Kaveh Akbari Hamed

Assistant Professor

Department of Mechanical Engineering, Virginia Tech
Hybrid Dynamic Systems and Robot Locomotion (HDSRL) Laboratory

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Research

I am an assistant professor in the Department of Mechanical Engineering at Virginia Tech. My primary academic interests span control theory, robotics, optimization, dynamical systems, machine learning, and artificial intelligence. My research goal is to establish a formal foundation to transform state-of-the-art methods for designing resilient and intelligent control algorithms for a wide range of dynamical systems with nonlinear and hybrid nature. These systems include, but are not limited to, 1) autonomous robots for disaster response and industrial applications, 2) cooperative multiagent systems with decentralized and distributed control policies, 3) walking and running robots with human/animal morphology, 4) complex systems, and 5) wearable robots like prostheses and orthoses to improve the quality of life for persons with disabilities. My research has a clear path from theory to experiments to advance two specific objectives: 1) Creating algorithms to systematically design robust and intelligent controllers for high-dimensional and complex hybrid dynamical systems; and 2) Transferring the control framework into practice with highly dynamic robotic systems in my research laboratory. These algorithms advance knowledge in designing feedback controllers for dynamical models arising from robot locomotion. The theoretical innovations also offer a unique opportunity to advance robotic legged locomotion, bio-inspired robotic technologies, robot-assisted walking, human-robot interaction, and high-tech tools for disaster response.

Education

- **Postdoctoral Research Fellow in Electrical Engineering (Control Engineering)**
  Department of Electrical Engineering and Computer Science, University of Michigan, Ann Arbor, MI, USA, January 2012 to August 2014

  - Advisor: Prof. Jessy W. Grizzle

- **Ph.D. in Electrical Engineering (Control Engineering)**
  Electrical Engineering Department, Sharif University of Technology, January 2007 to June 2011

  - Advisors: Prof. Nasser Sadati
  - Co-Advisors: Prof. William A. Gruver (Simon Fraser University, Canada) and Prof. Guy A. Dumont (The University of British Columbia, Canada)
  - GPA: **4/4**
  - Ph.D. Thesis Grade: **Excellent**

- **M.S. in Electrical Engineering (Control Engineering)**
  Electrical Engineering Department, Sharif University of Technology, September 2004 to September 2006
- **B.S. in Electrical Engineering (Electronic Engineering)**
  University of Tabriz, September 2000 to June 2004

Professional Experience

- **Assistant Professor**
  Department of Mechanical Engineering, Virginia Tech, August 2018 to present
- **Assistant Professor**
  Department of Mechanical Engineering, San Diego State University, August 2014 to August 2018
- **Postdoctoral Research Fellow**
  Electrical Engineering and Computer Science Department, University of Michigan, January 2012 to August 2014
- **Graduate Student Research Assistant**
  Electrical Engineering Department, Sharif University of Technology, January 2007 to June 2011

Funding and Projects

(a) **Summary of External Funding**

- Total External Funding: $2,492,555
- Total External Funding to VT: $1,562,587
- Personal Share at VT: $1,127,490

(b) **Active External Projects**

- NSF Award CMMI #1923216/1923239: *Collaborative Research: Intelligent and Agile Robotic Legged Locomotion in Complex Environments: From Planning to Safety and Robust Control*, **Lead PI: K. Akbari Hamed**, Caltech PI: A. D. Ames, 09/01/19-08/31/23, $584,483.00 (PI Akbari Hamed's share: $242,543.00)

- NSF Award ECCS #1924617/1924526: *NRI: FND: COLLAB: Hierarchical, Safe, and Distributed Feedback Control of Multiagent Legged Robots for Cooperative Locomotion and Manipulation*, **Lead PI: K. Akbari Hamed**, Caltech PI: A. D. Ames, 09/15/19-08/31/23, $749,823.00 (PI Akbari Hamed's share: $374,823.00)

- NSF Award CMMI #1906727: *Control of Dynamically Coupled Agile Legged Robots and Bioinspired Robotic Tails*, PI: Bentzvi, **Co-PI: K. Akbari Hamed**, 06/01/19-05/31/23, $396,036.00 (Co-PI Akbari Hamed's share: $166,070.00)

- NSF Award CSE/CNS #2128948: *FW-HTF-P: Inspector Assistant Robot for Future Construction Progress Monitoring*, PI: K. Afsari, Co-PIs: **K. Akbari Hamed**, and R. Patrick, 10/01/21-09/30/23, $150,000 (Co-PI Akbari Hamed's share: $54,869)

(c) **Completed External Projects**

- NSF Award CMMI #1637704/1854898: *NRI: Decentralized Feedback Control Design for Cooperative Robotic Walking with Application to Powered Prosthetic Legs*, **PI: K. Akbari Hamed**, Co-PI: R. D. Gregg, 09/01/16-08/31/20, $612,213.00 (PI Akbari Hamed's share: $366,483.00)

(d) **Internal Funding**

- *Eyes in the Sky and Boots on the Ground: Collaborative Technologies for Monitoring and Managing Livestock Pastures*, CALS Strategic Plan Advancement, PI: Z. Easton; Co-PIs: R. White, **K. Akbari Hamed**, D. Fuka, and M. Eick, 03/01/21-06/30/22, $60,000 (Co-PI Akbari Hamed's share: $20,000)

Honors and Awards

- **TEDx Speaker:** "How Robot Armies Will Save Our Future Cities?," TEDxPearlStreet, Washington, DC, July 2020

  Link: `https://youtu.be/_XJqtbiqVRo`
- Elected full member of Sigma Xi Scientific Society, 2020
- Ranked $\mathbf{1}^{st}$ according to GPA among Ph.D. students of Electrical Engineering, major of control, Sharif University of Technology
- Ranked $\mathbf{16}^{th}$ among more than 10,000 students in the national entrance exam for graduate studies in Electrical Engineering in Iran, 2004
- Ranked $\mathbf{1}^{st}$ according to GPA among B.S. students of Electrical Engineering, University of Tabriz

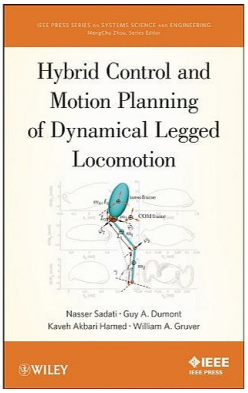
Publications

Summary of Publications

- Total number of peer-reviewed journal articles: 27
  Journal Articles: IEEE TAC, IEEE CST, IEEE TRO, IEEE RA-L, IEEE L-CSS, IJRR, IEEE TSMC, ASME JDSMC, NA:HS, IET CTA, IET PE, and IET EL
- Total number of peer-reviewed journal articles after joining VT: 15 (Articles J.27 to J.13)
- Total number of peer-reviewed conference articles: 23
  Conference Articles: ACC, IEEE CDC, IEEE ICRA, IEEE IROS, and IFAC ADHS
- Total number of peer-reviewed conference articles after joining VT: 12 (Articles C.23 to C.12)
- Total number of books: 1 (*Publisher:* Wiley-IEEE)

Books

[**B.**1] N. Sadati, G. A. Dumont, **K. Akbari Hamed**, and W. A. Gruver, *Hybrid Control and Motion Planning of Dynamical Legged Locomotion*, *Series on Systems Science and Engineering, Wiley-IEEE Press,* ISBN: 978-1-118-31707-5, 272 pages, Hoboken, NJ, USA, October 2012



Peer-reviewed Journal Papers

(Authors marked by * are my graduate students.)

[**J.**27] R. T. Fawcett*, K. Afsari, A. D. Ames, and **K. Akbari Hamed**, "Toward a data-driven template model for quadrupedal locomotion," *IEEE Robotics and Automation Letters*, vol. 7, issue 3, pp. 7636-7643, July 2022 (Impact Factor: 4.321)

[**J.**26] A. Pandala*, R. T. Fawcett*, U. Rosolia, A. D. Ames, and **K. Akbari Hamed**, "Robust predictive control for quadrupedal locomotion: Learning to close the gap between reduced- and full-order models," *IEEE Robotics and Automation Letters*, vol. 7, issue 3, pp. 6622-6629, July 2022 (Impact Factor: 4.321)

[**J.**25] V. R. Kamidi*, J. Kim*, R. T. Fawcett*, A. D. Ames, and **K. Akbari Hamed**, "Distributed quadratic programming-based nonlinear controllers for periodic gaits of legged locomotion," *IEEE Control Systems Letters*, vol. 6, pp. 2509-2514, April 2022

[**J.**24] R. T. Fawcett*, A. Pandala*, A. D. Ames, and **K. Akbari Hamed**, "Robust stabilization of periodic gaits for quadrupedal locomotion via QP-based virtual constraint controllers," *IEEE Control Systems Letters*, vol. 6, pp. 1736-1741, December 2021

[**J.**23] J. Kim* and **K. Akbari Hamed**, "Cooperative locomotion via supervisory predictive control and distributed nonlinear controllers," *ASME Journal of Dynamic Systems, Measurement, and Control*, 144(3), 031005, December 2021 (Impact Factor: 1.640)

[**J.**22] V. R. Kamidi*, J. C. Horn, R. D. Gregg, and **K. Akbari Hamed**, "Distributed controllers for human-robot locomotion: A scalable approach based on decomposition and hybrid zero dynamics," *IEEE Control Systems Letters*, vol. 5, issue 6, pp. 1976-1981, December 2021

[**J.**21] R. T. Fawcett*, A. Pandala*, J. Kim*, and **K. Akbari Hamed**, "Real-time planning and nonlinear control for quadrupedal locomotion with articulated tails," *ASME Journal of Dynamic Systems, Measurement, and Control*, 143(7), 071004, February 2021 (Impact Factor: 1.640)

[**J.**20] W. Ma, N. Csomay-Shanklin, S. Kolathaya, **K. Akbari Hamed**, and A. D. Ames, "Coupled control Lyapunov functions for interconnected systems, with application to quadrupedal locomotion," *IEEE Robotics and Automation Letters*, vol. 6, issue 2, pp. 3761-3768, April 2021 (Impact Factor: 4.321)

[**J.**19] **K. Akbari Hamed**, J. Kim*, and A. Pandala*, "Quadrupedal locomotion via event-based predictive control and QP-based virtual constraints," *IEEE Robotics and Automation Letters*, vol. 5, no. 3, pp. 4463-4470, July 2020 (Impact Factor: 4.321)

[**J.**18] J. C. Horn, A. Mohammadi, **K. Akbari Hamed**, and R. D. Gregg, "Nonholonomic virtual constraint design for variable-incline bipedal robotic walking," *IEEE Robotics and Automation Letters*, vol. 5, issue 2, pp. 3691-3698, April 2020 (Impact Factor: 4.321)

[**J.**17] **K. Akbari Hamed** and A. D. Ames, "Nonholonomic hybrid zero dynamics for the stabilization of periodic orbits: Application to underactuated robotics walking," *IEEE Transactions on Control Systems Technology*, vol. 28, issue 6, November 2020 (Impact Factor: 5.418)

[**J.**16] **K. Akbari Hamed**, V. R. Kamidi*, W-L. Ma, A. Leonessa, and A. D. Ames, "Hierarchical and safe motion control for cooperative locomotion of robotic guide dogs and humans: A hybrid systems approach," *IEEE Robotics and Automation Letters*, pp. 56-63, September 2019 (Impact Factor: 4.321)

[**J.**15] **K. Akbari Hamed**, B. Safaee, and R. D. Gregg, "Dynamic output controllers for exponential stabilization of periodic orbits for multi-domain hybrid models of robotic locomotion," *ASME Journal of Dynamic Systems, Measurement, and Control*, 141(12), 121011, December 2019 (Impact Factor: 1.640)

[**J.**14] **K. Akbari Hamed** and R. D. Gregg, "Decentralized event-based controllers for robust stabilization of hybrid periodic orbits: Application to underactuated 3D bipedal walking," *IEEE Transactions on Automatic Control*, vol. 64, no. 6, pp. 2266-2281, June 2019 (Impact Factor: 6.549)

[**J.**13] J. C. Horn, A. Mohammadi, **K. Akbari Hamed**, and R. D. Gregg, "Hybrid zero dynamics of bipedal robots under nonholonomic virtual constraints," *IEEE Control Systems Letters*, vol. 3, issue 2, pp. 386-391, January 2019

[**J.**12] **K. Akbari Hamed** and R. D. Gregg, "Decentralized feedback controllers for robust stabilization of periodic orbits of hybrid systems: Application to bipedal walking," *IEEE Transactions on Control Systems Technology*, vol. 25, issue 4, pp. 1153-1167, July 2017 (Impact Factor: 5.418)

[**J.**11] **K. Akbari Hamed** and J. W. Grizzle, "Reduced-order framework for exponential stabilization of periodic orbits on parameterized hybrid zero dynamics manifolds: Application to bipedal locomotion," *Nonlinear Analysis: Hybrid Systems*, vol. 25, pp. 227-245, August 2017 (Impact Factor: 5.477) **(Invited Paper)**

[**J.**10] **K. Akbari Hamed**, B. G. Buss, and J. W. Grizzle, "Exponentially stabilizing continuous-time controllers for periodic orbits of hybrid systems: Application to bipedal locomotion with ground height variations," *The International Journal of Robotics Research*, vol. 35, issue 8, pp. 977-999, August 2016 (Impact Factor: 6.887)

[**J.**9] **K. Akbari Hamed** and J. W. Grizzle, "Event-based stabilization of periodic orbits for underactuated 3D bipedal robots with left-right symmetry," *IEEE Transactions on Robotics*, vol. 30, issue 2, pp. 365-381, April 2014 (Impact Factor: 6.835)

[**J.**8] A. Ramezani, J. W. Hurst, **K. Akbari Hamed**, and J. W. Grizzle, "Performance analysis and feedback control of ATRIAS, a 3D bipedal robot," *ASME Journal of Dynamic Systems, Measurement, and Control*, DS-12-1421, October 2013 (Impact Factor: 1.640)

[**J.**7] **K. Akbari Hamed**, N. Sadati, W. A. Gruver, and G. A. Dumont, "Stabilization of periodic orbits for planar walking with non-instantaneous double support phase," *IEEE Transactions on Systems, Man, and Cybernetics, Part A*, vol. 42, issue 3, pp. 685-706, May 2012 (Impact Factor: 11.471)

[**J.**6] **K. Akbari Hamed**, N. Sadati, W. A. Gruver, and G. A. Dumont, "Exponential stabilisation of periodic orbits for running of a three-dimensional monopedal robot," *IET Control Theory and Applications*, vol. 5, issue 11, pp. 1304-1320, July 2011 (Impact Factor: 2.670)

[**J.**5] N. Sadati, G. A. Dumont, **K. Akbari Hamed**, and W. A. Gruver, "Two-level control scheme for stabilisation of periodic orbits for planar monopedal running," *IET Control Theory and Applications*, vol. 5, issue 13, pp. 1528-1543, August 2011 (Impact Factor: 2.670)

[**J.**4] R. Ansari, M. R. Feyzi, **K. Akbari Hamed**, N. Sadati, Y. Yasaei and S. Ouni, "Input-output linearisation of a fourth-order input-affine system describing the evolution of a three-phase/switch/level (Vienna) rectifier," *IET Power Electronics*, vol. 4 , issue 8, pp. 867-883, September 2011 (Impact Factor: 2.112)

[**J.**3] N. Sadati, **K. Akbari Hamed**, W. A. Gruver, and G. A. Dumont, "Radial basis function network for exponential stabilization of periodic orbits for planar bipedal walking," *IET Electronics Letters*, vol. 47, issue 12, June 2011 (Impact Factor: 1.202)

[**J.**2] N. Sadati, **K. Akbari Hamed**, G. A. Dumont, and W. A. Gruver, "Nonholonomic motion planning based on optimal control for flight phases of planar bipedal running," *IET Electronics Letters*, vol. 47, issue 20, September 2011 (Impact Factor: 1.202)

[**J.**1] **K. Akbari Hamed**, N. Sadati, W. A. Gruver, and G. A. Dumont, "Continuous-time update laws with radial basis step length for control of bipedal locomotion," *IET Electronics Letters*, vol. 46, issue 21, October 2010 (Impact Factor: 1.202)

Peer-reviewed Conference Papers

(Authors marked by * are my graduate students.)

[**C.**23] R. T. Fawcett*, K. Afsari, A. D. Ames, and **K. Akbari Hamed**, "Toward a data-driven template model for quadrupedal locomotion," *IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS)*, Accepted to Appear, July 2022

[**C.**22] A. Pandala*, R. T. Fawcett*, U. Rosolia, A. D. Ames, and **K. Akbari Hamed**, "Robust predictive control for quadrupedal locomotion: Learning to close the gap between reduced- and full-order models," *IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS)*, Accepted to Appear, July 2022

[**C.**21] V. R. Kamidi*, J. Kim*, R. T. Fawcett*, A. D. Ames, and **K. Akbari Hamed**, "Distributed quadratic programming-based nonlinear controllers for periodic gaits of legged locomotion, " *IEEE International Conference on Decision and Control (CDC)*, Accepted to Appear, July 2022

[**C.**20] R. T. Fawcett*, A. Pandala*, A. D. Ames, and **K. Akbari Hamed**, "Robust stabilization of periodic gaits for quadrupedal locomotion via QP-based virtual constraint controllers," *American Control Conference (ACC)*, pp. 1952-1967, Atlanta, GA, USA, June 2022

[**C.**19] V. R. Kamidi*, J. C. Horn, R. D. Gregg, and **K. Akbari Hamed**, "Distributed controllers for human-robot locomotion: A scalable approach based on decomposition and hybrid zero dynamics," *American Control Conference (ACC)*, pp. 2049-2054, New Orleans, LA, USA, May 2021

[**C.**18] W. Ma, N. Csomay-Shanklin, S. Kolathaya, **K. Akbari Hamed**, and A. D. Ames, "Coupled control Lyapunov functions for interconnected systems, with application to quadrupedal locomotion," *IEEE International Conference on Robotics and Automation (ICRA)*, China, June 2021

[**C.**17] A. Pandala*, V. R. Kamidi*, and **K. Akbari Hamed**, "Decentralized control schemes for stable quadrupedal locomotion: A decomposition approach from centralized controllers," *IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS)*, pp. 3975-3981, Las Vegas, NV, October 2020

[**C.**16] J. Martin*, V. R. Kamidi*, A. Pandala*, R. Fawcett*, and **K. Akbari Hamed**, "Exponentially stabilizing and time-varying virtual constraint controllers for dynamic quadrupedal bounding," *IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS)*, pp. 3914-3921, Las Vegas, NV, October 2020

[**C.**15] **K. Akbari Hamed**, V. R. Kamidi*, A. Pandala*, W. Ma, and A. D. Ames, "Distributed feedback controllers for stable cooperative locomotion of quadrupedal robots: A virtual constraint approach," *American Control Conference (ACC)*, pp. 5314-5321, Denver, CO, July 2020

[**C.**14] J. C. Horn, A. Mohammadi, **K. Akbari Hamed**, and R. D. Gregg, "Nonholonomic virtual constraint design for variable-incline bipedal robotic walking," *IEEE International Conference on Robotics and Automation (ICRA)*, France, June 2020

[**C.**13] W-L. Ma, **K. Akbari Hamed**, and A. D. Ames, "First steps towards full model based motion planning and control of quadrupeds: A hybrid zero dynamics approach," *IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS)*, pp. 5498-5503, Macau, China, November 2019

[**C.**12] **K. Akbari Hamed**, W. Ma, and A. D. Ames, "Dynamically stable 3D quadruped walking with multi-domain hybrid system models and virtual constraint controllers," *American Control Conference (ACC)*, pp. 4588-4595, Philadelphia, USA, July 2019

[**C.**11] **K. Akbari Hamed**, A. D. Ames, and R. D. Gregg, "Observer-based feedback controllers for exponential stabilization of hybrid periodic orbits: Application to underactuated bipedal walking," *American Control Conference (ACC)*, pp. 1438-1445, Milwaukee WI, June 2018

[**C.**10] **K. Akbari Hamed**, R. D. Gregg, and A. D. Ames, "Exponentially stabilizing controllers for multi-contact 3D bipedal locomotion," *American Control Conference (ACC)*, pp. 2210-2217, Milwaukee WI, June 2018

[**C.**9] **K. Akbari Hamed** and R. D. Gregg, "Decentralized feedback controllers for exponential stabilization of hybrid periodic orbits: Application to robotic walking," *American Control Conferences (ACC)*, pp. 4793-4800, Boston, MA, July 2016 **(Invited Paper)**

[**C.**8] B. G. Buss, **K. Akbari Hamed**, B. A. Griffin, and J. W. Grizzle, "Experimental results for 3D bipedal robot walking based on systematic optimization of virtual constraints," *American Control Conferences (ACC)*, pp. 4785-4792, Boston, MA, July 2016 **(Invited Paper)**

[**C.**7] **K. Akbari Hamed**, and J. W. Grizzle, "Iterative robust stabilization algorithm for periodic orbits of hybrid dynamical systems: Application to bipedal running," *IFAC Conference on Analysis and Design of Hybrid Systems (ADHS)*, pp 161-168, Atlanta, GA, USA, October 2015 **(Invited to be submitted as a journal paper)**

[**C.**6] **K. Akbari Hamed**, B. G. Buss, and J. W. Grizzle, "Continuous-time controllers for stabilizing periodic orbits of hybrid systems: Application to an underactuated 3D bipedal robot," *IEEE Conference on Decision and Control (CDC)*, pp. 1507-1513, Los Angeles, CA, USA, December 2014

[**C.**5] B. G. Buss, A. Ramezani, **K. Akbari Hamed**, B. A. Griffin, K. S. Galloway, and J. W. Grizzle, "Preliminary walking experiments with underactuated 3D bipedal robot MARLO," *IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS)*, pp. 2529-2536, Chicago, IL, USA, September 2014

[**C.**4] **K. Akbari Hamed** and J. W. Grizzle, "Robust event-based stabilization of periodic orbits for hybrid systems: Application to an underactuated 3D bipedal robot," *American Control Conference (ACC)*, pp. 6206-6212, Washington, DC, USA, 2013

[**C.**3] N. Sadati and **K. Akbari Hamed**, "CPG based controller for a 5-link planar biped robot," *IEEE International Conference on Mechatronics*, pp. 1-6, Kumamoto, Japan, May 2007

[**C.**2] N. Sadati and **K. Akbari Hamed**, "Neural control of a fully actuated biped robot," *IEEE International Conference on Robotics and Biomimetics*, pp. 1299-1304, Kunming, China, December 2006

[**C.**1] N. Sadati and **K. Akbari Hamed**, "Neural control of an underactuated biped robot," *IEEE-RAS International Conference on Humanoid Robot*, pp. 593-598, Genova, Italy, December 2006

Book Chapters

BC.1 N. Sadati, G. A. Dumont, and **K. Akbari Hamed**, *Design of a Neural Controller for Walking of a 5-Link Planar Biped Robot via Optimization*, Human-Robot Interaction, Daisuke Chugo (Ed.), ISBN: 978-953-307-051-3, InTech, pp. 267-288, February 2010

Theses

[**T.**2] **K. Akbari Hamed**, *Design of Continuous Time-Invariant Controllers for Exponential Stabilization of Periodic Walking and Running Locomotion in Planar Bipedal Robots*, Ph.D. dissertation, Sharif University of Technology, June 2011

[**T.**1] **K. Akbari Hamed**, *Simulation and Intelligent Control of Central Pattern Generators in Spinal Cord for Bipedal Robots*, M.Sc. dissertation, Sharif University of Technology, September 2006

Ph.D. and M.S. Theses Advised as the Main Advisor

[**ST.**4] J. Kim*, *Cooperative Locomotion of Quadrupedal Robots: From Supervisory Predictive Control to Distributed Control*, Ph.D. Thesis, Advisor: **K. Akbari Hamed**, Mechanical Engineering, Virginia Tech, August 2022

[**ST.**3] V. R. Kamidi*, *Distributed Feedback Control Algorithms for Cooperative Locomotion: From Bipedal to Quadrupedal Robots*, Ph.D. Thesis, Advisor: **K. Akbari Hamed**, Mechanical Engineering, Virginia Tech, March 2022

[**ST.**2] R. T. Fawcett*, *Real-Time Planning and Nonlinear Control for Robust Quadrupedal Locomotion with Tails*, M.S. Thesis, Advisor: **K. Akbari Hamed**, Mechanical Engineering, Virginia Tech, July 2021

[**ST.**1] J. B. Martin*, *Design of Time-Varying Hybrid Zero Dynamics Controllers for Exponential Stabilization of Agile Quadrupedal Locomotion*, M.S. Thesis, Advisor: **K. Akbari Hamed**, Mechanical Engineering, Virginia Tech, October 2020

Workshops

[**W.**4] **K. Akbari Hamed**, "Hierarchical feedback control of legged locomotion: From robust planning to nonlinear control," Workshop Towards Safe Legged Locomotion in Complex Environments: Learning, Estimation, Planning, and Autonomy, *American Control Conference*, June 2022

[**W.**3] **K. Akbari Hamed**, "Hierarchical and nonlinear feedback control of legged robots: From hybrid systems to planning and robust control," Workshop on Impact-Aware Robotics, *IEEE/RSJ International Conference on Intelligent Robots and Systems*, October 2021

[**W.**2] **K. Akbari Hamed**, B. G. Buss, and J. W. Grizzle, "Continuous-Time Controllers for Robust Stabilization of 3D Bipedal Walking," *Dynamic Locomotion RSS Workshop 2014*, UC Berkeley, CA, July 2014

[**W.**1] J. W. Grizzle, A. Ramezani, B. Buss, B. Griffin., **K. Akbari Hamed**, and K. S. Galloway, "Progress on controlling MARLO, an Atrias-series 3D underactuated bipedal robot," *Dynamic Walking 2013*, Pittsburgh, Pennsylvania, 2013

Invited Talks and Presentations

[**P.**14] **TEDx Talk:** "How Robot Armies Will Save Our Future Cities?," July 2020, Link: `https://youtu.be/_XJqtbiqVRo` (**Invited Speaker**)

[**P.**13] **K. Akbari Hamed**, "Hierarchical feedback control of legged locomotion: From robust planning to nonlinear control," Workshop Towards Safe Legged Locomotion in Complex Environments: Learning, Estimation, Planning, and Autonomy, American Control Conference, June 2022 (**Invited Speaker**)

[**P.**12] **K. Akbari Hamed**, "Hierarchical and nonlinear feedback control of legged robots: From hybrid systems to planning and robust control," Workshop on Impact-Aware Robotics, IEEE/RSJ International Conference on Intelligent Robots and Systems, October 2021 (**Invited Speaker**)

[**P.**11] **K. Akbari Hamed**, "Decentralized control algorithms for cooperative legged locomotion: A hybrid systems approach," NSF workshop on Human-Friendly Robots, University of Texas at San Antonio, May 2019 (**Invited Speaker**)

[**P.**10] **K. Akbari Hamed**, "Decentralized resilient control algorithms for robust stabilization of hybrid dynamical systems: Application to robotic walking", Department of Mechanical Engineering, Virginia Tech, 2018

[**P.**9] **K. Akbari Hamed**, "Decentralized resilient control algorithms for robust stabilization of cyber-physical systems: Application to autonomous and rehabilitation robotic walking", Department of Aerospace and Mechanical Engineering, University of Notre Dame, 2018

[**P.**8] **K. Akbari Hamed**, "Decentralized resilient control algorithms for robust stabilization of hybrid dynamical systems: Application to robotic walking", Department of Electrical and Computer Engineering, University of Central Florida, 2018

[**P.**7] **K. Akbari Hamed**, "Decentralized resilient control algorithms for robust stabilization of hybrid dynamical systems: Application to robotic walking", Department of Mechanical and Industrial Engineering, The University of Iowa, 2018

[**P.**6] **K. Akbari Hamed**, "Decentralized resilient control algorithms for robust stabilization of hybrid dynamical systems: Application to robotic walking", University of Nevada Reno, Department of Mechanical Engineering, 2018

[**P.**5] **K. Akbari Hamed**, "Centralized and decentralized feedback control design for robust stabilization of hybrid periodic orbits: Application to robotic walking", Department of Mechanical Engineering, University of Wisconsin-Madison, 2017

[**P.**4] **K. Akbari Hamed**, "Centralized and decentralized feedback control design for robust stabilization of hybrid periodic orbits: Application to robotic walking", Department of Computer Engineering, University of California, Santa Cruz, 2017

[**P.**3] **K. Akbari Hamed**, "Centralized and decentralized feedback control design for robust stabilization of hybrid periodic orbits: Application to robotic walking", Department of Mechanical Engineering, Rice University, 2017

[**P.**2] **K. Akbari Hamed**, "Continuous-time controllers for robust stabilization of periodic orbits for hybrid dynamical systems: Application to bipedal walking and running", University of Texas at Dallas, 2015

[**P.**1] **K. Akbari Hamed**, "Robust Dynamical Legged Locomotion Through Hybrid Control and Optimization", San Diego State University, San Diego, CA, 2014

Google Scholar

- Citations: 927, h-index: 15, and i10-index: 19

Editorial Board

[**E.**5] Editor for the IEEE RAS/EMBS International Conference for Biomedical Robotics and Biomechatronics (BioRob) 2020 and 2022

[**E.**4] Associate Editor for the American Control Conference (ACC) 2020-2023

[**E.**3] Associate Editor for the IEEE Conference on Decision and Control (CDC) 2020-2022

[**E.**2] Associate Editor for the IEEE International Conference on Robotics and Automation (ICRA) 2021

[**E.**1] Associate Editor for the IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS) 2021-2022

Session Chair

[**S.**5] Chair for the 2022 American Control Conference (ACC) session on "Robotics III", June 2022

[**S.**4] Chair for the 2021 IEEE International Conference on Robotics and Automation (ICRA) session on "Legged Robots II", June 2021

[**S.**3] Chair for the 2020 IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS) session on "Passive Walking", October 2020

[**S.**2] Co-chair for the 2018 American Control Conference ACC session on "Stability of Hybrid Systems", Milwaukee Wi, June 2018

[**S.**1] Co-chair for the 2014 IEEE Conference on Decision and Control (CDC) session on "Stability of Hybrid Systems", Los Angeles, CA, December 2014

Program Committee

- Robotics, Science and Systems (RSS) 2017 and 2018

Teaching Experience

(Courses marked by * are new courses that I have developed.)

[**TE.**5] ***Feedback Control of Dynamic Legged Locomotion**** **(ME 6804)**, Developer and Organizer, Graduate course, Department of Mechanical Engineering, Virginia Tech

[**TE.**4] ***Robotics and Automation*** **(ME 5704)**, Instructor, Graduate level course, Department of Mechanical Engineering, Virginia Tech

[**TE.**3] ***Controls Engineering*** **(ME 3534)**, Instructor, Senior level undergraduate course, Department of Mechanical Engineering, Virginia Tech

[**TE.**2] ***System Dynamics*** **(ME 3514)**, Instructor, Senior level undergraduate course, Department of Mechanical Engineering, Virginia Tech

[**TE.**1] ***Robotics and Mechatronics Seminar*** **(ME 4734)**, Instructor, Senior level undergraduate course, Department of Mechanical Engineering, Virginia Tech

Student Advising

Current Graduate Students as the Main Advisor

- Abhishek Pandala (Ph.D. Candidate at Virginia Tech)
- Jeeseop Kim (Ph.D. Candidate at Virginia Tech)
- Basit Muhammad Imran (Ph.D. Candidate at Virginia Tech)
- Leila Amanzadeh (Ph.D. Student at Virginia Tech)
- Randy Fawcett (Ph.D. Candidate at Virginia Tech)
- Taizoon Chunawala (Ph.D. Student at Virginia Tech)

Former Graduate Students as the Main Advisor

- Vinay R. Kamidi (Ph.D. Student at Virginia Tech), Ph.D. Defense Date: March 2022
- Randy Fawcett (M.S. Student at Virginia Tech), M.S. Defense Date: July 2021
- Joseph Martin (M.S. Student at Virginia Tech), M.S. Defense Date: October 2020

Former Undergraduate Students

- *Senior design project (2021-2022):* Alex Bottoms, Chris Macauley, Katrina Newby, Brandon Peysar, Eunice Reinhold, Nicklas Roth, Travis Walker
- *Senior design project (2019-2020):* Kyle Skiffington, Caroline McDonald, Shubham Rath, Louis Rizzi, Tim Ryan, Michael Repa
- *Volunteer undergraduate students for research:* Ruichang Chen, Yipin Zhou, Jerry Lian, Fujun Ruan, Ritish Shailly, Tung Xuan Le, Michael Otooni, Anshool Pradhan, Shengyuan Niu, Sean Eagen, Zihang Zhao, Jiajun Zhang
- *Volunteer K-12 students for research:* Neema Ahmadian

Press and Media

[**Pr.**14] Virginia Tech's terrifying touchdown robot wants to do push-ups, not take over the world, ***The Washington Post***, October 12, 2019

[**Pr.**13] Virginia Tech researchers aim to give robots bio-inspired gaits, *Virginia Tech*, September 27, 2019

[**Pr.**12] How Virginia Tech's pushup robot could one day help people with disabilities, *WSLS 10 News*, October 1, 2019

[**Pr.**11] Virginia Tech finds star on football field: Push-up pumping robot, *WDBJ7*, October 3, 2019

[**Pr.**10] Behold, Virginia Tech's football team has a robot that does pushups when they score, *Mashable*, September 28, 2019

[**Pr.**9] A Leg Up for Prosthetics, *SDSU NewsCenter*, December 7, 2016

[**Pr.**8] MARLO an underactuated 3D bipedal robot with passive prosthetic feet, *IEEE Spectrum*, December 6 2013

[**Pr.**7] No Big Deal, Just a Robot Walking Around Campus, *The Atlantic*, December 4, 2013

[**Pr.**6] For door-to-door delivery, robots must improve gait, *The Business of Robotics*, December 4 2013

[**Pr.**5] Google's robotics properties and U of M's walking robot, *examiner*, December 4 2013

[**Pr.**4] Two-legged robot walks outside at U-M, Michigan Engineering, *Michigan Engineering*, December 3, 2013

[**Pr.**3] Two-legged robot walks outside at U-Michigan, *EECS News, University of Michigan*, December 4 2013

[**Pr.**2] Walk the Robot - Preliminary Outdoor Walking with Underactuated Bipedal Robot MARLO, *futurescope*, December 5 2013

[**Pr.**1] The University of Michigan's newest two-legged robot has taken its first steps outside, *Frequency*, December 4 2013

Professional Service

- Member, IEEE
- Elected full member of Sigma Xi Scientific Society, 2020
- Member, IEEE Control Systems Society
- Member, IEEE Robotics and Automation Society
- Member, IEEE Technical Committee on Hybrid Systems

Ph.D. and M.S. Thesis Committee Member

- Biggers, Zackory James (Advisor: Dr. Alan Asbeck), Virginia Tech
- Amrite, Shardul (Advisor: Dr. Andrea L'Afflitto), Virginia Tech
- Zhang, Zichen (Advisor: Dr. Mehdi Ahmadian), Virginia Tech
- Neighborgall, Campbell Reed (Advisor: Dr. Mehdi Ahmadian), Virginia Tech
- Rajasekaran, Darshan (Advisor: Dr. Saied Taheri), Virginia Tech
- Hunde, Sena Aschalew (Advisor: Dr. Alexander Leonessa), Virginia Tech
- Conte, Dean Edward (Advisor: Dr. Tomonari Furukawa), Virginia Tech
- Nikafrooz, Negin (Advisor: Dr. Alexander Leonessa), Virginia Tech
- Hancock, Philip Jackson (Advisor: Dr. Alexander Leonessa), Virginia Tech
- Pang, Zhoubao (Advisor: Dr. Alexander Leonessa), Virginia Tech
- Marshall, Julius Allen (Advisor: Dr. Andrea L'Afflitto), Virginia Tech
- Mast, Timothy Edward (Advisor: Dr. Mehdi Ahmadian), Virginia Tech
- Liu, Purong (Advisor: Dr. Alexander Leonessa), Virginia Tech
- Budolak, Daniel Wojciech (Advisor: Dr. Alexander Leonessa), Virginia Tech
- Radmehr, Ahmad (Advisor: Dr. Mehdi Ahmadian), Virginia Tech
- Nagi, Navneet Singh (Advisor: Dr. Alexander Leonessa), Virginia Tech

Reviewer

- *National Science Foundation Panelist*
- *Journals:* IEEE Transactions on Automatic Control, IEEE Transactions on Control Systems Technology, IEEE Control Systems Letters, Automatica, IEEE Transactions on Control of Network Systems, SIAM Journal of Control and Optimization, ASME Journal of Dynamic Systems, Measurement, and Control, International Journal of Robotics Research, IEEE Transactions on Robotics, IEEE Robotics and Automation Letters, IEEE Transactions on Systems, Man and Cybernetics, IEEE/ASME Transactions on Mechatronics, IEEE Transactions on Neural Networks, IET Control Theory and Applications, Robotica, Mechatronics, a journal of IFAC, Journal of Intelligent & Robotic Systems
- *Conferences:* American Control Conference (ACC), IEEE International Conference on Decision and Control (CDC), IEEE International Conference on Robotics and Automation (ICRA), IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS), IEEE-RAS International Conference on Humanoid Robots, IEEE/ASME International Conference on Advanced Intelligent Mechatronics (AIM), Robotics: Science and Systems (RSS)

Outreach

- Virginia Tech Science Festival: Robot locomotion exhibit for local families and kids, 2019 and 2020
- Robot demo in the field during Virginia Tech's football games featured by different news sources including ESPN, 2019
- TEDx talk: "How robot armies will save our future cities?," July 2020
- Multiple interviews with different news, including The Washington Post, to discuss my research on robot locomotion and its importance for society
- Robot locomotion exhibit for Virginia Tech Open House, Fall 2021 and Spring 2022
- Multiple STEM lab tours for K-12 students, teachers, local schools, and families

Professional Skills

- Control Theory
- Robotics

- Robot Locomotion
- Autonomous Robots
- Machine Learning and Artificial Intelligence
- Dynamical Systems Theory
- Decentralized and Distributed Control
- Nonlinear and Robust Control
- Multiagent Systems
- Optimization Theory
- Wearable and Rehabilitation Robots

Graduate Courses

- Nonlinear Control, Robot Control, Adaptive Control, Robust Control, Optimal Control, Multi-Variable Control, Model Predictive Control, Digital Control, Linear System Theory, Estimation Theory and Optimal Filters, Linear and Nonlinear Programming, Theory of Advanced Differential Equations and Dynamical Systems, Differential Geometry, Artificial Neural Networks and Their Applications, Fuzzy Logic and its Applications, Digital Signal Processing, Stochastic Processes

Computer Skills

- C/C++, MATLAB, Simulink, xPC Target, dSpace, LabVIEW, Arduino, and Raspberry Pi