

Exponent®
Engineering & Scientific Consulting

Bruce Miller, Ph.D., P.E.

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Professional Profile

Dr. Miller has extensive expertise in the fields of biomechanics and restraint systems, encompassing human kinematics and dynamics, injury mechanics and tolerance, as well as safety and restraint system performance. His professional experience includes biomechanical reconstruction and analysis of injuries resulting from vehicular, pedestrian, occupational, and recreational incidents. Additionally, he has conducted comprehensive restraint system evaluations to assess occupant restraint performance and functionality and examines occupant interactions with these systems under crash conditions. Dr. Miller has also carried out extensive research and testing on occupant-to-glazing interactions and the efficacy of glazing systems within automotive contexts.

He has conducted a variety of experimental evaluations for the purpose of investigating injury mechanics, injury potential, and restraint interaction and performance, including through the use of anthropomorphic test devices (ATDs). This includes full-scale vehicle crash testing, automotive and sled testing, component testing, and specialized biomechanical studies such as head impact evaluations and helmet impact testing, as well as destructive and non-destructive studies to characterize and evaluate the performance of glazing systems in association with typical usage and crash forces, including occupant loading and containment.

Prior to joining Exponent, Dr. Miller was a post-doctoral researcher in the Scansorial and Terrestrial Robotics and Integrated Design (STRIDe) Lab at Florida State University where he completed the Intelligence Community (IC) Postdoctoral Research Fellowship Program. His research projects focused on analysis of human and animal locomotion for rapid and robust movement on level, vertical, and inclined surfaces. This included modeling and simulation of dynamic locomotion modalities as well as robot design, fabrication, and experimental testing.

Dr. Miller is proficient in the collection of kinematic and kinetic data using high-speed motion capture, force/torque transducers, and joint position sensors as well as analyses using advanced computational software. He also has extensive experience developing and analyzing reduced-order and multi-body dynamic models (Working Model 2D and ADAMS) and in the fabrication of electromechanical systems.

Academic Credentials & Professional Honors

Ph.D., Mechanical Engineering, Florida State University, 2013

B.S., Biomedical Engineering, Boston University, 2009

Intelligence Community Postdoctoral Fellow

Florida State University - University Fellow

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Boston University Trustee Scholar

Licenses and Certifications

Professional Engineer Mechanical, Arizona, #71560

Professional Engineer, Georgia, #053230

Professional Engineer, New York, #111055

Professional Engineer Mechanical, Texas, #155178

Motorcycle Safety Foundation (MSF) Basic Rider Course

Northwestern University Center for Public Safety, Traffic Crash Reconstruction for Engineers

Professional Affiliations

Society of Automotive Engineers (SAE)

American Society of Mechanical Engineers (ASME)

Publications

Rapp van Roden E, Miller B, Pearson J, Williamson J, Brown T. Revisiting Rear Seat Safety: Field Evaluations of Relative Injury Risk Across Seating Positions and the Integration of Advanced Rear Seat Belt Systems. SAE Technical Paper 2026-01-0561, 2026

Bove R, Elmasry S, Amin D, Aber R, Rapp van Roden E, Miller B. Evaluation of Pedestrian Overturn Risk Associated with Railing Interaction. American Society of Biomechanics Annual Meeting, Pittsburgh, PA, August 13 - 16, 2025.

Miller B, Elmasry S, Sharpe S, Allin L, Salipur Z. Effectiveness of Bicycle, Motorcycle, and Skateboard Helmets in Reducing Risk of Concussion and Skull Fracture Across Various Impact Locations and Velocities. American Society of Biomechanics Annual Meeting, Pittsburgh, PA, August 13 - 16, 2025.

Courtney A, Crosby C, Miller B, Osterhout A, Walker J, Gondek J. Effects of Anthropometry and Passive Restraint Deployment Timing on Occupant Metrics in Moderate-Severity Offset Frontal Collisions. SAE Technical Paper 2024-01-2749.

Miller B, Dibb A, Allin L, Carhart M, Sharpe S. Seat Belt Restraint Evidence Generated by Unrestrained Occupant Interaction in a Rollover. SAE Int. J. Adv. & Curr. Prac. in Mobility 4(5):1642-1650, 2022

Isaacs J, George J, Campolettano E, Cutcliffe H, Miller B. The Role of Three-Point Restraints for Occupants in Moderate Severity Frontal Collisions. SAE Technical Paper 2022-01-0845, 2022.

Miller B, Smedley J, Carhart M, Sharpe S, Krishnaswami R. Evaluation of Laminated Side Glazing and Curtain Airbags for Occupant Containment in Rollover. SAE Technical Paper 2020-01-0976, 2020.

Parenteau C, Miller B, Burnett R. Injury Rates by Crash Severity, Belt Use and Head Restraint Type and Performance in Rear Impacts. SAE Technical Paper 2020-01-1223, 2020.

Toney-Bolger M, Campbell I, Miller B, Davis M, Fisher J. Evaluation of Occupant Loading in Low- to Moderate-Speed Frontal and Rear-End Motor Vehicle Collisions. SAE Technical Paper 2019-01-1220,

2019.

Brown JM, Austin MP, Miller BD, Clark JE. Evidence for multiple dynamic climbing gait families. Bioinspiration & Biomimetics 2019; 14(3).

Blackman DJ, Nicholson JV, Ordonez C, Miller BD, Clark JE. Gait development on Minitaur, a direct drive quadrupedal robot. SPIE Unmanned Systems Technology XVIII, Baltimore, MD, 2016.

Brown JM, Miller BD, Clark JE. Classification of dynamical vertical climbing gaits. IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS), Daejeon, Korea, 2016.

Miller BD, Clark JE. Towards highly-tuned mobility in multiple domains with a dynamical legged platform. Bioinspiration & Biomimetics 2015; 10(4).

Miller BD, Clark JE. Dynamic similarity and scaling for the design of dynamical legged robots. IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS), Hamburg, Germany, 2015.

Miller BD, Rivera PR, Dickson JD, Clark JE. Running up a wall: the role and challenges of dynamic climbing in enhancing multi-modal legged systems. Bioinspiration & Biomimetics 2015; 10(2).

Miller BD, Brown J, Clark JE. On prismatic and torsional actuation for running legged robots. Experimental Robotics 2016; 109.

Miller BD, Cartes D, Clark JE. Adaptive control of leg stiffness for hopping on unknown terrains. IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS), Tokyo, Japan, 2013.

Miller BD, Darnell A, Clark JE. Running in the horizontal plane with a multi-modal dynamical robot. IEEE International Conference on Robotics and Automation (ICRA), Karlsruhe, Germany, 2013.

Miller BD, Ordonez C, Clark JE. Examining the effect of rear leg specialization on dynamic climbing with SCARAB: a dynamic quadrupedal robot for locomotion on vertical and horizontal surfaces. International Symposium on Experimental Robotics (ISER), Quebec City, Canada, 2012.

Miller BD, Schmitt J, Clark JE. Quantifying disturbance rejection of SLIP-like running systems. The International Journal of Robotics Research 2012; 31(5).

Andrews B, Miller BD, Schmitt J, Clark JE. Running over unknown rough terrain with a one-legged planar robot. Bioinspiration & Biomimetics 2011; 6(2).

Miller BD, Andrews B, Clark JE. Improved stability of running over unknown rough terrain via prescribed energy removal. International Symposium on Experimental Robotics (ISER), New Dehli, India, 2010.

Shill J, Miller BD, Schmitt J, Clark JE. Design of a dynamically stable horizontal plane running. IEEE International Conference on Robotics and Automation (ICRA), Anchorage, AK, 2010.

Presentations

Revisiting Rear Seat Safety: Field Evaluations of Relative Injury Risk Across Seating Positions and the Integration of Advanced Rear Seat Belt Systems. SAE World Congress WCX 2026, Detroit, MI.

Effects of Anthropometry and Passive Restraint Deployment Timing on Occupant Metrics in Moderate-Severity Offset Frontal Collisions. SAE World Congress WCX 2024, Detroit, MI.

Seat Belt Restraint Evidence Generated by Unrestrained Occupant Interaction in a Rollover. SAE World Congress WCX 2022, April, Detroit, MI.

The Role of Three-Point Restraints for Occupants in Moderate Severity Frontal Collisions. SAE World Congress WCX 2022, April, Detroit, MI.

On prismatic and torsional actuation for running legged robots. International Symposium on Experimental Robotics (ISER) 2014, June 15 - 18, Marrakech/Essaouira, Morocco.

Dynamic, multi-modal locomotion with miniature, legged platforms, Intelligence Community Postdoctoral Research Fellowship Consortium 2014, April 29 - May 1, Washington, DC.

A novel platform for locomotion in vertical and horizontal regimes, Florida Conference on Recent Advances in Robotics 2013, May 14, Tallahassee, FL.

Dynamic quadrupedal vertical running and designs for dynamic running using monolithic compliant legs, Dynamic Walking 2012, May 21 - 24, Pensacola Beach, FL.

Additional Education & Training

Northwestern University Center for Public Safety, Traffic Crash Reconstruction

Motorcycle Safety Foundation Basic Rider Course