

Exponent®
Engineering & Scientific Consulting

Randy Fawcett, Ph.D.

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Professional Profile

Dr. Randall Fawcett's area of expertise is in autonomy; planning and control of complex systems, with an emphasis on robotic applications. He has extensive knowledge regarding complex multi-body robotics and nonlinear control algorithms, along with experience designing prototypes for robots and significant programming knowledge for analysis of system behavior and implementation of real-time control algorithms.

Prior to joining exponent, Dr. Fawcett was a graduate research assistant in the Hybrid Dynamic Systems and Robot Locomotion Lab at Virginia Tech, where he focused on creating algorithms that allowed quadrupedal robots to navigate unknown and unstructured environments robustly. More specifically, his work focused on utilizing data-driven methods and optimization techniques for both trajectory planning and nonlinear control of quadrupeds. In addition, he conducted research into efficient algorithms that could be used in multi-agent configurations, allowing groups of robots to physically interact with one another while maneuvering through challenging environments. Dr. Fawcett further performed experimental evaluations of the robustness of all control methodologies thoroughly on real hardware platforms.

Academic Credentials & Professional Honors

Ph.D., Mechanical Engineering, Virginia Polytechnic Institute and State Univ, 2023

M.S., Mechanical Engineering, Virginia Polytechnic Institute and State Univ, 2021

B.S., Mechanical Engineering, Auburn University (AU), 2019

Best Conference Paper Award, IEEE International Conference on Robotics and Automation, 2023

Rudolf Kalman Best Paper Award, ASME Dynamic Systems and Control Division, 2022

Licenses and Certifications

C++ Nanodegree Certificate from Udacity

Prior Experience

Graduate Research Assistant – Hybrid Dynamic Systems and Robot Locomotion Laboratory, Virginia Tech, 2020-2023

Graduate Teaching Assistant – Engineering Analysis using Numerical Methods in MATLAB, Virginia

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Tech, Fall 2019

Research Assistant – Sport Biomechanics Lab; Locomotor and Movement Control Lab; Brain and Behavior Lab, Auburn University, 2017-2019

Engineering Intern, MITRE Corporation, 2016

Publications

Amanzadeh, L., Chunawala, T., Fawcett, R. T., Leonessa, A., and Akbari Hamed, K., “Predictive Control with Indirect Adaptive Laws for Payload Transportation by Quadrupedal Robots," IEEE Robotics and Automation Letters, vol. 9, no. 11, pp. 10359-10366, Nov. 2024.

Imran, B. M., Fawcett, R. T., Kim, J., Leonessa, A., and Akbari Hamed, K., "A Distributed Layered Planning and Control Algorithm for Teams of Quadrupedal Robots: An Obstacle-Aware Nonlinear Model Predictive Control Approach." ASME. J. Dyn. Sys., Meas., Control. Vol 147, No 3, Oct. 2024.

Fawcett, R. T., Ames, A. D., Akbari Hamed, K., “Distributed Planning of Collaborative Locomotion: A Physics-Based and Data-Driven Approach,” IEEE Access, Vol 11, pp. 128369-128382, 2023.

Kim, J., Fawcett, R. T., Kamidi, V. R., Ames, A. D., Akbari Hamed, K., “Layered Control for Cooperative Locomotion of Two Quadrupedal Robots: Centralized and Distributed Approaches,” IEEE Transactions on Robotics, vol 39, no. 6, pp. 4728-4748, 2023.

Fawcett, R. T., Amanzadeh, L., Kim, J., Ames, A. D., Akbari Hamed, K., “Distributed Data-Driven Predictive Control for Multi-Agent Collaborative Legged Locomotion,” in proceedings for IEEE International Conference on Robotics and Automation (ICRA), pp. 9924-9930, 2023.

Fawcett, R. T., Kereshmeh, A., Ames, A. D., Akbari Hamed, K., “Toward a data-driven template model for quadrupedal locomotion,” IEEE Robotics and Automation Letters, vol. 7, no. 3, pp. 7636–7643, 2022.

Pandala, A., Fawcett, R. T., Rosolia, U., Ames, A. D., Akbari Hamed, K., “Robust Predictive Contorl for Quadrupedal Locomotion: Learning to Close the Gap Between Reduced- and Full-Order Models,” IEEE Robotics and Automation Letters, Vol 7, No. 3, pp. 6622-6629, 2022.

Kamidi, V., Kim, J., Fawcett, R. T., Ames, A. D., Akbari Hamed, K., “Distributed Quadratic Programming-Based Nonlinear Controllers for Periodic Gaits on Legged Robots,” IEEE Control Systems Letters, vol. 6, pp. 2509-2514, 2022.

Fawcett, R. T., Pandala, A., Ames, A. D., Akbari Hamed, K., “Robust Stabilization of Periodic Gaits for Quadrupedal Locomotion via QP-Based Virtual Constraint Controllers,” IEEE Control Systems Letters, Vol 6, pp. 1736-1741, 2021

Fawcett, R. T., Pandala, A., Kim, J., Akbari Hamed, K., “Real-Time Planning and Nonlinear Control for Quadrupedal Locomotion with Articulated Tails,” Journal of Dynamic Systems, Measurement, and Control, Vol. 143, No. 7, 2021.

Holmes, H. H., Fawcett, R. T., Roper, J. A., “Changes in Spatiotemporal Measures and Variability During User-Driven Treadmill, Fixed-Speed Treadmill, and Overground Walking in Young Adults: A Pilot Study,” Journal of Applied Biomechanics, 37(3), 277-281, 2021.

Martin, J. B., Kamidi, V. R., Pandala, A., Fawcett, R. T., Akbari Hamed, K.,” Exponentially stabilizing and time-varying virtual constraint controllers for dynamic quadrupedal bounding,” in proceedings for IEEE International Conference on Intelligent Robots and Systems (IROS), pp. 3914-3921, 2020.

Presentations

Fawcett, R. T., Amanzadeh, L., Kim, J., Ames, A. D., Akbari Hamed, K., “Distributed Data-Driven Predictive Control for Multi-Agent Collaborative Legged Locomotion,” Oral and Poster Presentation, IEEE International Conference on Robotics and Automation (ICRA), 2023.

Fawcett, R. T., Kereshmeh, A., Ames, A. D., Akbari Hamed, K., “Toward a data-driven template model for quadrupedal locomotion,” Oral Presentation, IEEE International Conference on Intelligent Robots and Systems (IROS), 2022.

Pandala, A., Fawcett, R. T., Rosolia, U., Ames, A. D., Akbari Hamed, K., “Robust Predictive Contorl for Quadrupedal Locomotion: Learning to Close the Gap Between Reduced- and Full-Order Models,” Oral Presentation, IEEE International Conference on Intelligent Robots and Systems (IROS), 2022.

Kamidi, V., Kim, J., Fawcett, R. T., Ames, A. D., Akbari Hamed, K., “Distributed Quadratic Programming-Based Nonlinear Controllers for Periodic Gaits on Legged Robots,” Oral presentation, IEEE Conference on Decision and Control (CDC), 2022.

Fawcett, R. T., Pandala, A., Ames, A. D., Akbari Hamed, K., “Robust Stabilization of Periodic Gaits for Quadrupedal Locomotion via QP-Based Virtual Constraint Controllers,” Hybrid oral and poster presentation, IEEE American Controls Conference (ACC), 2022.

Martin, J. B., Kamidi, V. R., Pandala, A., Fawcett, R. T., Akbari Hamed, K.,” Exponentially stabilizing and time-varying virtual constraint controllers for dynamic quadrupedal bounding,” Oral presentation, IEEE International Conference on Intelligent Robots and Systems (IROS), 2020.

Holmes H. H., Corona, K., Fawcett, R. T., Roper, J. A., “Joint Moment Contributions During Flat, Incline, and Decline Running in Individuals With ACLR,” Poster Presentation, Medicine & Science in Sports & Exercise 2019, 51(6S), 259.

Corona, K., Holmes H. H., Fawcett, R. T., Roper, J. A., “Hip, Knee, and Ankle Contributions Are Altered During Sloped Walking in Individuals With ACLR,” Poster Presentation, Medicine & Science in Sports & Exercise 2019, 51(6S), 259.

Willburn, C., Decoux, B., Fawcett, R. T., Williams, R. T., Moore, N. H., Weimar, W. H., “Effects of Arch Type of the Propulsion Mechanics of Jumping and Hopping Tasks,” Poster presentation, Medicine & Science in Sports & Exercise 2019, 51(6S), 265.

Decoux, B. E., Willburn, C. M., Fawcett, R. T., Brewer, L., Williams, P. T., Moore, N. H., Smallwood, L., Weimar, W. H., “Relationship Between Arch Stiffness, Vertical Stiffness, Loading Rate, and Hopping Frequency During Unilateral Stationary Hopping Among Male Collegiate Athletes,” Oral presentation, Southeastern American College of Sports Medicine Annual Conference, 2018.

Willburn, C. H., Decoux, B. E., Fawcett, R. T., Brewer, L., Williams, P. T., Moore, N. H., Smallwood, L., Weimar, W. H., “The Influence of Arch Height on Propulsion Mechanics during Forward Hopping and Lateral Jumping Tasks,” Poster presentation, Southeastern American College of Sports Medicine Annual Conference, 2018.

Weimar, W. H, Willburn, C. H., Decoux, B. E., Fawcett, R. T., Brewer, L., Moore, N. H., “Effect of Arch Flexibility on Propulsive Parameters of Hopping,” Oral presentation, Southeastern American College of Sports Medicine Annual Conference, 2018.

Brewer, L, Decoux, B. E., Willburn, C. M., Moore, N. H., Fawcett, R. T., Weimar, W. H., “Effect of Pack Load Position on Trunk Flexion During Obstacle Task,” Poster presentation, Southeastern American College of Sports Medicine Annual Conference, 2018.

Peer Reviews

IEEE Robotics and Automation Letters

IEEE International Conference on Robotics and Automation

IEEE International Conference on Intelligent Robots and Systems

IEEE Conference on Decision and Control