control. A video of walking behavior can be found at:

V1. *Dynamic Multi-Domain Bipedal Walking with ATRIAS* [J28, C101], October 2013. `http://youtu.be/yiEbWwC-sR0`

Vanderbilt Prosthesis



The Vanderbilt Prosthesis is a powered transfemoral prosthesis located at the Rehabilitation Institute of Chicago (RIC). Through collaboration among AMBER Lab, RIC and the University of Illinois Urbana-Champaign, impedance parameters for the device were learned based upon robotic walking gaits generated through human-inspired control. These parameters successfully yielded natural locomotion experimentally. A video of walking behavior can be found at:

V1. *Impedance Control for Lower-Limb Prostheses* [C111], April 2013.
`http://youtu.be/AzF5-gqtRbc`

Valkyrie

Valkyrie is a humanoid robot developed by NASA Johnson Space Center. Locomotion, including slow walking, turning, side-stepping, and walking backwards, was achieved using algorithms developed by AMBER Lab. In addition, a method for full-body coordination was developed by AMBER Lab allowing for behaviors like stepping up and over a cinder block as illustrated in the following video:

V1. *Valkyrie - Cinder Block* [J37], November 2013
`http://youtu.be/qubDKVCut4o`

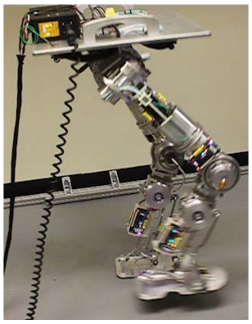
MABEL

MABEL is a 2D underactuated bipedal walking robot at the University of Michigan that was designed at Oregon State University. Locomotion was achieved through collaboration between AMBER Lan and the University of Michigan using Control Lyapunov Function Based Quadratic Programs (CLF based QPs), implemented through torque control. This is the first example of locomotion with online CLF based QPs. Videos of the walking behaviors are at:

V2. *Dynamic Torque Saturation with a CLF-based Feedback Controller on MABEL* [J35], February 2013. `http://youtu.be/rc1FSXpfrrM`

V1. *Robotic Walking with Control Lyapunov Functions* [J40, C120], November 2012.
`http://youtu.be/ZchIcWL_Vcg`

NASA Prototype Legs

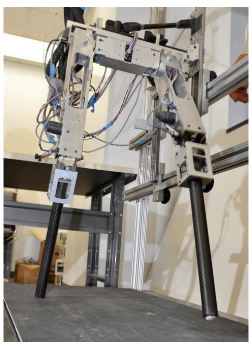


The NASA Prototype Legs are a fully actuated 3D bipedal robot leg testbed developed by NASA Johnson Space Center. Locomotion was achieved using human-inspired control coupled with partial hybrid zero dynamics reconstructions. This is the first example of dynamic walking achieved on a full-scale 3D bipedal robot.

V1. *3D Human-Inspired Robotic Walking on NASA's Prototype Biped*, 2013.
`https://youtu.be/73neNIYJ4dU`

Additional details can be found in the Master's Thesis of M. J. Powell.

AMBER 1



AMBER 1 is a 2D underactuated bipedal walking robot that was designed and built in AMBER Lab at Texas A&M University. Locomotion was achieved using human-inspired control, implemented through voltage control. In addition to flat ground walking, walking up and down slopes and rough terrain locomotion has been demonstrated. Videos of the walking behaviors and robustness tests are at:

V4. *Quadratic Programs + Impedance Control for Prosthesis* [C110], September 2013. `http://youtu.be/3UflxhfX7WE`

V3. *Walking on Rough Terrain with Motion Transitions* [C123], August 2012.
`https://youtu.be/aUiEXt8otrY`

V2. *Robustness Tests on the Bipedal Robot AMBER* [C127], February 2012.
`http://youtu.be/RgQ8atV1NW0`

V1. *AMBER Walking with Human-Inspired Control* [J39, C118], December 2011.
`http://youtu.be/SYXWoNU8QUE`

NAO

NAO is a 3D fully actuated humanoid robot that is commercially available and produced by Aldebaran Robotics. Locomotion was achieved using custom software developed by AMBER Lab based upon human-inspired control as implemented through onboard position controls. In addition to flat ground walking, speed regulated walking was achieved. Videos of the walking behaviors are at:

V3. *Speed Regulated Robotic Walking on NAO* [C113], April 2013
`http://youtu.be/P0UERYbDEJc`

V2. *3D Robotic Walking through Motion Transitions* [C116], September 2012
`http://youtu.be/kLakY9rWh6Y`

V1. *NAO: First Human-Inspired Robotic Walking* [J39, C119], October 2011
`http://youtu.be/0BGHU-e1kc0`

Teaching Experience

Teaching

Instructor, *Nonlinear control* (CDS 233). Graduate level course, Caltech, Spring 2018, 2019, 2020. Course description: "This course studies nonlinear control systems from Lyapunov perspective. Beginning with feedback linearization and the stabilization of feedback linearizable system, these concepts are related to control Lyapunov functions, and corresponding stabilization results in the context of optimization based controllers. Advanced topics that build upon these core results will be discussed including: stability of periodic orbits, controller synthesis through virtual constraints, safety-critical controllers, and the role of physical constraints and actuator limits. The control of robotic systems will be used as a motivating example."

Instructor, *Nonlinear dynamics* (CDS 232). Graduate level course, Caltech, Winter 2018, 2019, 2020. Course Description: "This course studies nonlinear dynamical systems beginning from first principles. Topics include: existence and uniqueness properties of solutions to nonlinear ODEs, stability of nonlinear systems from the perspective of Lyapunov, and behavior unique to nonlinear systems; for example: stability of periodic orbits, Poincaré maps and stability/invariance of sets. The dynamics of robotic systems will be used as a motivating example."

Instructor, *Advanced Topics in Systems and Control* (CDS 270). Graduate level course, Caltech, Spring 2017. Course description: "CDS 270 is an ongoing course that is aimed at exploring the applications of control and dynamical systems (CDS) tools to new domains."

Instructor, *Nonlinear Systems* (ECE 6552). Graduate level course, Georgia Institute of Technology, Spring 2016. Course description: "Classical analysis techniques and stability theory for nonlinear systems. Control design for nonlinear systems, including robotic systems. Design projects."

Instructor, *Capstone Design* (ME 4182). Senior level undergraduate course, Georgia Institute of Technology, Fall 2015 and Fall 2016. Course description: "Teams apply a systematic design process to real multidisciplinary problems. Problems selected from a broad spectrum of interest areas, including biomedical, ecological, environmental, mechanical, and thermal. ."

Instructor, *Dynamics and Vibrations* (MEEN 363). Junior level undergraduate course, Texas A&M University, Spring 2010, Spring 2011, Fall 2011. Course description: "Application of Newtonian and energy methods to model dynamic systems (particles and rigid bodies) with ordinary differential equations; solution of models using analytical and numerical approaches; interpreting solutions; linear vibrations."

Instructor, *Design of Nonlinear Control Systems.* (MEEN 655). Graduate level course, Texas A&M University, Spring 2009, Spring 2011, Spring 2014. Course description: "Nonlinear phenomena such as multiple equilibria, limit cycles and complex behavior will be introduced. Planer dynamical systems will be considered and theorems characterizing their behavior will be discussed. Foundational theorems for nonlinear systems such as existence and uniqueness will be proven. Stability of nonlinear systems will be considered in great detail, introducing Lyapunov's theorem as well as the converse stability theorems. Results related to the control of nonlinear systems, such as input/output linearization and zero dynamics will be considered and examples will be given. Mechanical systems will be used as a prime example of nonlinear systems. Finally, more advanced concepts from control will be discussed, e.g., hybrid systems, together with the needed mathematical background."

Instructor, *Dynamic Systems and Controls* (MEEN 364). Junior level undergraduate course, Texas A&M University, Fall 2008 and Fall 2009. Course description: "Mathematical modeling, analysis, measurement and control of dynamic systems; extensions of modeling techniques of MEEN 363 to other types of dynamic systems; introduction to feedback control, time and frequency domain analysis of control systems, stability, PID control, root locus; design and implementation of computer-based controllers in the lab."

Instructor, *Engineering Laboratory* (MEEN 404). Senior level undergraduate course, Texas A&M University, Fall 2010 and Fall 2012. Course description: "Systematic design of experimental investigations; student teams identify topics and develop experiment designs including establishing the need; functional decomposition; requirements; conducting the experiment; analyzing and interpreting the results and preparing written and oral reports documenting the objectives, procedure, analysis, and results and conclusions of three experiments."

Instructor, *Introduction to Dynamics* (CDS 140A), co-taught with Sujit Nair. First year graduate level course, California Institute of Technology, Fall 2007. Course covered "basics in topics in dynamics in Euclidean space, including equilibria, stability, Lyapunov functions, periodic solutions, Poincaré-Bendixon theory, Poincaré maps, the Euler-Lagrange equations, mechanical systems, dissipation, energy as a Lyapunov function, and simple conservation laws. Introduction to basic bifurcations and eigenvalue crossing conditions. Discussion of bifurcations in applications, invariant manifolds, the method of averaging, Melnikov's method, and the Smale horseshoe."

Developed, organized and taught: *Bipedal Robotic Walking: From Theory to Practice*, a special research course on bipedal robotic walking, Fall 2005 and Spring 2006, UC Berkeley. Resulted in an original research paper, which appeared in the 2006 Workshop on Lagrangian and Hamiltonian Methods for Nonlinear Control: "Towards the Geometric Reduction of Controlled Three-Dimensional Robotic Bipedal Walkers."

Teaching Assistant Introduction to Circuit Analysis (EE 42), Fall 2001, UC Berkeley.

Student Advising

Current Graduate Students

Wenlong Ma (PhD student, Spring 2012-present)

Eric Ambrose (PhD student, Fall 2013-present)

Jake Reher (PhD student, Spring 2014-present)

Rachel D. Gehlhar (PhD student, Fall 2016-present), *NSF Fellow*

Xiaobin Xiong (PhD student, Spring 2017-present)

Andrew Singletary (PhD student, Fall 2017-present)

Andrew Taylor (PhD student, Fall 2017-present)

Maegan Tucker (PhD student, Fall 2017-present), *NSF Fellow*

Prithvi Akella (PhD student, Spring 2019-present)

Ryan Costner (PhD student, Spring 2020-present)

Min Dai (PhD student, Spring 2020-present)

Wyatt Ubellacker (PhD student, Spring 2020-present)

Noel Csomay-Shanklin (PhD student, Spring 2020-present)

Amy (PhD student, Spring 2020-present)

Kejun (Amy) Li(PhD student, Spring 2020-present)

Ph.D. Students Graduated

Thomas Gurriet
Thesis: *Applied Safety Critical Control.*
Degree Conferred: PhD, Mechanical Engineering
Institution: California Institute of Technology
Graduation Date: April, 2020 (Defended May 2020)

Matthew Powell
Thesis: *Mechanics-Based Control of Underactuated Robotics Walking.*
Degree Conferred: PhD, Mechanical Engineering
Institution: Georgia Institute of Technology
Graduation Date: August, 2017 (Defended June 2017)

Micheal Grey (co-advised with Karen Liu)
Thesis: *High Level Decomposition for Bipedal Locomotion Planning.*
Degree Conferred: PhD, Robotics
Institution: Georgia Institute of Technology
Graduation Date: August, 2017 (Defended June 2017)

Shishir Kolathaya
Thesis: *Input to State Stabilizing Control Lyapunov Functions for Hybrid Systems.*
Degree Conferred: PhD, Mechanical Engineering
Institution: Georgia Institute of Technology
Graduation Date: December, 2016

Ayonga Hereid
Thesis: *Dynamic Humanoid Locomotion: Hybrid Zero Dynamics Based Gait Optimization via Direct Collocation Methods.*
Degree Conferred: PhD, Mechanical Engineering
Institution: Georgia Institute of Technology
Graduation Date: August, 2016

Huihua Zhao
Thesis: *From Bipedal Locomotion to Prosthetic Waling: A Hybrid System and Nonlinear Control Approach.*
Degree Conferred: PhD, Mechanical Engineering
Institution: Georgia Institute of Technology
Graduation Date: August, 2016

Ryan Sinnet
Thesis: *Energy Shaping of Non-Smooth Mechanical Systems with Application to Bipedal Locomotion.*
Degree Conferred: PhD, Mechanical Engineering
Institution: Texas A&M University
Graduation Date: May, 2015

M.S. Students Graduated

Thomas Waters
Thesis: *Realizing Simultaneous Lane Keeping and Adaptive Speed Regulation on Accessible Mobile Robot Testbeds.*
Degree Conferred: Master of Science, Mechanical Engineering
Institution: Georgia Institute of Technology
Graduation Date: September, 2017

Jonathan Horn
Thesis: *Design and Implementation of the Powered Self-Contained AMPRO Prostheses.*
Degree Conferred: Master of Science, Mechanical Engineering
Institution: Texas A& M University
Graduation Date: August, 2015

Aakar Mehra
Thesis: *Analysis of Various Adaptive Cruise Controllers via Experimental Implementation.*
Degree Conferred: Master of Science, Mechanical Engineering
Institution: Texas A& M University
Graduation Date: August, 2015

Eric Cousineau
Thesis: *Realizing Torque Controllers for Underactuated Bipedal Walking Using the Ideal Model Resolved Motion Method.*
Degree Conferred: Master of Science, Mechanical Engineering
Institution: Texas A& M University
Graduation Date: December, 2014

Shao-Chen Hsu
Thesis: *Control Barrier Function based Quadratic Programs with Application to Bipedal Robotic Walking.*
Degree Conferred: Master of Science, Mechanical Engineering
Institution: Texas A& M University
Graduation Date: December, 2014

Wenlong Ma
Thesis: *Flat-Foot Dynamic Walking via Human-Inspired Controller Design.*
Degree Conferred: Master of Science, Mechanical Engineering
Institution: Texas A& M University
Graduation Date: May, 2014

Matthew Powell
Thesis: *Robot Controller Generation through Human-Inspired Optimization.*
Degree Conferred: Master of Science, Mechanical Engineering
Institution: Texas A& M University
Graduation Date: December, 2013

Jordan Lack
Thesis: *Planar Multicontact Locomotion using Hybrid Zero Dynamics.*
Degree Conferred: Master of Science, Mechanical Engineering
Institution: Texas A& M University
Graduation Date: December, 2013

Shishir Kolathaya
Thesis: *Achieving Human-Inspired Walking in AMBER on flat-ground, upslope and rough terrain with Hybrid Zero Dynamics.*
Degree Conferred: Master of Science, Electrical and Computer Engineering
Institution: Texas A& M University
Graduation Date: September, 2012

Murali Pasupuleti
Thesis: *Design and Implementation of Voltage Based Human Inspired Feedback Control of a Planar Bipedal Robot AMBER.*
Degree Conferred: Masters of Science, Electrical and Computer Engineering
Institution: Texas A& M University
Graduation Date: May, 2012

Ryan Sinnet
Thesis: *Hybrid Geometric Feedback Control of Three-Dimensional Bipedal Robotic Walkers with Knees and Feet.*
Degree Conferred: Master of Science, Mechanical Engineering
Institution: Texas A& M University
Graduation Date: May, 2011

Bhargav Kothapalli
Thesis: *Application of Product Design Concepts and Hybrid System Dynamics to Demonstrate Zeno Behavior and Zeno Periodic Orbits in a Physical Double Pendulum Setup.*
Degree Conferred: Master of Science, Mechanical Engineering
Institution: Texas A& M University
Graduation Date: May, 2011

Postdoctoral Scholars

Ugo Rosolia (September 2019 - Present), Caltech Postdoctoral Fellow.

Mohamadreza Ahmadi (January 2019 - Present), Caltech Postdoctoral Fellow.

Yuxiao Chen (July 2018 - Present), Caltech Postdoctoral Fellow.

Petter Nilsson (September 2017 - December 2019), Caltech Postdoctoral Fellow.

Luca Bonanomi (September 2017 - May 2019), Caltech Postdoctoral Fellow.

Shishir Kolathaya (January 2017 - December 2017), Caltech Postdoctoral Fellow. Now an INSPIRE Faculty fellow in the Robert Bosch Center for Cyber Physical Systems (RBCCPS) in IISc Bangalore.

Christian Hubicki (August 2015 - December 2016), Georgia Tech Postdoctoral Fellow. Now an assistant professor at Flordia State University.

Austin Jones (July 2015 - December 2015), Georgia Tech Postdoctoral Fellow.

Research Engineers

Eric Cousineau (January 2015 - July 2015), TEES Research Engineering Associate.

Dr. Benjamin Morris (October 2012 - December 2013), TEES Associate Research Engineer.

Visiting Scholars

Vahid Azimi (June 2016 - December 2016), Cleveland State University

Victor Christian Paredes Cauna (January 2013 - December 2013), National University of Engineering, Lima, Peru.

Undergraduate Student Researchers/ Mentorship

Robert Gregg (SUPERB program, UC Berkeley, Summer 2005)

Jessica Austin (Senior Thesis, Caltech, Fall 2007 - Spring 2009)

Rigoberto Lopez (2009-2010)
Supported by the LSAMP program for underrepresented minorities.

Ivan Joel Alaniz (2010)

George Montgomery (2010-2011)

Peter Nystrom (2011)

Grant O'Connor (Summer 2011)

Michael Zeagler (2011-2013)

Shawanee Patrick (2010-present)
Recipient of the Undergraduate Summer Research Grant (USRG), 2011
Supported by the LSAMP program for underrepresented minorities, Fall 2011

Eric Cousineau (2011-2012)
Recipient of the Undergraduate Summer Research Grant (USRG), 2011

Bridget Hill (Fall 2012)

Jonathan Horn (Summer 2012-Fall 2013)

John Mayo (Fall 2013-Spring 2014)

John Micheal Frullo (Summer 2014)
Research Experiences for Undergraduates (REU), 2014

Nathan Viehmann (Summer 2014)
Research Experiences for Undergraduates (REU), 2014

Alejandro Azocar (Fall 2014 - Spring 2015)
Undergraduate Research Scholars Program, Thesis: Using Neural Signals for Real-time Robot Control

Tony Shu (Fall 2015 - Fall 2016)

Jordyn Schroeder (Summer 2016)

Andrew Singletary (Summer 2016 - Fall 2016)
Continued as graduate student in the lab

Maegan Tucker (Summer 2016 - Fall 2017)
Continued as graduate student in the lab

Sara Adams (SURF student, Summer 2017)

Noel Csomay-Shanklin (SURF student, Summer 2017)
Continued as graduate student in the lab

Filippos Lymperopoulos-Bountalis (SURF student, Summer 2017)

Elin Samuelsson (SURF student, Summer 2017)

Michael Estrada (WAVE student, Summer 2018)

Sergio Esteban (WAVE student, Summer 2018)

Alexander Bouman (SURF student, Summer 2018)

Jesus Hernandez (SURF student, Summer 2018)

Cindy Huang (SURF student, Summer 2018)

Hana Keller (SURF student, Summer 2018)

Connor Soohoo (SURF student, Summer 2018)

Hyung Ju Suh (SURF student, Summer 2018)

Andrew Galassi (SURF student, Summer 2018)

Paulina Ridland (SURF student, Summer 2019)

Sofia Kwok (SURF student, Summer 2019)

Allison Cheng (SURF student, Summer 2019)

Andrew Galassi (SURF student, Summer 2019)

Alexander Bouman (SURF student, Summer 2019)

Annabel Gomez (FSRI student, Summer 2019)

Diana Frias Franco (FSRI student, Summer 2019)

Lorenzo Shaikewitz (SURF student, Summer 2020)

Toussaint Pegues (SURF student, Summer 2020)

Professional Experience and Service

Workshop Organizer

RSS Workshop on Dynamic Locomotion, co-organized with Koushil Sreenath, July 12-13 2014, UC Berkeley, CA. Additional details at: `http://www.dynamiclocomotion.org/`

2nd NSF Workshop on Formal Composition of Motion Primitives, co-organized with Jessy Grizzle and Necmiye Ozay, April 8 2013, CPS Week, Philadelphia, PA. Additional details at: `www.formalcomp.com`

NSF Workshop on Formal Composition of Motion Primitives, co-organized with Calin Belta, June 12 2012, MIT. Additional details at: `www.formalcomp.com`

Invited Session Organizer

Theory and Applications of Control Barrier Functions, co-organized with Dimitra Panagou, Conference on Decision and Control (CDC), 2020.

Professional Service

Senior Member, Institute of Electrical and Electronics Engineers (IEEE)

Member, IEEE CSS Technical Committee on Hybrid Systems.

Member, ASME Dynamic Systems and Control Division, Robotics Technical Committee.

Associate Editor (Journal)

IEEE Transactions on Robotics (TRO), 12/2014-12/2016

Associate Editor (Conference)

IEEE/RSJ International Conference on Intelligent and Robotic Systems (IROS) 2011, 2012, 2013.

Conference Chair

Hybrid Systems: Computation and Control, 2020, co-organized with Sanjit Seshia

Area Chair

Conference on Robot Learning (CoRL) , 2020.

Program Committee

IEEE Conference on Control Technology and Applications (CCTA 2017)

ACM/IEEE International Conference on Cyber-Physical Systems (ICCPS 2014).

Workshop on the Algorithmic Foundations of Robotics (WAFR 2014)

Robotics: Science and Systems (RSS 2014, RSS 2017).

Hybrid Systems: Computation and Control (HSCC 2012, HSCC 2011 and HSCC 2010).

IEEE Workshop on Design, Modeling and Evaluation of Cyber Physical Systems (CyPhy 2012, CyPhy 2011).

NSF Panel Reviewer

1 CAREER Panel.

1 National Robotics Initiative (NRI) panel.

1 Smart Health and Wellbeing panel, CISE Directorate.

4 Cyber-Physical Systems (CPS) panels, CISE Directorate.

Journal Reviewer

• SIAM Journal on Control and Optimization. • IEEE Transactions on Automatic Control. • IEEE Transactions on Robotics. • IEEE Robotics and Automation Magazine. • Journal of Mathematical Analysis and Applications. • Control Systems Magazine. •ESAIM: Control, Optimization, and the Calculus of Variations. • IEEE Transactions on Mechatronics. • Optimal Control, Applications and Methods. • Nonlinear Analysis: Hybrid Systems. • ASME Journal of Dynamic Systems, Measurement and Control.

Conference Reviewer • Conference on Decision and Control. • American Control Conference. • European Control Conference. • International Symposium of Robotics Research. • IEEE International Conference on Robotics and Automation. • Hybrid Systems: Computation and Control. • IEEE/RSJ International Conference on Intelligent Robots and Systems. • Workshop on Design, Modeling and Evaluation of Cyber-Physical Systems. • ACM/IEEE International Conference on Cyber-Physical Systems. • Robotics: Systems and Science. • Workshop on the Algorithmic Foundations of Robotics.

Invited Presentations

[P95] **Restoring Dynamic Mobility with Exoskeletons**
Wandercraft Webinar, Paris (virtually), July, 2020.

[P94] **Safety-Critical Autonomy for Dynamic Robots**
Robust Autonomy Workshop, Robotics: Science and Systems (RSS), July, 2020.

[P93] **Safety-Critical Control of Dynamic Robots**
Contextual Robotics Seminar, UC San Diego, April, 2020.

[P92] **Safety-Critical Control of Dynamic Robots**
Stanford Robotics Seminar, Stanford, February, 2020.

[P91] **Safety-Critical Control of Dynamic Robotic Systems**
Robotics, Controls, and Dynamical Systems (RCDS) Seminar Series, CU Boulder, November, 2019.

[P90] **Learning the Model to Reality Gap in Dynamic Robots**
Workshop on Learning for Control, NSF CPS PI Meeting, November, 2019.

[P89] **Towards the Robots of Science Fiction**
TEDx, Manhattan Beach, October, 2019.

[P88] **Safety-Critical Control of Dynamic Robotic Systems**
GRASP Seminar Series, University of Pennsylvania, September, 2019.

[P87] **Real-World Deployment of Nonlinear Control**
Challenges and Solutions for Legged Robotics: Control, Dynamics, and Optimization for Theory and Application, ACC Workshop, May, 2019.

[P86] **Learning the Model to Reality Gap in Dynamic Robots**
Learning Legged Locomotion, ICRA Workshop, May, 2019.

[P95] **Optimization-Based Control of Legged Robots**
Toward Online Optimal Control of Dynamic Robots: From Algorithmic Advances to Field Applications, ICRA Workshop, May, 2019.

[P84] **Real-World Deployment of Nonlinear Control**
Towards Real-World Deployment of Legged Robots, ICRA Workshop, May, 2019.

[P83] **The Quest for Autonomy on Robotic Systems**
SOCal Robotics Symposium, Caltech, April, 2019.

[P82] **Safety-Critical Control of Dynamic Robotic Systems**
Distinguished Series in Autonomy and Control, University of Illinois, Urbana-Champaign, April, 2019.

[P81] **Safety-Critical Control of Dynamic Robotic Systems**
ECE and CPSRC Seminar, University of California, Santa Cruz, April, 2019.

[P80] **Robotics + Control + Machine Learning**
AI for Science, Caltech, February, 2019.

[P79] **Safety-Critical Control of Dynamic Robotic Systems**
DREAM Seminar, University of California, Berkeley, January, 2019.

[P78] **Safety-Critical Control of Dynamic Robotic Systems**
Cymer Center for Control Systems and Dynamics, University of California, San Diego, November, 2018.

[P77] **Imagining the Robots of Science Fiction**
Mechanical Engieering Section, National Academy of Engineering, October, 2018.

[P76] **Automatic Control of Autonomous Robots**
Vistas in Control, ETH Zürich, September, 2018.

[P75] **Safety-Critical Control of Dynamic Robotic Systems**
Mitsubishi Electric Research Laboratories (MERL), Boston MA, September, 2018.

[P74] **Safety-Critical Control of Dynamic Robotic Systems**
MAE Seminar, University of California, Irvine, May, 2018.

[P73] **Toward the Robots of Science Fiction**
Caltech Alumni Association, California Institute of Technology, May, 2018.

[P72] **The Quest for Autonomy on Dynamic Robotic Systems**
Plenary Speaker, Southwest Robotics Symposium, January, 2018.

[P71] **Toward the Robots of Science Fiction**
Earnest C. Watson Lecture Series, California Institute of Technology, December, 2017.

[P70] **Eye, Robot: Computer Vision and Autonomous Robotics**
Deep Learning Summit, Amazon AWS re:Invent, November, 2017.

[P69] **Unified Control of Dynamic Robotic Systems**
Center for Controls, Dynamical Systems, and Computation (CCDC), University of California, Santa Barbara (UCSB), October, 2017.

[P68] **Unified Control of Dynamic Robotic Systems**
Center for Systems and Control, University of Southern California (USC), October, 2017.

[P67] **Composing Motion Primitives on Walking Robots: A Categorical Perspective**
IROS Workshop: Planning Legged and Aerial Locomotion with Dynamic Motion Primitives , IROS, September, 2017.

[P66] **Towards the Robots of Science Fiction**
CAM Colloquium, University of St. Thomas, September, 2017.

[P65] **Safe and Efficient Dynamic Robotic Locomotion**
RSS Workshop: Challenges in Dynamic Legged Locomotion, Robotics System and Science, July, 2017.

[P64] **Categorical Perspectives on Hybrid Systems with a View Toward Robotics**
Invited Workshop, SIAM Conference on Control and Its Applications , July, 2017.

[P63] **Dynamic Walking on Humanoid Robots and Robotic Assistive Devices**
Centre Automatique et Systèmes, École des Mines de Paris, June, 2017.

[P62] **Imagining the Robots of Science Fiction**
Keynote Speaker, Entrepreneurs Forum, California Institute of Technology, May, 2017.

[P61] **Optimization-Based Control of Dynamic Robotic Systems**
William E. Boeing Department of Aeronautics & Astronautics Distinguished Seminar Series , University of Washington, March, 2017.

[P60] **Unified Control of Dynamic Robotic Systems**
IST Lunch Bunch , Caltech, March, 2017.

[P59] **Safety-Critical Control of Dynamic Robotic Systems**
Mechanical Engineering Seminar , Carnegie Mellon University (CMU), Decmeber, 2016.

[P58] **Safety-Critical Control of Dynamic Robotic Systems**
Jet Propulsion Laboratory (JPL) , Pasadena CA, November, 2016.

[P57] **Controlling the Next Generation of Bipedal Robots and Robotic Assistive Devices**
Planery Presentation, American Control Conference (ACC) , Boston, July, 2016.

[P56] **Control of Hybrid System Models of Robotic Systems: Bipedal Walking**
DISC Summer School , The Netherlands, June, 2016.

[P55] **Towards the Humanoid Robots of Science Fiction**
Design of Robotics and Embedded systems, Analysis, and Modeling Seminar (DREAMS) , UC Berkeley, May, 2016.

[P54] **Towards the Humanoid Robots of Science Fiction**
Mechanical and Aerospace Engineering Colloquium Series , Cornell University, May, 2016.

[P53] **Towards the Humanoid Robots of Science Fiction**
Center for Information & Systems Engineering Seminar , Boston University, February, 2016.

[P52] **Humanoid Robots as ART: Challenges and Opportunities in Dynamic Walking**
Workshop on Accessible Remote Testbeds , National Science Foundation, November, 2015.

[P51] **Towards the Humanoid Robots of Science Fiction**
Laboratory for Computational Sensing + Robotics , Johns Hopkins University, November, 2015.

[P50] **Triumph of Control Theory: How Hybrid System Models and Nonlinear Control Realized Efficient Dynamic Walking on the Humanoid Robot DURUS**
Mechanical and Civil Engineering Seminar, California Institute of Technology, November, 2015.

[P49] **Towards the Humanoid Robots of Science Fiction.**
7785: Introduction to Robotics Research, Georgia Institute of Technology, October, 2015.

[P48] **First Steps toward Formal Controller Synthesis for Bipedal Robots**
Hybrid Modeling Languages (HyML), Rice University, May, 2015.

[P47] **Online Optimization-Based Control of Bipedal Walking Robots.**
Automatic Control Laboratory, ETH Zürich, November, 2014.

[P46] **Controlling the Next Generation of Bipedal Robots.**
ECE Departmental Seminar, Georgia Institute of Technology, August, 2014.

[P45] **Controlling the Next Generation of Bipedal Robots.**
ECE Departmental Seminar, University of Minnesota, April, 2014.

[P44] **Controlling the Next Generation of Bipedal Robots.**
ME Departmental Seminar, Southern Methodist University, March, 2014.

[P43] **Controlling the Next Generation of Bipedal Robots.**
MCE Department Seminar, California Institute of Technology, February, 2014.

[P42] **Controlling the Next Generation of Bipedal Robots.**
Control Seminar Series, Texas A&M University, College Station TX, February, 2014.

[P41] **Controlling the Next Generation of Bipedal Robots.**
681 Graduate Seminar Series, Department of Computer Science & Engineering, Texas A&M University, College Station TX, February, 2014.

[P40] **Controlling the Next Generation of Bipedal Robots.**
GRASP Seminar Series, University of Pennsylvania, Philadelphia, PA, November, 2013.

[P39] **Human-Inspired Control of Bipedal Robotics via Control Lyapunov Functions and Quadratic Programs.**
Invited (keynote) speaker, Hybrid Systems: Computation and Control, Philadelphia, PA, March, 2013.

[P38] **Controlling the Next Generation of Bipedal Robots.**
Departement of Mechanical Engineering Seminar, Massachusetts Institute of Technology, Cambridge MA, February, 2013.

[P37] **Better Feedback Control of Bipedal Locomotion.**
International Workshop on Recent Developments in Robotics and Control (SpongFest), University of Texas at Dallas, Dallas TX, November, 2012.

[P36] **Simplicity on the Far Side of Complexity in the Control of Bipedal Robots.**
Control and Dynamical Systems Department Seminar, California Institute of Technology, Pasadena CA, October, 2012.

[P35] **Human-Inspired Bipedal Robotic Walking: From Theorems to Experimental Realization.**
681 Graduate Seminar Series, Department of Mechanical Engineering, Texas A&M University, College Station TX, September, 2012.

[P34] **Human-Inspired Bipedal Robotic Walking: Formal Methods, Software Structures and Experimental Realization.**
Halmstad Colloquium, Halmstad University, Halmstad, Sweden, June, 2012.

[P33] **Human-Inspired Bipedal Robotic Walking: From Theorems to Experimental Realization.**
Automated Control Seminar, Kungliga Tekniska Högskolan (KTH) Royal Institute of Technology, Stockholm, Sweden, June, 2012.

[P32] **Human-Inspired Bipedal Robotic Walking: From Human Data to Controller Design to Experimental Realization.**
Departmental Seminar, Aeronautics & Astronautics Department, University of Washington, Seattle, March, 2012.

[P31] **Human-Inspired Bipedal Robotic Walking: From Human Data to Controller Design to Experimental Realization.**
Control Science Laboratory (CSL), Electrical & Computer Engineering, University of Illinois, Urbana-Champaign, February, 2012.

[P30] **Human-Inspired Bipedal Robotic Walking.**
Departmental Seminar, Biomedical Engineering, Texas A&M University, College Station TX, November, 2011.

[P29] **First Steps Toward Automatically Generating Bipedal Robotic Walking from Human Data.**
Keynote Presentation, 8th International Workshop on Robot Motion and Control (RoMoCo), Gronow, Poland, June, 2011.

[P28] **From Human Data to Bipedal Robotic Walking and Beyond.**
Departmental Seminar, Department of Electrical Engineering and Computer Science, Northwestern University, Chicago IL, March, 2011.

[P27] **From Human Data to Bipedal Robotic Walking and Beyond.**
Sensor Motor Performance Program, Rehabilitation Institute of Chicago, Chicago IL, March, 2011.

[P26] **Bipedal Robotic Walking via Human-Inspired Control.**
Robotics and Embedded Systems Seminar, Department of Electrical Engineering and Computer Sciences, University of California at Berkeley, Berkeley CA, March, 2011.

[P25] **First Steps Toward Closing the Loop on Walking: From Human Walking to Hybrid Systems to Robotic Walking and Back.**
System, Control & Robotics Seminar Series, Texas A&M University, College Station, TX, February, 2011.

[P24] **First Steps Toward Closing the Loop on Walking: From Human Walking to Hybrid Systems to Robotic Walking and Back.**
Sensor Motor Performance Program, Rehabilitation Institue of Chicago and Northwestern University, Chicago IL, January, 2011.

[P23] **First Steps Toward Closing the Loop on Walking: From Human Walking to Hybrid Systems to Robotic Walking and Back.**
Robotic Systems Technology Branch, NASA, Houston TX, November, 2010.

[P22] **First Steps Toward Closing the Loop on Walking: From Human Walking to Hybrid Systems to Robotic Walking and Back.**
681 Graduate Seminar Series, Department of Mechanical Engineering, Texas A&M University, College Station TX, October, 2010.

[P21] **First Steps Toward Closing the Loop on Walking: From Human Walking to Hybrid Systems to Robotic Walking and Back.**
Dynamic Walking 2010, Principles and Concepts of Legged Locomotion, Massachusetts Institute of Technology, Boston MA, July, 2010.

[P20] **Bipedal Robotic Walking: Motivating the Study of Hybrid Phenomena.**
División de Ingenierías, Campus Irapuato-Salamanca, Universidad de Guanajuato, Guanajuato, Mexico, May, 2010.

[P19] **Bipedal Robotic Walking: Motivating the Study of Hybrid Phenomena.**
Robotics and Embedded Systems Seminar, Department of Electrical Engineering and Computer Sciences, University of California at Berkeley, Berkeley CA, May, 2010.

[P18] **Bipedal Robotic Walking: Motivating the Study of Hybrid Phenomena.**
Departmental Seminar, Department of Mechanical Engineering and Materials Science, Rice University, Houston TX, October, 2009.

[P17] **Detection of Zeno Behavior and Completion of Hybrid Systems Applied to a Bipedal Walking Robot.** Mini-Symposium on Analysis of Hybrid, Measure-Driven, and Linear Complementarity Dynamical Systems (invited), SIAM Conference on Control and its Applications, Denver CO, July, 2009.

[P16] **Bipedal Robotic Walking: Motivating the Study of Hybrid Phenomena.** *Departmental Seminar*, Department of Mechanical Engineering, Northwestern University, March 2008.

[P15] **Bipedal Robotic Walking: Motivating the Study of Hybrid Phenomena.** *Departmental Seminar*, Department of Mechanical Engineering, Texas A&M University, March 2008.

[P14] **Stably Extending Two-Dimensional Bipedal Walking to Three Dimensions via Geometric Reduction.** *Controls Seminar,* Department of Electrical Engineering, University of California at Los Angeles, May 2007.

[P13] **Stably Extending Two-Dimensional Bipedal Walking to Three Dimensions via Geometric Reduction.** *Systems Science Seminar,* Department of Electrical Engineering & Computer Science, University of Michigan, December 2006.

[P12] **Hybrid Model Category Structures and Homotopy Colimits.** *Topology Seminar,* Department of Mathematics, University of Illinois at Urbana-Champaign, November 2006.

[P11] **Stably Extending Two-Dimensional Bipedal Walking to Three Dimensions via Geometric Reduction.** *Decision and Control Seminar,* Department of Electrical & Computer Engineering, University of Illinois at Urbana-Champaign, November 2006.

[P10] **Hybrid Model Structures (or Hybrid Homotopy Theory).** *Workshop on Topology and Robotics,* Forschungsinstitut für Mathematik, ETH Zürich, 2006.

[P9] **A Categorical Theory of Hybrid Systems.** *Center for Hybrid and Embedded Software Systems Seminar,* Department of EECS, UC Berkeley, 2006.

[P8] **Diagrams in Model Categories.** *Noncommutative Geometry Seminar,* Department of Mathematics, UC Berkeley, 2006.

[P7] **Homogeneous Semantic Preserving Deployments of Heterogeneous Networks of Embedded Systems.** *Networked Embedded Systems Seminar,* Department of EECS, UC Berkeley, 2006.

[P6] **A Categorical Approach to the Hybrid Reduction of Hybrid Symplectic Manifolds with Hybrid Symmetry.** *Departmental Seminar,* Department of Electrical Engineering, University of Notre Dame, 2005.

[P5] **A Categorical Theory of Dynamical and Hybrid Systems.** *Noncommutative Geometry Seminar,* Department of Mathematics, UC Berkeley, 2005.

[P4] **A Categorical Theory of Hybrid Systems.** *Center for Hybrid and Embedded Software Systems Seminar,* Department of EECS, UC Berkeley, 2004.

[P3] **An Introduction to Hybrid Systems.** *Center for Hybrid and Embedded Software Systems Seminar,* Department of EECS, UC Berkeley, 2004.

[P1] **Blowing Up Affine Hybrid Systems.** *Center for Hybrid and Embedded Software Systems Seminar,* Department of EECS, UC Berkeley, 2004.

[P1] **Scissors Congruences on Polytopes, Group Homology, and Some Questions in Algebraic K-Theory.** *Noncommutative Geometry Seminar,* Department of Mathematics, UC Berkeley, 2003.

Publications

Theses

[T1] Aaron D Ames
A categorical theory of hybrid systems
PhD thesis. University of California, Berkeley, 2006.

[T2] Aaron D Ames
Hybrid model structures
MA thesis. University of California, Berkeley, 2006.

Journals

[J1] Yuxiao Chen, Andrew Singletary, and Aaron D Ames
Guaranteed obstacle avoidance for multi-robot operations with limited actuation: a control barrier function approach
In: *IEEE Control Systems Letters* 5.1 (2021), pp. 127–132.

[J2] Rachel Gehlhar and Aaron D Ames
Separable Control Lyapunov Functions with Application to Prostheses
In: *IEEE Control Systems Letters* 5.2 (2021), pp. 559–564.

[J3] Rohit Konda, Aaron D Ames, and Samuel Coogan
Characterizing Safety: Minimal Control Barrier Functions From Scalar Comparison Systems
In: *IEEE Control Systems Letters* 5.2 (2021), pp. 523–528.

[J4] Wen-Loong Ma, Noel Csomay-Shanklin, and Aaron D Ames
Coupled Control Systems: Periodic Orbit Generation With Application to Quadrupedal Locomotion
In: *IEEE Control Systems Letters* 5.3 (2021), pp. 935–940.

[J5] Ugo Rosolia and Aaron D Ames
Multi-Rate Control Design Leveraging Control Barrier Functions and Model Predictive Control Policies
In: *IEEE Control Systems Letters* 5.3 (2021), pp. 1007–1012.

[J6] Andrew J Taylor, Pio Ong, Jorge Cortés, and Aaron D Ames
Safety-Critical Event Triggered Control via Input-to-State Safe Barrier Functions
In: *IEEE Control Systems Letters* 5.3 (2021), pp. 749–754.

[J7] Andrew J Taylor, Andrew Singletary, Yisong Yue, and Aaron D Ames
A Control Barrier Perspective on Episodic Learning via Projection-to-State Safety
In: *IEEE Control Systems Letters* 5.3 (2021), pp. 1019–1024.

[J8] Aaron D Ames, Gennaro Notomista, Yorai Wardi, and Magnus Egerstedt
Integral Control Barrier Functions for Dynamically Defined Control Laws
In: *IEEE Control Systems Letters* 5.3 (2020), pp. 887–892.

[J9] Alexander H Chang, Christian M Hubicki, Jeffrey J Aguilar, Daniel I Goldman, Aaron D Ames, and Patricio A Vela
Learning Terrain Dynamics: A Gaussian Process Modeling and Optimal Control Adaptation Framework Applied to Robotic Jumping
In: *IEEE Transactions on Control Systems Technology* (2020).

[J10] Thomas Gurriet, Maegan Tucker, Alexis Duburcq, Guilhem Boeris, and Aaron D Ames
Towards Variable Assistance for Lower Body Exoskeletons
In: *IEEE Robotics and Automation Letters* 5.1 (2020), pp. 266–273.

[J11] Kaveh Akbari Hamed, Vinay R Kamidi, Wen-Loong Ma, Alexander Leonessa, and Aaron D Ames
Hierarchical and Safe Motion Control for Cooperative Locomotion of Robotic Guide Dogs and Humans: A Hybrid Systems Approach
In: *IEEE Robotics and Automation Letters* 5.1 (2020), pp. 56–63.

[J12] Tatsuya Ibuki, Sean Wilson, Aaron D Ames, and Magnus Egerstedt
Distributed Collision-Free Motion Coordination on a Sphere: A Conic Control Barrier Function Approach
In: *IEEE Control Systems Letters* 4.4 (2020), pp. 976–981.

[J13] Xiaobin Xiong and Aaron D Ames
Dynamic and versatile humanoid walking via embedding 3D actuated SLIP model with hybrid lip based stepping
In: *IEEE Robotics and Automation Letters* 5.4 (2020), pp. 6286–6293.

[J14] You Yu, Joanna Nassar, Changhao Xu, Jihong Min, Yiran Yang, Adam Dai, Rohan Doshi, Adrian Huang, Yu Song, Rachel Gehlhar, et al.
Biofuel-powered soft electronic skin with multiplexed and wireless sensing for human-machine interfaces
In: *Science Robotics* 5.41 (2020).

[J15] Vahid Azimi, Tony Shu, Huihua Zhao, Rachel Gehlhar, Dan Simon, and Aaron D Ames
Model-Based Adaptive Control of Transfemoral Prostheses: Theory, Simulation, and Experiments
In: *IEEE Transactions on Systems, Man, and Cybernetics: Systems* (2019).

[J16] Kaveh Akbari Hamed and Aaron D Ames
Nonholonomic Hybrid Zero Dynamics for the Stabilization of Periodic Orbits: Application to Underactuated Robotic Walking
In: *IEEE Transactions on Control Systems Technology* (2019).

[J17] Shishir Kolathaya and Aaron D Ames
Input-to-State Safety with Control Barrier Functions
In: *IEEE Control Systems Letters* 3.1 (2019), pp. 108–113.

[J18] Omar Harib, Ayonga Hereid, Ayush Agrawal, Thomas Gurriet, Sylvain Finet, Guilhem Boeris, Alexis Duburcq, M Eva Mungai, Mattieu Masselin, Aaron D Ames, et al.
Feedback control of an exoskeleton for paraplegics: Toward robustly stable, hands-free dynamic walking
In: *IEEE Control Systems Magazine* 38.6 (2018), pp. 61–87.

[J19] Ayonga Hereid, Christian M Hubicki, Eric A Cousineau, and Aaron D Ames
Dynamic humanoid locomotion: A scalable formulation for HZD gait optimization
In: *IEEE Transactions on Robotics* 34.2 (2018), pp. 370–387.

[J20] Shishir Kolathaya, William Guffey, Ryan W Sinnet, and Aaron D Ames
Direct Collocation for Dynamic Behaviors With Nonprehensile Contacts: Application to Flipping Burgers
In: *IEEE Robotics and Automation Letters* 3.4 (2018), pp. 3677–3684.

[J21] Xiangru Xu, Jessy W Grizzle, Paulo Tabuada, and Aaron D Ames
Correctness guarantees for the composition of lane keeping and adaptive cruise control
In: *IEEE Transactions on Automation Science and Engineering* 15.3 (2018). Best New Application Paper Award, pp. 1216–1229.

[J22] Ayush Agrawal, Omar Harib, Ayonga Hereid, Sylvain Finet, Matthieu Masselin, Laurent Praly, Aaron D Ames, Koushil Sreenath, and Jessy W Grizzle
First steps towards translating HZD control of bipedal robots to decentralized control of exoskeletons
In: *IEEE Access* 5 (2017), pp. 9919–9934.

[J23] Aaron D Ames, Paulo Tabuada, Austin Jones, Wen-Loong Ma, Matthias Rungger, Bastian Schürmann, Shishir Kolathaya, and Jessy W Grizzle
First steps toward formal controller synthesis for bipedal robots with experimental implementation
In: *Nonlinear Analysis: Hybrid Systems* 25 (2017), pp. 155–173.

[J24] Aaron D Ames, Xiangru Xu, Jessy W Grizzle, and Paulo Tabuada
Control barrier function based quadratic programs for safety critical systems
In: *IEEE Transactions on Automatic Control* 62.8 (2017), pp. 3861–3876.

[J25] Omar Hussien, Aaron D Ames, and Paulo Tabuada
Abstracting Partially Feedback Linearizable Systems Compositionally
In: *IEEE Control Systems Letters* 1.2 (2017), pp. 227–232.

[J26] Shishir Kolathaya and Aaron D Ames
Parameter to state stability of control Lyapunov functions for hybrid system models of robots
In: *Nonlinear Analysis: Hybrid Systems* 25 (2017), pp. 174–191.

[J27] Li Wang, Aaron D Ames, and Magnus Egerstedt
Safety Barrier certificates for collisions-free multirobot systems
In: *IEEE Transactions on Robotics* 33.3 (2017), pp. 661–674.

[J28] Huihua Zhao, Ayonga Hereid, Wen-loong Ma, and Aaron D Ames
Multi-contact bipedal robotic locomotion
In: *Robotica* 35.5 (2017), pp. 1072–1106.

[J29] Huihua Zhao, Jonathan Horn, Jacob Reher, Victor Paredes, and Aaron D Ames
First steps toward translating robotic walking to prostheses: a nonlinear optimization based control approach
In: *Autonomous Robots* 41.3 (2017), pp. 725–742.

[J30] Michal Konecny, Walid Taha, Ferenc A Bartha, Jan Duracz, Adam Duracz, and Aaron D Ames
Enclosing the behavior of a hybrid automaton up to and beyond a Zeno point
In: *Nonlinear Analysis: Hybrid Systems* 20 (2016), pp. 1–20.

[J31] Petter Nilsson, Omar Hussien, Ayca Balkan, Yuxiao Chen, Aaron D Ames, Jessy W Grizzle, Necmiye Ozay, Huei Peng, and Paulo Tabuada
Correct-by-construction adaptive cruise control: Two approaches
In: *IEEE Transactions on Control Systems Technology* 24.4 (2016), pp. 1294–1307.

[J32] Huihua Zhao, Jonathan Horn, Jacob Reher, Victor Paredes, and Aaron D Ames
Multicontact locomotion on transfemoral prostheses via hybrid system models and optimization-based control
In: *IEEE Transactions on Automation Science and Engineering* 13.2 (2016), pp. 502–513.

[J33] Urs Borrmann, Li Wang, Aaron D Ames, and Magnus Egerstedt
Control barrier certificates for safe swarm behavior
In: *IFAC-PapersOnLine* 48.27 (2015), pp. 68–73.

[J34] Neil T Dantam, Daniel M Lofaro, Ayonga Hereid, Paul Y Oh, Aaron D Ames, and Mike Stilman
The Ach library: a new framework for real-time communication
In: *IEEE Robotics & Automation Magazine* 22.1 (2015), pp. 76–85.

[J35] Kevin Galloway, Koushil Sreenath, Aaron D Ames, and Jessy W Grizzle
Torque saturation in bipedal robotic walking through control Lyapunov function-based quadratic programs
In: *IEEE Access* 3 (2015), pp. 323–332.

[J36] Shishir Kolathaya and Aaron D Ames
Parameter sensitivity and boundedness of robotic hybrid periodic orbits
In: *IFAC-PapersOnLine* 48.27 (2015), pp. 377–382.

[J37] Nicolaus A Radford, Philip Strawser, Kimberly Hambuchen, Joshua S Mehling, William K Verdeyen, A Stuart Donnan, James Holley, Jairo Sanchez, Vienny Nguyen, Lyndon Bridgwater, Reginald Berka, Robert Ambrose, Mason M. Markee, N. J. Fraser-Chanpong, Christopher McQuin, John D. Yamokoski, Stephen Hart, Raymond Guo, Adam Parsons, Brian Wightman, Paul Dinh, Barrett Ames, Charles Blakely, Courney Edmondson, Brett Sommers, Rochelle Rea, Chad Tabler, Heather Bibby, Brice Howard, Lei Niu, Andrew Lee, Michael Conover, Lily Truong, Ryan Reed, David Chesney, Robert Platt Jr, Gwendolyn Johnson, Chien-Liang Fok, Nicholas Paine, Luis Sentis, Eric Cousineau, Ryan Sinnet, Jordan Lack, Matthew Powell, Benjamin Morris, Aaron D Ames, and Jide Akinyode
Valkyrie: NASA's first bipedal humanoid robot
In: *Journal of Field Robotics* 32.3 (2015), pp. 397–419.

[J38] Xiangru Xu, Paulo Tabuada, Jessy W Grizzle, and Aaron D Ames
Robustness of Control Barrier Functions for Safety Critical Control
In: *IFAC-PapersOnLine* 48.27 (2015), pp. 54–61.

[J39] Aaron D Ames
Human-inspired control of bipedal walking robots
In: *IEEE Transactions on Automatic Control* 59.5 (2014), pp. 1115–1130.

[J40] Aaron D Ames, Kevin Galloway, Koushil Sreenath, and Jessy W Grizzle
Rapidly exponentially stabilizing control Lyapunov functions and hybrid zero dynamics
In: *IEEE Transactions on Automatic Control* 59.4 (2014), pp. 876–891.

[J41] Neil T Dantam, Daniel M Lofaro, Ayonga Hereid, Paul Y Oh, Aaron D Ames, and Mike Stilman
Multiprocess Communication and Control Software for Humanoid Robots
In: *IEEE Robotics and Automation Magazine* (2014).

[J42] Jessy W Grizzle, Christine Chevallereau, Ryan W Sinnet, and Aaron D Ames
Models, feedback control, and open problems of 3D bipedal robotic walking
In: *Automatica* 50.8 (2014), pp. 1955–1988.

[J43] Ryan W Sinnet, Shu Jiang, and Aaron D Ames
A human-inspired framework for bipedal robotic walking design
In: *International Journal of Biomechatronics and Biomedical Robotics* 3.1 (2014), pp. 20–41.

[J44] Huihua Zhao, Matthew J Powell, and Aaron D Ames
Human-inspired motion primitives and transitions for bipedal robotic locomotion in diverse terrain
In: *Optimal Control Applications and Methods* 35.6 (2014), pp. 730–755.

[J45] Andrew Lamperski and Aaron D Ames
Lyapunov theory for Zeno stability
In: *IEEE Transactions on Automatic Control* 58.1 (2013), pp. 100–112.

[J46] Ramanarayan Vasudevan, Aaron D Ames, and Ruzena Bajcsy
Persistent homology for automatic determination of human-data based cost of bipedal walking
In: *Nonlinear Analysis: Hybrid Systems* 7.1 (2013), pp. 101–115.

[J47] Ryan W Sinnet and Aaron D Ames
Bio-inspired feedback control of three-dimensional humanlike bipedal robots
In: *Journal of Robotics and Mechatronics* 24.4 (2012), p. 595.

[J48] Eric Wendel and Aaron D Ames
Rank deficiency and superstability of hybrid systems
In: *Nonlinear Analysis: Hybrid Systems* 6.2 (2012), pp. 787–805.

[J49] Yizhar Or and Aaron D Ames
Stability and completion of Zeno equilibria in Lagrangian hybrid systems
In: *IEEE Transactions on Automatic Control* 56.6 (2011), pp. 1322–1336.

[J50] Walid Taha, Paul Brauner, Robert Cartwright, Veronica Gaspes, Aaron D Ames, and Alexandre Chapoutot
A core language for executable models of cyber physical systems: work in progress report
In: *ACM SIGBED Review* 8.2 (2011), pp. 39–43.

[J51] Ram Vasudevan, Aaron D Ames, and Ruzena Bajcsy
Human Based Cost from Persistent Homology for Bipedal Walking
In: *IFAC Proceedings Volumes* 44.1 (2011), pp. 3292–3297.

[J52] Paulo Tabuada, Aaron D Ames, Agung Julius, and George J Pappas
Approximate reduction of dynamic systems
In: *Systems & Control Letters* 57.7 (2008), pp. 538–545.

[J53] Aaron D Ames
Homotopy Meaningful Hybrid Model Structures
In: *Contemporary Mathematics* 438 (2007), p. 121.

[J54] Jonathan Sprinkle, Aaron D Ames, J Mikael Eklund, Ian M Mitchell, and S Shankar Sastry
Online safety calculations for glide-slope recapture
In: *Innovations in Systems and Software Engineering* 1.2 (2005), pp. 157–175.

Book Chapters

[B1] Jacob P Reher, Ayonga Hereid, Shishir Kolathaya, Christian M Hubicki, and Aaron D Ames
Algorithmic foundations of realizing multi-contact locomotion on the humanoid robot DURUS
In: *Algorithmic Foundations of Robotics XII*. Springer, Cham, 2020, pp. 400–415.

[B2] Aaron D Ames and Ioannis Poulakakis
Hybrid Zero Dynamics Control of Legged Robots
In: *Bioinspired Legged Locomotion: Models, Concepts, Control and Applications*. Elsevier, 2017, pp. 292–331.

[B3] Shishir Kolathaya, Wen-Loong Ma, and Aaron D Ames
Composing Dynamical Systems to Realize Dynamic Robotic Dancing
In: *Algorithmic Foundations of Robotics XI*. Springer, Cham, 2015, pp. 425–442.

[B4] Aaron D Ames and Matthew Powell
Towards the unification of locomotion and manipulation through control Lyapunov functions and quadratic programs
In: *Control of Cyber-Physical Systems*. Springer, Heidelberg, 2013, pp. 219–240.

[B5] Shishir Nadubettu Yadukumar, Murali Pasupuleti, and Aaron D Ames
From formal methods to algorithmic implementation of human inspired control on bipedal robots
In: *Algorithmic Foundations of Robotics X*. Springer, Berlin, Heidelberg, 2013, pp. 511–526.

[B6] Aaron D Ames
First steps toward automatically generating bipedal robotic walking from human data
In: *Robot Motion and Control 2011*. Springer, London, 2012, pp. 89–116.

[B7] Aaron D Ames, Ryan W Sinnet, and Eric DB Wendel
Three-dimensional kneed bipedal walking: A hybrid geometric approach
In: *International Workshop on Hybrid Systems: Computation and Control*. 2009, pp. 16–30.

[B8] Yizhar Or and Aaron D Ames
Existence of periodic orbits with Zeno behavior in completed Lagrangian hybrid systems
In: *International Workshop on Hybrid Systems: Computation and Control*. 2009, pp. 291–305.

[B9] Andrew Lamperski and Aaron D Ames
Sufficient conditions for Zeno behavior in Lagrangian hybrid systems
In: *International Workshop on Hybrid Systems: Computation and Control*. 2008, pp. 622–625.

[B10] Aaron D Ames, Robert Gregg, Eric Wendel, and Shankar Sastry
On the geometric reduction of controlled three-dimensional bipedal robotic walkers
In: Springer Berlin/Heidelberg, 2007, pp. 183–196.

[B11] Sumitra Ganesh, Aaron D Ames, and Ruzena Bajcsy
Composition of dynamical systems for estimation of human body dynamics
In: *International Workshop on Hybrid Systems: Computation and Control*. 2007, pp. 702–705.

[B12] Aaron D Ames, Alberto Sangiovanni-Vincentelli, and Shankar Sastry
Homogeneous semantics preserving deployments of heterogeneous networks of embedded systems
In: *Networked Embedded Sensing and Control*. Springer, Berlin, Heidelberg, 2006, pp. 127–154.

[B13] Aaron D Ames, Paulo Tabuada, and Shankar Sastry
On the stability of Zeno equilibria
In: *International Workshop on Hybrid Systems: Computation and Control*. 2006, pp. 34–48.

[B14] Haiyang Zheng, Edward A Lee, and Aaron D Ames
Beyond Zeno: Get on with it!
In: *International Workshop on Hybrid Systems: Computation and Control*. 2006, pp. 568–582.

[B15] Aaron D Ames and Shankar Sastry
A homology theory for hybrid systems: Hybrid homology
In: *International Workshop on Hybrid Systems: Computation and Control*. 2005, pp. 86–102.

[B16] Aaron D Ames and Shankar Sastry
Affine hybrid systems
In: *International Workshop on Hybrid Systems: Computation and Control*. 2004, pp. 16–31.

[B17] Aaron D Ames, Jeffrey A Jalkio, and Cheri Shakiban
Three-dimensional object recognition using invariant Euclidean signature curves
In: *Analysis, combinatorics and computing*. 2002, pp. 13–23.

Conference Papers (Refereed)

[C1] Mohamadreza Ahmadi, Masahiro Ono, Michel D Ingham, Richard M Murray, and Aaron D Ames
Risk-Averse Planning Under Uncertainty
In: *2020 American Control Conference (ACC)*. IEEE. 2020, pp. 3305–3312.

[C2] Eric Ambrose and Aaron D Ames
Improved Performance on Moving-Mass Hopping Robots with Parallel Elasticity
In: *2020 IEEE International Conference on Robotics and Automation (ICRA)*. IEEE. 2020, pp. 2457–2463.

[C3] Yuxiao Chen, Mohamadreza Ahmadi, and Aaron D Ames
Optimal safe controller synthesis: A density function approach
In: *2020 American Control Conference (ACC)*. IEEE. 2020, pp. 5407–5412.

[C4] Yuxiao Chen, Andrew W Singletary, and Aaron D Ames
Density Functions for Guaranteed Safety on Robotic Systems
In: *2020 American Control Conference (ACC)*. IEEE. 2020, pp. 3199–3204.

[C5] Ludvig Doeser, Petter Nilsson, Aaron D Ames, and Richard M Murray
Invariant Sets for Integrators and Quadrotor Obstacle Avoidance
In: *2020 American Control Conference (ACC)*. IEEE. 2020, pp. 3814–3821.

[C6] Chang Gao, Rachel Gehlhar, Aaron D Ames, Shih-Chii Liu, and Tobi Delbruck
Recurrent Neural Network Control of a Hybrid Dynamical Transfemoral Prosthesis with EdgeDRNN Accelerator
In: *2020 IEEE International Conference on Robotics and Automation (ICRA)*. IEEE. 2020, pp. 5460–5466.

[C7] Kaveh Akbari Hamed, Vinay R Kamidi, Abhishek Pandala, Wen-Loong Ma, and Aaron D Ames
Distributed Feedback Controllers for Stable Cooperative Locomotion of Quadrupedal Robots: A Virtual Constraint Approach
In: *2020 American Control Conference (ACC)*. IEEE. 2020, pp. 5314–5321.

[C8] Filip Klaesson, Petter Nilsson, Aaron D Ames, and Richard M Murray
Intermittent Connectivity for Exploration in Communication-Constrained Multi-Agent Systems
In: *2020 ACM/IEEE 11th International Conference on Cyber-Physical Systems (ICCPS)*. IEEE. 2020, pp. 196–205.

[C9] Wen-Loong Ma and Aaron D Ames
From Bipedal Walking to Quadrupedal Locomotion: Full-Body Dynamics Decomposition for Rapid Gait Generation
In: *2020 IEEE International Conference on Robotics and Automation (ICRA)*. 2020, pp. 4491–4497.

[C10] Petter Nilsson and Aaron D Ames
Lyapunov-Like Conditions for Tight Exit Probability Bounds through Comparison Theorems for SDEs
In: *2020 American Control Conference (ACC)*. IEEE. 2020, pp. 5175–5181.

[C11] Ayush Pandey and Aaron D Ames
On a Converse theorem for Finite-time Lyapunov Functions to Estimate Domains of Attraction
In: *2020 American Control Conference (ACC)*. IEEE. 2020, pp. 3763–3769.

[C12] Jenna Reher, Noel Csomay-Shanklin, David L. Christensen, Bobby Bristow, Aaron D. Ames, and Lanny Smoot
Passive Dynamic Balancing and Walking in Actuated Environments
In: *2020 IEEE International Conference on Robotics and Automation (ICRA)*. 2020, pp. 9775–9781.

[C13] Jenna Reher, Claudia Kann, and Aaron D Ames
An inverse dynamics approach to control Lyapunov functions
In: *2020 American Control Conference (ACC)*. IEEE. 2020, pp. 2444–2451.

[C14] Andrew Singletary, Thomas Gurriet, Petter Nilsson, and Aaron D. Ames
Safety-Critical Rapid Aerial Exploration of Unknown Environments
In: *2020 IEEE International Conference on Robotics and Automation (ICRA)*. 2020, pp. 10270–10276.

[C15] HJ Suh, Xiaobin Xiong, Andrew Singletary, Aaron D Ames, and Joel W Burdick
Optimal Motion Planning for Multi-Modal Hybrid Locomotion
In: *2020 IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS)*. IEEE. 2020.

[C16] Andrew J Taylor and Aaron D Ames
Adaptive safety with control barrier functions
In: *2020 American Control Conference (ACC)*. IEEE. 2020, pp. 1399–1405.

[C17] Andrew Taylor, Andrew Singletary, Yisong Yue, and Aaron Ames
Learning for safety-critical control with control barrier functions
In: *Learning for Dynamics and Control*. PMLR. 2020, pp. 708–717.

[C18] Maegan Tucker, Ellen Novoseller, Claudia Kann, Yanan Sui, Yisong Yue, Joel Burdick, and Aaron D Ames
Preference-Based Learning for Exoskeleton Gait Optimization
In: *2020 IEEE International Conference on Robotics and Automation (ICRA)*. ICRA Best Conference Paper Award, and Best Paper Award on Human-Robot Interaction (HRI). 2020, pp. 2351–2357.

[C19] Xiaobin Xiong and Aaron Ames
Sequential Motion Planning for Bipedal Somersault via Flywheel SLIP and Momentum Transmission with Task Space Control
In: *2020 IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS)*. IEEE. 2020.

[C20] Mohamadreza Ahmadi, Andrew Singletary, Joel W Burdick, and Aaron D Ames
Safe Policy Synthesis in Multi-Agent POMDPs via Discrete-Time Barrier Functions
In: *2019 IEEE 58th Conference on Decision and Control (CDC)*. IEEE. 2019, pp. 4797–4803.

[C21] Eric Ambrose, Noel Csomay-Shanklin, Yizhar Or, and Aaron Ames
Design and Comparative Analysis of 1D Hopping Robots
In: *2019 IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS)*. IEEE. 2019, pp. 5717–5724.

[C22] Aaron D Ames, Samuel Coogan, Magnus Egerstedt, Gennaro Notomista, Koushil Sreenath, and Paulo Tabuada
Control barrier functions: Theory and applications
In: *2019 18th European Control Conference (ECC)*. IEEE. 2019, pp. 3420–3431.

[C23] Alexander H Chang, Christian Hubicki, Aaron D Ames, and Patricio A Vela
Every Hop is an Opportunity: Quickly Classifying and Adapting to Terrain During Targeted Hopping
In: *2019 International Conference on Robotics and Automation (ICRA)*. IEEE. 2019, pp. 3188–3194.

[C24] Yuxiao Chen, James Anderson, Karan Kalsi, Steven H Low, and Aaron D Ames
Compositional set invariance in network systems with assume-guarantee contracts
In: *2019 American Control Conference (ACC)*. IEEE. 2019, pp. 1027–1034.

[C25] Thomas Gurriet, Mark Mote, Andrew Singletary, Eric Feron, and Aaron D Ames
A scalable controlled set invariance framework with practical safety guarantees
In: *2019 IEEE 58th Conference on Decision and Control (CDC)*. IEEE. 2019, pp. 2046–2053.

[C26] Thomas Gurriet, Petter Nilsson, Andrew Singletary, and Aaron D Ames
Realizable Set Invariance Conditions for Cyber-Physical Systems
In: *2019 American Control Conference (ACC)*. IEEE. 2019, pp. 3642–3649.

[C27] Kaveh Akbari Hamed, Wen-Loong Ma, and Aaron D Ames
Dynamically Stable 3D Quadrupedal Walking with Multi-Domain Hybrid System Models and Virtual Constraint Controllers
In: *2019 American Control Conference (ACC)*. IEEE. 2019, pp. 4588–4595.

[C28] Wen-Loong Ma, Kaveh Akbari Hamed, and Aaron D Ames
First steps towards full model based motion planning and control of quadrupeds: A hybrid zero dynamics approach
In: *2019 IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS)*. IEEE. 2019, pp. 5498–5503.

[C29] Wen-Loong Ma, Yizhar Or, and Aaron D Ames
Dynamic walking on slippery surfaces: Demonstrating stable bipedal gaits with planned ground slippage
In: *2019 International Conference on Robotics and Automation (ICRA)*. IEEE. 2019, pp. 3705–3711.

[C30] Vishal Murali, Aaron D Ames, and Erik I Verriest
Optimal Walking Speed Transitions for Fully Actuated Bipedal Robots
In: *2019 IEEE 58th Conference on Decision and Control (CDC)*. IEEE. 2019, pp. 6295–6300.

[C31] Gábor Orosz and Aaron D Ames
Safety Functionals for Time Delay Systems
In: *2019 American Control Conference (ACC)*. IEEE. 2019, pp. 4374–4379.

[C32] Jacob Reher, Wen-Loong Ma, and Aaron D Ames
Dynamic walking with compliance on a cassie bipedal robot
In: *2019 18th European Control Conference (ECC)*. IEEE. 2019, pp. 2589–2595.

[C33] Andrew Singletary, Petter Nilsson, Thomas Gurriet, and Aaron D Ames
Online Active Safety for Robotic Manipulators
In: *2019 IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS)*. IEEE. 2019, pp. 173–178.

[C34] Andrew J Taylor, Victor D Dorobantu, Meera Krishnamoorthy, Hoang M Le, Yisong Yue, and Aaron D Ames
A control lyapunov perspective on episodic learning via projection to state stability
In: *2019 IEEE 58th Conference on Decision and Control (CDC)*. IEEE. 2019, pp. 4797–4803.

[C35] Andrew J Taylor, Victor D Dorobantu, Hoang M Le, Yisong Yue, and Aaron D Ames
Episodic learning with control lyapunov functions for uncertain robotic systems
In: *2019 IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS)*. IEEE. 2019, pp. 6878–6884.

[C36] Tyler Westenbroek, Xiaobin Xiong, Aaron D Ames, and S Shankar Sastry
Optimal control of piecewise-smooth control systems via singular perturbations
In: *2019 IEEE 58th Conference on Decision and Control (CDC)*. IEEE. 2019, pp. 3046–3053.

[C37] Xiaobin Xiong and Aaron Ames
Motion Decoupling and Composition via Reduced Order Model Optimization for Dynamic Humanoid Walking with CLF-QP based Active Force Control
In: *2019 IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS)*. IROS RoboCup Best Paper Award. IEEE. 2019, pp. 1018–1024.

[C38] Xiaobin Xiong and Aaron Ames
Orbit Characterization, Stabilization and Composition on 3D Underactuated Bipedal Walking via Hybrid Passive Linear Inverted Pendulum Model
In: *2019 IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS)*. IEEE. 2019, pp. 4644–4651.

[C39] Jonathan R Gosyne, Christian M Hubicki, Xiaobin Xiong, Aaron D Ames, and Daniel I Goldman
Bipedial Locomotion Up Sandy Slopes: Systematic Experiments Using Zero Moment Point Methods
In: *2018 IEEE-RAS 18th International Conference on Humanoid Robots (Humanoids)*. IEEE. 2018, pp. 994–1001.

[C40] Thomas Gurriet, Sylvain Finet, Guilhem Boeris, Alexis Duburcq, Ayonga Hereid, Omar Harib, Matthieu Masselin, Jessy Grizzle, and Aaron D Ames
Towards restoring locomotion for paraplegics: Realizing dynamically stable walking on exoskeletons
In: *2018 IEEE International Conference on Robotics and Automation (ICRA)*. IEEE. 2018, pp. 2804–2811.

[C41] Thomas Gurriet, Mark Mote, Aaron D Ames, and Eric Feron
An online approach to active set invariance
In: *2018 IEEE Conference on Decision and Control (CDC)*. IEEE. 2018, pp. 3592–3599.

[C42] Thomas Gurriet, Andrew Singletary, Jacob Reher, Laurent Ciarletta, Eric Feron, and Aaron Ames
Towards a framework for realizable safety critical control through active set invariance
In: *2018 ACM/IEEE 9th International Conference on Cyber-Physical Systems (ICCPS)*. Best Theory Paper Award Finalist of ICCPS. IEEE. 2018, pp. 98–106.

[C43] Sofie Haesaert, Petter Nilsson, Cristian Ioan Vasile, Rohan Thakker, Ali-akbar Agha-mohammadi, Aaron D Ames, and Richard M Murray
Temporal logic control of POMDPs via label-based stochastic simulation relations
In: *IFAC Conference on Analysis and Design of Hybrid Systems (ADHS)*. Vol. 51. 16. Elsevier, 2018, pp. 271–276.

[C44] Kaveh Akbari Hamed, Aaron D Ames, and Robert D Gregg
Observer-based feedback controllers for exponential stabilization of hybrid periodic orbits: Application to underactuated bipedal walking
In: *2018 Annual American Control Conference (ACC)*. IEEE. 2018, pp. 1438–1445.

[C45] Kaveh Akbari Hamed, Robert D Gregg, and Aaron D Ames
Exponentially stabilizing controllers for multi-contact 3d bipedal locomotion
In: *2018 Annual American Control Conference (ACC)*. IEEE. 2018, pp. 2210–2217.

[C46] Shishir Kolathaya, Jacob Reher, Ayonga Hereid, and Aaron D Ames
Input to state stabilizing control Lyapunov functions for robust bipedal robotic locomotion
In: *2018 Annual American Control Conference (ACC)*. IEEE. 2018, pp. 2224–2230.

[C47] Petter Nilsson and Aaron D Ames
Barrier functions: Bridging the gap between planning from specifications and safety-critical control
In: *2018 IEEE Conference on Decision and Control (CDC)*. IEEE. 2018, pp. 765–772.

[C48] Petter Nilsson, Sofie Haesaert, Rohan Thakker, Kyohei Otsu, Cristian Ioan Vasile, Ali-Akbar Agha-Mohammadi, Richard M Murray, and Aaron D Ames
Toward Specification-Guided Active Mars Exploration for Cooperative Robot Teams.
In: *Robotics: Science and systems*. 2018.

[C49] Xiaobin Xiong and Aaron D Ames
Bipedal hopping: Reduced-order model embedding via optimization-based control
In: *2018 IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS)*. IEEE. 2018, pp. 3821–3828.

[C50] Xiaobin Xiong and Aaron D Ames
Coupling reduced order models via feedback control for 3d underactuated bipedal robotic walking
In: *2018 IEEE-RAS 18th International Conference on Humanoid Robots (Humanoids)*. IEEE. 2018, pp. 1–9.

[C51] Eric Ambrose, Wen-Loong Ma, Christian Hubicki, and Aaron D Ames
Toward benchmarking locomotion economy across design configurations on the modular robot: AMBER-3M
In: *Control Technology and Applications (CCTA), 2017 IEEE Conference on*. IEEE. 2017, pp. 1270–1276.

[C52] Vahid Azimi, Tony Shu, Huihua Zhao, Eric Ambrose, Aaron D Ames, and Dan Simon
Robust control of a powered transfemoral prosthesis device with experimental verification
In: *American Control Conference (ACC), 2017*. Best Student Paper Award Finalist, ACC 2017. IEEE. 2017, pp. 517–522.

[C53] Alexander H Chang, Christian M Hubicki, Jeff J Aguilar, Daniel I Goldman, Aaron D Ames, and Patricio A Vela
Learning to jump in granular media: Unifying optimal control synthesis with Gaussian process-based regression
In: *Robotics and Automation (ICRA), 2017 IEEE International Conference on*. IEEE. 2017, pp. 2154–2160.

[C54] Michael X. Grey, Aaron D Ames, and Karen C Liu
Probabilistic Completeness of Randomized Possibility Graphs Applied to Bipedal Walking in Semi-unstructured Environments
In: *Proceedings of Robotics: Science and Systems.* 2017.

[C55] Michael X Grey, Aaron D Ames, and C Karen Liu
Footstep and motion planning in semi-unstructured environments using randomized possibility graphs
In: *Robotics and Automation (ICRA), 2017 IEEE International Conference on.* IEEE. 2017, pp. 4747–4753.

[C56] Ayonga Hereid and Aaron D Ames
FROST: Fast Robot Optimization and Simulation Toolkit
In: *Intelligent Robots and Systems (IROS), 2017 IEEE/RSJ International Conference on.* IEEE. 2017, pp. 4552–4559.

[C57] Christian Hubicki, Jeffrey Aguilar, Allison Kim, Jennifer Rieser, Aaron D Ames, and Daniel Goldman
Paused intrusions improve robot jumping performance in granular media
In: *APS Meeting Abstracts.* 2017.

[C58] Wen-Loong Ma, Shishir Kolathaya, Eric R Ambrose, Christian M Hubicki, and Aaron D Ames
Bipedal Robotic Running with DURUS-2D: Bridging the Gap between Theory and Experiment
In: *Proceedings of the 20th International Conference on Hybrid Systems: Computation and Control.* ACM. 2017, pp. 265–274.

[C59] Daniel Pickem, Paul Glotfelter, Li Wang, Mark Mote, Aaron D Ames, Eric Feron, and Magnus Egerstedt
The Robotarium: A remotely accessible swarm robotics research testbed
In: *Robotics and Automation (ICRA), 2017 IEEE International Conference on.* Best Multi-Robot Systems Paper Award & Best Conference Paper Award Finalist of ICRA 2017. IEEE. 2017, pp. 1699–1706.

[C60] Yasser Shoukry, Paulo Tabuada, Stephanie Tsuei, Mark B Milam, Jessy W Grizzle, and Aaron D Ames
Closed-form controlled invariant sets for pedestrian avoidance
In: *American Control Conference (ACC), 2017.* IEEE. 2017, pp. 1622–1628.

[C61] Paulo Tabuada, Wen-Loong Ma, Jessy Grizzle, and Aaron D Ames
Data-driven control for feedback linearizable single-input systems
In: *Decision and Control (CDC), 2017 IEEE 56th Annual Conference on.* IEEE. 2017, pp. 6265–6270.

[C62] Li Wang, Aaron D Ames, and Magnus Egerstedt
Safe certificate-based maneuvers for teams of quadrotors using differential flatness
In: *Robotics and Automation (ICRA), 2017 IEEE International Conference on.* IEEE. 2017, pp. 3293–3298.

[C63] Xiaobin Xiong, Jeffrey Aguilar, Jennifer Rieser, Allison Kim, Aaron D Ames, and Daniel Goldman
Overshoot intrusion forces promote robophysical bipedal walking on homogenous granular media
In: *APS Meeting Abstracts.* 2017.

[C64] Xiaobin Xiong, Aaron D Ames, and Daniel I Goldman
A stability region criterion for flat-footed bipedal walking on deformable granular terrain
In: *Intelligent Robots and Systems (IROS), 2017 IEEE/RSJ International Conference on.* IEEE. 2017, pp. 4552–4559.

[C65] Xiangru Xu, Thomas Waters, Daniel Pickem, Paul Glotfelter, Magnus Egerstedt, Paulo Tabuada, Jessy W Grizzle, and Aaron D Ames
Realizing simultaneous lane keeping and adaptive speed regulation on accessible mobile robot testbeds
In: *Control Technology and Applications (CCTA), 2017 IEEE Conference on.* IEEE. 2017, pp. 1769–1775.

[C66] Huihua Zhao, Eric Ambrose, and Aaron D Ames
Preliminary results on energy efficient 3D prosthetic walking with a powered compliant transfemoral prosthesis
In: *Robotics and Automation (ICRA), 2017 IEEE International Conference on*. BestMedical Robotics Paper Award Finalist of ICRA 2017. IEEE. 2017, pp. 1140–1147.

[C67] Kenneth Y Chao, Matthew J Powell, Aaron D Ames, and Pilwon Hur
Unification of locomotion pattern generation and control Lyapunov function-based quadratic programs
In: *American Control Conference (ACC), 2016*. IEEE. 2016, pp. 3910–3915.

[C68] Michael X Grey, Caelan R Garrett, C Karen Liu, Aaron D Ames, and Andrea L Thomaz
Humanoid manipulation planning using backward-forward search
In: *Intelligent Robots and Systems (IROS), 2016 IEEE/RSJ International Conference on*. IEEE. 2016, pp. 5467–5473.

[C69] Thomas Gurriet, Mark L Mote, Aaron D Ames, and Eric Feron
Establishing trust in remotely reprogrammable systems
In: *Proceedings of the International Conference on Human-Computer Interaction in Aerospace*. ACM. 2016, p. 19.

[C70] Ayonga Hereid, Eric A Cousineau, Christian M Hubicki, and Aaron D Ames
3D dynamic walking with underactuated humanoid robots: A direct collocation framework for optimizing hybrid zero dynamics
In: *Robotics and Automation (ICRA), 2016 IEEE International Conference on*. Best Paper Award Finalist of ICRA 2016. IEEE. 2016, pp. 1447–1454.

[C71] Ayonga Hereid, Shishir Kolathaya, and Aaron D Ames
Online optimal gait generation for bipedal walking robots using Legendre pseudospectral optimization
In: *Decision and Control (CDC), 2016 IEEE 55th Conference on*. IEEE. 2016, pp. 6173–6179.

[C72] Christian M Hubicki, Jeff J Aguilar, Daniel I Goldman, and Aaron D Ames
Tractable terrain-aware motion planning on granular media: an impulsive jumping study
In: *Intelligent Robots and Systems (IROS), 2016 IEEE/RSJ International Conference on*. IEEE. 2016, pp. 3887–3892.

[C73] Christian M Hubicki, Ayonga Hereid, Michael X Grey, Andrea L Thomaz, and Aaron D Ames
Work those arms: Toward dynamic and stable humanoid walking that optimizes full-body motion
In: *Robotics and Automation (ICRA), 2016 IEEE International Conference on*. IEEE. 2016, pp. 1552–1559.

[C74] Christian Hubicki, Daniel Goldman, and Aaron D Ames
Optimal bipedal interactions with dynamic terrain: synthesis and analysis via nonlinear programming
In: *APS March Meeting Abstracts*. 2016.

[C75] Shishir Kolathaya, Ayonga Hereid, and Aaron D Ames
Time dependent control Lyapunov functions and hybrid zero dynamics for stable robotic locomotion
In: *American Control Conference (ACC), 2016*. IEEE. 2016, pp. 3916–3921.

[C76] Wen-Loong Ma, Ayonga Hereid, Christian M Hubicki, and Aaron D Ames
Efficient HZD gait generation for three-dimensional underactuated humanoid running
In: *Intelligent Robots and Systems (IROS), 2016 IEEE/RSJ International Conference on*. IEEE. 2016, pp. 5819–5825.

[C77] Quan Nguyen, Ayonga Hereid, Jessy W Grizzle, Aaron D Ames, and Koushil Sreenath
3D dynamic walking on stepping stones with control barrier functions
In: *Decision and Control (CDC), 2016 IEEE 55th Conference on*. IEEE. 2016, pp. 827–834.

[C78] Matthew J Powell and Aaron D Ames
Mechanics-based control of underactuated 3D robotic walking: Dynamic gait generation under torque constraints
In: *Intelligent Robots and Systems (IROS), 2016 IEEE/RSJ International Conference on*. IEEE. 2016, pp. 555–560.

[C79] Matthew J Powell and Aaron D Ames
Towards real-time parameter optimization for feasible nonlinear control with applications to robot locomotion
In: *American Control Conference (ACC), 2016*. IEEE. 2016, pp. 3922–3927.

[C80] Matthew J Powell, Wen-Loong Ma, Eric R Ambrose, and Aaron D Ames
Mechanics-based design of underactuated robotic walking gaits: Initial experimental realization
In: *Humanoid Robots (Humanoids), 2016 IEEE-RAS 16th International Conference on*. IEEE. 2016, pp. 981–986.

[C81] Jacob P Reher, Ayonga Hereid, Shishir Kolathaya, Christian M Hubicki, and Aaron D Ames
Algorithmic foundations of realizing multi-contact locomotion on the humanoid robot DURUS
In: *The International Workshop on the Algorithmic Foundations of Robotics (WAFR)*. 2016.

[C82] Jacob Reher, Eric A Cousineau, Ayonga Hereid, Christian M Hubicki, and Aaron D Ames
Realizing dynamic and efficient bipedal locomotion on the humanoid robot DURUS
In: *Robotics and Automation (ICRA), 2016 IEEE International Conference on*. IEEE. 2016, pp. 1794–1801.

[C83] Li Wang, Aaron D Ames, and Magnus Egerstedt
Multi-objective compositions for collision-free connectivity maintenance in teams of mobile robots
In: *Decision and Control (CDC), 2016 IEEE 55th Conference on*. IEEE. 2016, pp. 2659–2664.

[C84] Li Wang, Aaron D Ames, and Magnus Egerstedt
Safety barrier certificates for heterogeneous multi-robot systems
In: *American Control Conference (ACC), 2016*. IEEE. 2016, pp. 5213–5218.

[C85] Huihua Zhao, Ayonga Hereid, Eric Ambrose, and Aaron D Ames
3D multi-contact gait design for prostheses: Hybrid system models, virtual constraints and two-step direct collocation
In: *Decision and Control (CDC), 2016 IEEE 55th Conference on*. IEEE. 2016, pp. 3668–3674.

[C86] Aaron D Ames, Paulo Tabuada, Bastian Schürmann, Wen-Loong Ma, Shishir Kolathaya, Matthias Rungger, and Jessy W Grizzle
First steps toward formal controller synthesis for bipedal robots
In: *Proceedings of the 18th International Conference on Hybrid Systems: Computation and Control*. ACM. 2015, pp. 209–218.

[C87] Eric Cousineau and Aaron D Ames
Realizing underactuated bipedal walking with torque controllers via the ideal model resolved motion method
In: *Robotics and Automation (ICRA), 2015 IEEE International Conference on*. IEEE. 2015, pp. 5747–5753.

[C88] Ayonga Hereid, Christian M Hubicki, Eric A Cousineau, Jonathan W Hurst, and Aaron D Ames
Hybrid zero dynamics based multiple shooting optimization with applications to robotic walking
In: *Robotics and Automation (ICRA), 2015 IEEE International Conference on*. IEEE. 2015, pp. 5734–5740.

[C89] Shao-Chen Hsu, Xiangru Xu, and Aaron D Ames
Control barrier function based quadratic programs with application to bipedal robotic walking
In: *American Control Conference (ACC), 2015*. IEEE. 2015, pp. 4542–4548.

[C90] Aakar Mehra, Wen-Loong Ma, Forrest Berg, Paulo Tabuada, Jessy W Grizzle, and Aaron D Ames
Adaptive cruise control: Experimental validation of advanced controllers on scale-model cars
In: *American Control Conference (ACC), 2015*. IEEE. 2015, pp. 1411–1418.

[C91] Benjamin J Morris, Matthew J Powell, and Aaron D Ames
Continuity and smoothness properties of nonlinear optimization-based feedback controllers
In: *Decision and Control (CDC), 2015 IEEE 54th Annual Conference on*. IEEE. 2015, pp. 151–158.

[C92] Matthew J Powell, Eric A Cousineau, and Aaron D Ames
Model predictive control of underactuated bipedal robotic walking
In: *Robotics and Automation (ICRA), 2015 IEEE International Conference on*. IEEE. 2015, pp. 5121–5126.

[C93] Ryan W Sinnet and Aaron D Ames
Energy shaping of hybrid systems via control Lyapunov functions
In: *American Control Conference (ACC), 2015*. IEEE. 2015, pp. 5992–5997.

[C94] Walid Taha, Adam Duracz, Yingfu Zeng, Kevin Atkinson, Ferenc A. Bartha, Paul Brauner, Jan Duracz, Fei Xu, Robert Cartwright, Michal Konečný, Eugenio Moggi, Jawad Masood, Pererik Andreasson, Jun Inoue, Anita Sant'Anna, Roland Philippsen, Alexandre Chapoutot, Marcia O'Malley, Aaron D Ames, Veronica Gaspes, Lise Hvatum, Shyam Mehta, Henrik Eriksson, and Christian Grante
Acumen: An open-source testbed for cyber-physical systems research
In: *International Internet of Things Summit*. Springer, Cham. 2015, pp. 118–130.

[C95] Huihua Zhao, Jonathan Horn, Jacob Reher, Victor Paredes, and Aaron D Ames
A hybrid systems and optimization-based control approach to realizing multi-contact locomotion on transfemoral prostheses
In: *Decision and Control (CDC), 2015 IEEE 54th Annual Conference on*. IEEE. 2015, pp. 1607–1612.

[C96] Huihua Zhao, Jacob Reher, Jonathan Horn, Victor Paredes, and Aaron D Ames
Realization of stair ascent and motion transitions on prostheses utilizing optimization-based control and intent recognition
In: *Rehabilitation Robotics (ICORR), 2015 IEEE International Conference on*. IEEE. 2015, pp. 265–270.

[C97] Huihua Zhao, Jake Reher, Jonathan Horn, Victor Paredes, and Aaron D Ames
Demonstration of locomotion with the powered prosthesis AMPRO utilizing online optimization-based control
In: *Proceedings of the 18th International Conference on Hybrid Systems: Computation and Control*. ACM. 2015, pp. 305–306.

[C98] Huihua Zhao, Jake Reher, Jonathan Horn, Victor Paredes, and Aaron D Ames
Realization of nonlinear real-time optimization based controllers on self-contained transfemoral prosthesis
In: *Proceedings of the ACM/IEEE Sixth International Conference on Cyber-Physical Systems*. ACM. 2015, pp. 130–138.

[C99] Aaron D Ames, Jessy W Grizzle, and Paulo Tabuada
Control barrier function based quadratic programs with application to adaptive cruise control
In: *Decision and Control (CDC), 2014 IEEE 53rd Annual Conference on*. IEEE. 2014, pp. 6271–6278.

[C100] Aaron D Ames and James Holley
Quadratic program based nonlinear embedded control of series elastic actuators
In: *Decision and Control (CDC), 2014 IEEE 53rd Annual Conference on*. IEEE. 2014, pp. 6291–6298.

[C101] Ayonga Hereid, Shishir Kolathaya, Mikhail S Jones, Johnathan Van Why, Jonathan W Hurst, and Aaron D Ames
Dynamic multi-domain bipedal walking with ATRIAS through SLIP based human-inspired control
In: *Proceedings of the 17th international conference on Hybrid systems: computation and control*. DENSO Best Student Paper Award of HSCC 2014. ACM. 2014, pp. 263–272.

[C102] Ayonga Hereid, Matthew J Powell, and Aaron D Ames
Embedding of SLIP dynamics on underactuated bipedal robots through multi-objective quadratic program based control
In: *Decision and Control (CDC), 2014 IEEE 53rd Annual Conference on*. IEEE. 2014, pp. 2950–2957.

[C103] Shishir Kolathaya and Aaron D Ames
Exponential convergence of a unified CLF controller for robotic systems under parameter uncertainty
In: *American Control Conference (ACC), 2014*. IEEE. 2014, pp. 3710–3715.

[C104] Jordan Lack, Matthew J Powell, and Aaron D Ames
Planar multi-contact bipedal walking using hybrid zero dynamics
In: *Robotics and Automation (ICRA), 2014 IEEE International Conference on*. IEEE. 2014, pp. 2582–2588.

[C105] Wen-Loong Ma, Hui-Hua Zhao, Shishir Kolathaya, and Aaron D Ames
Human-inspired walking via unified PD and impedance control
In: *Robotics and Automation (ICRA), 2014 IEEE International Conference on*. IEEE. 2014, pp. 5088–5094.

[C106] Petter Nilsson, Omar Hussien, Yuxiao Chen, Ayca Balkan, Matthias Rungger, Aaron Ames, Jessy Grizzle, Necmiye Ozay, Huei Peng, and Paulo Tabuada
Preliminary results on correct-by-construction control software synthesis for adaptive cruise control
In: *Decision and Control (CDC), 2014 IEEE 53rd Annual Conference on*. IEEE. 2014, pp. 816–823.

[C107] Matthew J Powell and Aaron D Ames
Hierarchical control of series elastic actuators through control Lyapunov functions
In: *Decision and Control (CDC), 2014 IEEE 53rd Annual Conference on*. IEEE. 2014, pp. 2986–2992.

[C108] Hui-Hua Zhao, Wen-Loong Ma, Michael B Zeagler, and Aaron D Ames
Human-inspired multi-contact locomotion with AMBER2
In: *Cyber-Physical Systems (ICCPS), 2014 ACM/IEEE International Conference on*. Best Paper Award Finalist of ICCPS 2014. IEEE. 2014, pp. 199–210.

[C109] Huihua Zhao and Aaron D Ames
Quadratic program based control of fully-actuated transfemoral prosthesis for flat-ground and upslope locomotion
In: *American Control Conference (ACC), 2014*. IEEE. 2014, pp. 4101–4107.

[C110] Huihua Zhao, Shishir Kolathaya, and Aaron D Ames
Quadratic programming and impedance control for transfemoral prosthesis
In: *Robotics and automation (ICRA), 2014 IEEE international conference on*. IEEE. 2014, pp. 1341–1347.

[C111] Navid Aghasadeghi, Huihua Zhao, Levi J Hargrove, Aaron D Ames, Eric J Perreault, and Timothy Bretl
Learning impedance controller parameters for lower-limb prostheses
In: *Intelligent robots and systems (IROS), 2013 IEEE/RSJ international conference on*. IEEE. 2013, pp. 4268–4274.

[C112] Aaron D Ames
Human-inspired control of bipedal robots via control Lyapunov functions and quadratic programs
In: *Proceedings of the 16th international conference on Hybrid systems: computation and control*. ACM. 2013, pp. 31–32.

[C113] Neil Dantam, Ayonga Hereid, Aaron D Ames, and Mike Stilman
Correct software synthesis for stable speed-controlled robotic walking
In: *Robotics: Science and Systems (RSS)*. 2013.

[C114] Michal Konecny, Walid Taha, Jan Duracz, Adam Duracz, and Aaron D Ames
Enclosing the behavior of a hybrid system up to and beyond a Zeno point
In: *Cyber-Physical Systems, Networks, and Applications (CPSNA), 2013 IEEE 1st International Conference on*. Best Paper Award of CPSNA 2013. IEEE. 2013, pp. 120–125.

[C115] Benjamin Morris, Matthew J Powell, and Aaron D Ames
Sufficient conditions for the Lipschitz continuity of QP-based multi-objective control of humanoid robots
In: *Decision and Control (CDC), 2013 IEEE 52nd Annual Conference on*. IEEE. 2013, pp. 2920–2926.

[C116] Matthew J Powell, Ayonga Hereid, and Aaron D Ames
Speed regulation in 3D robotic walking through motion transitions between human-inspired partial hybrid zero dynamics
In: *Robotics and Automation (ICRA), 2013 IEEE International Conference on*. IEEE. 2013, pp. 4803–4810.

[C117] Andrew R Teel, Rafal Goebel, Benjamin Morris, Aaron D Ames, and Jessy W Grizzle
A stabilization result with application to bipedal locomotion
In: *Decision and Control (CDC), 2013 IEEE 52nd Annual Conference on*. IEEE. 2013, pp. 2030–2035.

[C118] Aaron D Ames
First steps toward underactuated human-inspired bipedal robotic walking
In: *Robotics and Automation (ICRA), 2012 IEEE International Conference on*. IEEE. 2012, pp. 1011–1017.

[C119] Aaron D Ames, Eric A Cousineau, and Matthew J Powell
Dynamically stable bipedal robotic walking with NAO via human-inspired hybrid zero dynamics
In: *Proceedings of the 15th ACM international conference on Hybrid Systems: Computation and Control*. ACM. 2012, pp. 135–144.

[C120] Aaron D Ames, Kevin Galloway, and Jessy W Grizzle
Control Lyapunov functions and hybrid zero dynamics
In: *Decision and Control (CDC), 2012 IEEE 51st Annual Conference on*. IEEE. 2012, pp. 6837–6842.

[C121] Zhao Huihua, Shishir Nadubettu Yadukumar, and Aaron D Ames
Bipedal robotic running with partial hybrid zero dynamics and human-inspired optimization
In: *Intelligent Robots and Systems (IROS), 2012 IEEE/RSJ International Conference on*. IEEE. 2012, pp. 1821–1827.

[C122] Shu Jiang, Shawanee Partrick, Huihua Zhao, and Aaron D Ames
Outputs of human walking for bipedal robotic controller design
In: *American Control Conference (ACC), 2012*. IEEE. 2012, pp. 4843–4848.

[C123] Shishir Kolathaya and Aaron D Ames
Achieving bipedal locomotion on rough terrain through human-inspired control
In: *Safety, Security, and Rescue Robotics (SSRR), 2012 IEEE International Symposium on*. IEEE. 2012, pp. 1–6.

[C124] Matthew J Powell, Huihua Zhao, and Aaron D Ames
Motion primitives for human-inspired bipedal robotic locomotion: walking and stair climbing
In: *Robotics and Automation (ICRA), 2012 IEEE International Conference on*. IEEE. 2012, pp. 543–549.

[C125] Ryan W Sinnet and Aaron D Ames
Extending two-dimensional human-inspired bipedal robotic walking to three dimensions through geometric reduction
In: *American Control Conference (ACC), 2012*. IEEE. 2012, pp. 4831–4836.

[C126] Shishir Nadubettu Yadukumar, Bhargav Kothapalli, and Aaron D Ames
Zeno behavior in electromechanical hybrid systems: From theory to experimental validation
In: *American Control Conference (ACC), 2012*. IEEE. 2012, pp. 2437–2442.

[C127] Shishir Nadubettu Yadukumar, Murali Pasupuleti, and Aaron D Ames
Human-inspired underactuated bipedal robotic walking with amber on flat-ground, up-slope and uneven terrain
In: *Intelligent Robots and Systems (IROS), 2012 IEEE/RSJ International Conference on*. IEEE. 2012, pp. 2478–2483.

[C128] Aaron D Ames
Characterizing knee-bounce in bipedal robotic walking: A Zeno behavior approach
In: *Proceedings of the 14th international conference on Hybrid systems: computation and control*. ACM. 2011, pp. 163–172.

[C129] Aaron D Ames, Ramanarayan Vasudevan, and Ruzena Bajcsy
Human-data based cost of bipedal robotic walking
In: *Proceedings of the 14th international conference on Hybrid systems: computation and control*. ACM. 2011, pp. 153–162.

[C130] Ryan W Sinnet, Matthew J Powell, Shu Jiang, and Aaron D Ames
Compass gait revisited: A human data perspective with extensions to three dimensions
In: *Decision and Control and European Control Conference (CDC-ECC), 2011 50th IEEE Conference on*. IEEE. 2011, pp. 682–689.

[C131] Ryan W Sinnet, Matthew J Powell, Rajiv P Shah, and Aaron D Ames
A human-inspired hybrid control approach to bipedal robotic walking
In: *Proceedings of the 18th IFAC World Congress*. Vol. 44. 1. Elsevier, 2011, pp. 6904–6911.

[C132] Ryan W Sinnet, Huihua Zhao, and Aaron D Ames
Simulating prosthetic devices with human-inspired hybrid control
In: *Intelligent robots and systems (IROS), 2011 IEEE/RSJ international conference on*. IEEE. 2011, pp. 1723–1730.

[C133] Eric Wendel and Aaron D Ames
Rank deficiency and superstability of hybrid systems with application to bipedal robots
In: *Decision and Control and European Control Conference (CDC-ECC), 2011 50th IEEE Conference on*. IEEE. 2011, pp. 7422–7427.

[C134] Jessy W Grizzle, Christine Chevallereau, Aaron D Ames, and Ryan W Sinnet
3D bipedal robotic walking: models, feedback control, and open problems
In: *Proceedings of the 8th IFAC Symposium on Nonlinear Control Systems (NOLCOS)*. Vol. 43. 14. Elsevier, 2010, pp. 505–532.

[C135] Eric DB Wendel and Aaron D Ames
Rank properties of Poincaré maps for hybrid systems with applications to bipedal walking
In: *Proceedings of the 13th ACM international conference on Hybrid systems: computation and control*. ACM. 2010, pp. 151–160.

[C136] Yun Zhu, Edwin Westbrook, Jun Inoue, Alexandre Chapoutot, Cherif Salama, Marisa Peralta, Travis Martin, Walid Taha, Marcia O'Malley, Robert Cartwright, et al.
Mathematical equations as executable models of mechanical systems
In: *Proceedings of the 1st ACM/IEEE International Conference on Cyber-Physical Systems*. ACM. 2010, pp. 1–11.

[C137] Yizhar Or and Aaron D Ames
Formal and practical completion of Lagrangian hybrid systems
In: *American Control Conference, 2009. ACC'09*. IEEE. 2009, pp. 3624–3631.

[C138] Ryan W Sinnet and Aaron D Ames
2D bipedal walking with knees and feet: A hybrid control approach
In: *Decision and Control, 2009 held jointly with the 2009 28th Chinese Control Conference. CDC/CCC 2009. Proceedings of the 48th IEEE Conference on*. IEEE. 2009, pp. 3200–3207.

[C139] Ryan W Sinnet and Aaron D Ames
3D bipedal walking with knees and feet: A hybrid geometric approach
In: *Decision and Control, 2009 held jointly with the 2009 28th Chinese Control Conference. CDC/CCC 2009. Proceedings of the 48th IEEE Conference on*. IEEE. 2009, pp. 3208–3213.

[C140] Aaron D Ames and John C Doyle
Complexity and fragility in stability for linear systems
In: *American Control Conference, 2008*. IEEE. 2008, pp. 1630–1637.

[C141] Andrew Lamperski and Aaron D Ames
On the existence of Zeno behavior in hybrid systems with non-isolated Zeno equilibria
In: *Decision and Control, 2008. CDC 2008. 47th IEEE Conference on*. IEEE. 2008, pp. 2776–2781.

[C142] Yizhar Or and Aaron D Ames
Stability of Zeno equilibria in Lagrangian hybrid systems
In: *Decision and Control, 2008. CDC 2008. 47th IEEE Conference on*. IEEE. 2008, pp. 2770–2775.

[C143] Aaron D Ames, Alessandro Abate, and Shankar Sastry
Sufficient conditions for the existence of Zeno behavior in a class of nonlinear hybrid systems via constant approximations
In: *Decision and Control, 2007 46th IEEE Conference on*. IEEE. 2007, pp. 4033–4038.

[C144] Aaron D Ames and Robert D Gregg
Stably extending two-dimensional bipedal walking to three dimensions
In: *American Control Conference, 2007. ACC'07*. IEEE. 2007, pp. 2848–2854.

[C145] Aaron D Ames, Robert D Gregg, and Mark W Spong
A geometric approach to three-dimensional hipped bipedal robotic walking
In: *Decision and Control, 2007 46th IEEE Conference on*. IEEE. 2007, pp. 5123–5130.

[C146] Andrew Lamperski and Aaron D Ames
Lyapunov-like conditions for the existence of Zeno behavior in hybrid and Lagrangian hybrid systems
In: *Decision and Control, 2007 46th IEEE Conference on*. IEEE. 2007, pp. 115–120.

[C147] David Pekarek, Aaron D Ames, and Jerrold E Marsden
Discrete mechanics and optimal control applied to the compass gait biped
In: *Decision and Control, 2007 46th IEEE Conference on*. IEEE. 2007, pp. 5376–5382.

[C148] Alessandro Abate, Aaron D Ames, and Shankar Sastry
A Priori detection of Zeno behavior in communication networks modeled as hybrid systems
In: *American Control Conference*. IEEE. 2006, 6–pp.

[C149] Alessandro Abate, Aaron D Ames, and Shankar Sastry
Error bounds based stochastic approximations and simulations of hybrid dynamical systems
In: *American Control Conference*. IEEE. 2006, 6–pp.

[C150] Aaron D Ames, Robert D. Gregg, Eric D. B. Wendel, and Shankar Sastry
On the Geometric Reduction of Controlled Three-Dimensional Bipedal Robotic Walkers
In: *3rd Workshop on Lagrangian and Hamiltonian Methods for Nonlinear Control*. 2006.

[C151] Aaron D Ames and Shankar Sastry
Hybrid cotangent bundle reduction of simple hybrid mechanical systems with symmetry
In: *American Control Conference*. IEEE. 2006, 6–pp.

[C152] Aaron D Ames and Shankar Sastry
Hybrid geometric reduction of hybrid systems
In: *Decision and Control, IEEE Conference on*. IEEE, 2006.

[C153] Aaron D Ames and Shankar Sastry
Hybrid Routhian reduction of Lagrangian hybrid systems
In: *American Control Conference*. IEEE. 2006, 6–pp.

[C154] Aaron D Ames, Haiyang Zheng, Robert D Gregg, and Shankar Sastry
Is there life after Zeno? Taking executions past the breaking (Zeno) point
In: *American Control Conference*. IEEE. 2006, 6–pp.

[C155] Paulo Tabuada, Aaron D Ames, Agung Julius, and George Pappas
Approximate Reduction of Dynamical Systems
In: *Decision and Control, IEEE Conference on*. IEEE, 2006.

[C156] Alessandro Abate, Aaron D Ames, and S Shankar Sastry
Stochastic approximations of hybrid systems
In: *American Control Conference. Proceedings of the*. IEEE. 2005, pp. 1557–1562.

[C157] Aaron D Ames, Alessandro Abate, and Shankar Sastry
Sufficient conditions for the existence of Zeno behavior
In: *Decision and Control, 2005 and 2005 European Control Conference. CDC-ECC'05. 44th IEEE Conference on*. IEEE. 2005, pp. 696–701.

[C158] Aaron D Ames and Shankar Sastry
Characterization of Zeno behavior in hybrid systems using homological methods
In: *American Control Conference, 2005. Proceedings of the 2005*. IEEE. 2005, pp. 1160–1165.

[C159] Jonathan Sprinkle, Aaron D Ames, Alessandro Pinto, Haiyang Zheng, and S Shankar Sastry
On the partitioning of syntax and semantics for hybrid systems tools
In: *Decision and Control, 2005 and 2005 European Control Conference. CDC-ECC'05. 44th IEEE Conference on*. IEEE. 2005, pp. 4694–4699.

[C160] Aaron D Ames and Shankar Sastry
Blowing up affine hybrid systems
In: *Decision and Control, 2004. CDC. 43rd IEEE Conference on*. Vol. 1. IEEE. 2004, pp. 473–478.

Patients

[P1] Lanny S Smoot, Gunter D Niemeyer, Aaron D Ames, and David Loyal Christensen
Robotic bouncing ball
US Patent 10,092,850. Oct. 2018.

Papers under Review, ArXiv Papers, and Technical Reports

[U1] Mohamadreza Ahmadi, Andrew Singletary, Joel W Burdick, and Aaron D Ames
Barrier functions for multiagent-pomdps with dtl specifications
arXiv preprint arXiv:2003.09267. 2020.

[U2] Mohamadreza Ahmadi, Arun A Viswanathan, Michel D Ingham, Kymie Tan, and Aaron D Ames
Partially Observable Games for Secure Autonomy
arXiv preprint arXiv:2002.01969. 2020.

[U3] Prithvi Akella, Mohamadreza Ahmadi, Richard M Murray, and Aaron D Ames
Formal test synthesis for safety-critical autonomous systems based on control barrier functions
arXiv preprint arXiv:2004.04227. 2020.

[U4] Aaron D Ames, Tamas G Molnar, Andrew W Singletary, and Gabor Orosz
Safety-Critical Control of Active Interventions for COVID-19 Mitigation
medRxiv. 2020.

[U5] Richard Cheng, Mohammad Javad Khojasteh, Aaron D Ames, and Joel W Burdick
Safe multi-agent interaction through robust control barrier functions with learned uncertainties
arXiv preprint arXiv:2004.05273. 2020.

[U6] Rachel Gehlhar, Yuxiao Chen, and Aaron D Ames
Data-driven Characterization of Human Interaction for Model-based Control of Powered Prostheses
arXiv preprint arXiv:2003.07524. 2020.

[U7] Ruben Grandia, Andrew J Taylor, Andrew Singletary, Marco Hutter, and Aaron D Ames
Nonlinear Model Predictive Control of Robotic Systems with Control Lyapunov Functions
arXiv preprint arXiv:2006.01229. 2020.

[U8] Andrew Singletary, Yuxiao Chen, and Aaron D Ames
Control Barrier Functions for Sampled-Data Systems with Input Delays
arXiv preprint arXiv:2005.06418. 2020.

[U9] Brijen Thananjeyan, Ashwin Balakrishna, Ugo Rosolia, Joseph E Gonzalez, Aaron Ames, and Ken Goldberg
ABC-LMPC: Safe Sample-Based Learning MPC for Stochastic Nonlinear Dynamical Systems with Adjustable Boundary Conditions
arXiv preprint arXiv:2003.01410. 2020.

[U10] Maegan Tucker, Myra Cheng, Ellen Novoseller, Richard Cheng, Yisong Yue, Joel W Burdick, and Aaron D Ames
Human Preference-Based Learning for High-dimensional Optimization of Exoskeleton Walking Gaits
arXiv preprint arXiv:2003.06495. 2020.

[U11] Kaveh Akbari Hamed, Wen-Loong Ma, Vinay R Kamidi, and Aaron D Ames
Hierarchical Feedback Control for Complex Hybrid Models of Multiagent Legged Robotic Systems
arXiv preprint arXiv:1902.03690. 2019.

[U12] Yuxiao Chen and Aaron D Ames
Duality between density function and value function with applications in constrained optimal control and Markov Decision Process
arXiv preprint arXiv:1902.09583. 2019.

[U13] Yuxiao Chen, James Anderson, Karan Kalsi, Aaron D Ames, and Steven H Low
Safety-Critical Control Synthesis for network systems with Control Barrier Functions and Assume-Guarantee Contracts
arXiv preprint arXiv:1911.03452. 2019.

[U14] Rachel Gehlhar, Jenna Reher, and Aaron D Ames
Control of Separable Subsystems with Application to Prostheses
arXiv preprint arXiv:1909.03102. 2019.

[U15] Thomas Gurriet, Maegan Tucker, Claudia Kann, Guilhem Boeris, and Aaron D Ames
Stabilization of Exoskeletons through Active Ankle Compensation
arXiv preprint arXiv:1909.11848. 2019.

[U16] Shishir Kolathaya, Jacob Reher, and Aaron D Ames
Input to State Stability of Bipedal Walking Robots: Application to DURUS
arXiv preprint arXiv:1801.00618. 2018.

[U17] Michael X Grey, Aaron D Ames, and C Karen Liu
Traversing Environments Using Possibility Graphs for Humanoid Robots
arXiv preprint arXiv:1608.03845. 2016.

[U18] Michael X Grey, C Karen Liu, and Aaron D Ames
Traversing Environments Using Possibility Graphs with Multiple Action Types
arXiv preprint arXiv:1610.00701. 2016.

[U19] Shishir Kolathaya, Benjamin J Morris, Ryan W Sinnet, and Aaron D Ames
System Identification and Control of Valkyrie through SVA–Based Regressor Computation
arXiv preprint arXiv:1608.02683. 2016.

[U20] Daniel Pickem, Li Wang, Paul Glotfelter, Yancy Diaz-Mercado, Mark Mote, Aaron D Ames, Eric Feron, and Magnus Egerstedt
Safe, remote-access swarm robotics research on the Robotarium
arXiv preprint arXiv:1604.00640. 2016.

[U21] Ryan W Sinnet and Aaron D Ames
Optimal Energy-Based Control of Hybrid Systems with Applications to Robotic Walking
Book of Abstracts-Extract. 2015.

[U22] Kevin Galloway, Koushil Sreenath, Aaron D Ames, and JW Grizzle
Control Lyapunov Function based Quadratic Programs for Torque Saturated Bipedal Walking
arXiv preprint arXiv:1302.7314. 2013.

[U23] Aaron D Ames and Paulo Tabuada
H-categories and graphs
Technical Note. 2005.

Press

Note: that this is not an exhaustive list, but rather a sampling of some of the news and press that my research group, and the robots we have worked on, have received.)

[N51] **Robots that can walk are now striding to market**
The Economist, August, 2020 [Online & Print]

[N50] **Caltech AI lab optimizes exoskeleton gait for human comfort**
VentureBeat, June, 2020 [Online]

[N49] **How robots are replacing wheelchairs to help people with disabilities walk again**
CNBC, May, 2020 [Online & Video]

[N48] **The new burger chef makes $3 an hour and never goes home. (It's a robot)**
LA Times, February, 2020 [Online & Print]

[N47] **Caltech's Brain-Controlled Exoskeleton Will Help Paraplegics Walk**
IEEE Spectrum, January, 2020 [Online & Print]

[N46] **A promising step in returning bipedal mobility**
TechXplore, August, 2019 [Online]

[N45] **These walking robots could help humans get back on their feet again**
CNet, December, 2018 [Online & Video]

[N44] **Inside the Mad Lab That's Getting Robots to Walk and Jump Like Us**
Wired, June, 2018 [Online]

[N43] **Moving Robotics Forward One Step at a Time**
University of St. Thomas, May, 2018 [Online & Print]

[N42] **AMBER Lab on CBS**
CBS National Local News, April, 2018 [Television]

[N41] **Tell a Robot to Take a Hike, and It Might Listen: "Cassie" Takes on the Pacific Crest Trail**
AWS Startups Blog, March, 2018 [Online]

[N40] **Caltech opens a drone lab, with big ideas to improve how robots work with humans**
LA Times, October, 2017 [Print Edition & Online]

[N39] **Caltech Teams With NASA's Jet Propulsion Lab To Build The Next Generation Of Robots**
Forbes, October, 2017 [Online]

[N38] **One Step at a Time: A Conversation with Aaron Ames.**
Caltech, May, 2017 [Online]

[N37] **Swarms of Robots Manage to Not Run Into Each Other**
IEEE Spectrum, September, 2016 [Online]

[N36] **This robot takes power walking to a new level.**
The Washington Post, July, 2016 [Online]

[N35] **Georgia Tech's DURUS robot has a more natural human-like stride.**
Engadget, July, 2016 [Online]

[N34] **This robot is designed to strut like a human.**
CNN, July, 2016 [Online]

[N33] **DURUS robot walks naturally while wearing sneakers.**
The Verge, July, 2016 [Online]

[N32] **DURUS Brings Human-Like Gait (and Fancy Shoes) to Hyper-Efficient Robots.**
IEEE Spectrum, July, 2016 [Online]

[N31] **Shoe-Wearing Robot's No Flatfoot–It Walks like a Person.**
Scientific American, July, 2016 [Online]

[N30] **Check Out This Robot's Funky Walking Style.**
Gizmodo, July, 2016 [Online]

[N29] **The robot uprising has begun.**
WSB-TV, May 17, 2016 [Television]

[N28] **Robots Are Getting Really Good at Running.**
Gizmodo, March, 2016 [Online]

[N27] **Watch AMBER Lab's Thomping Robot Jog Like a Human: This robot's gait matches imperfect human swagger.**
Inverse, March, 2016 [Online]

[N26] **AMBER Lab robot jogs just like a human.**
Engadget, March, 2016 [Online]

[N25] **Welcome to the Robot Zoo.**
Georgia Tech, College of Engineering Magazine, January, 2016 [Print & Online]

[N24] **How someday robots may run to the rescue – literally**
NSF Research News, December, 2015 [Online]

[N23] **The Infinite Ways to Move a Robot.**
Georgia Tech, College of Engineering News, October, 2015 [Online]

[N22] **The Roundtable: Robotic Technology.**
Atlanta Tech Edge, NBC 11 Alive, September, 2015 [Television]

[N21] **Designing an Ultra-Efficient Walking Robot.**
Tested, June, 2015 [YouTube]

[N20] **SRI Durus humanoid walking robot is ultra-efficient.**
Slash Gear, June, 2015 [Online]

[N19] **This ultra-efficient robot walks just like people do.**
Engadget, June, 2015 [Online]

[N18] **DURUS: SRI's Ultra-Efficient Walking Humanoid Robot.**
IEEE Spectrum, June, 2015 [YouTube]

[N17] **DURUS: SRI's Ultra-Efficient Walking Humanoid Robot.**
IEEE Spectrum, June, 2015 [Online]

[N16] **AMBER Lab develops smart prosthesis.**
The Battalion, September, 2014 [Print & Online]

[N15] **First Steps: A&M researchers make strides in bipedal robotics.**
The Battalion, February, 2014 [Print & Online]

[N14] **AMBER Lab Featured on Daily Planet on Discovery Channel Canada.**
Daily Planet, January, 2014 [Television]

[N13] **NASA/Aggie team to test humanoid robot in Miami.**
The Eagle, December 20, 2013 [Print & Online]

[N12] **AMBER 2 bipedal robot mimics humans for a more natural gait.**
Gizmag, November, 2013 [Online]

[N11] **This Fleet-Footed New Robot Walks Exactly Like You Do.**
Gizmodo, October, 2013 [Online]

[N10] **Amber 2 robot walks with a human gait.**
Phys.org, October, 2013 [Online]

[N9] **AMBER Robot Gets Feet The Little Mermaid Would've Envied.**
übergizmo, October, 2013 [Online]

[N8] **AMBER robot walks on human-like feet but isn't quite ready for British Knights.**
Engadget, October, 2013 [Online]

[N7] **National Science Foundation Announces Projects to Expand the Frontiers of Cyber-Physical Systems.**
National Science Foundation, Press Release 13-079, May, 2013 [Online]

[N6] **AMBER 2, il robot che cammina come un essere umano.**
Webnews, January, 2013 [Online]

[N5] **Human-Like Bipedal Walking Robot.**
Design News, January, 2013 [Print & Online]

[N4] **Walking Robots.**
Texas A&M Engineer Magazine, 2012 [Print]

[N3] **Achieving Human-Inspired Bipedal Robotic Walking With LabVIEW.**
Quality Magazine, May, 2012 [Online]

[N2] **Software will predict robot behavior before they are built.**
R&D Magazine, November, 2011 [Online]

[N1] **Accelerating robotic innovation.**
Rice University, Office of Public Affairs, News & Media Relations, November, 2011 [Online]