



205 NE Northlake Way  
Suite 100  
Seattle, WA 98105  
+1 206.466.1913



[www.guidanceengineering.com](http://www.guidanceengineering.com)

## **BETHANY L SUDERMAN, PHD, PE**

*Senior Biomechanical Engineer*

Dr. Bethany Suderman is a Senior Biomechanical Engineer at Guidance Engineering and specializes in accident reconstruction and injury biomechanics. Dr. Suderman has investigated injury claims arising from motor vehicle accidents, slip/trip and falls, and recreational activities. By applying the principles of engineering to the human body, she determines the forces and motions experienced during an event and analyzes whether they are consistent with an alleged injury. Dr. Suderman also compares these forces and motions to injury tolerance levels and those produced during other activities to provide context for the forces and motions. She has investigated and evaluated injury claims involving personal protective equipment in workplace and recreational environments. Dr. Suderman also has experience using injuries as evidence to determine how a particular event occurred.

Dr. Suderman has conducted studies using anthropomorphic test devices (ATDs “crash test dummies”) and computational human models to determine forces and motions acting on the head and neck in accidents involving falling objects and falls to the ground. She has also assessed the energy attenuating potential of personal protective headgear. Dr. Suderman has worked with national motor vehicle and injury surveillance databases to determine the types of injuries people sustain in motor vehicle, recreational, and workplace accidents. Dr. Suderman has conducted water sports research studying the relationship between boat kinematics and rider kinematics. She also investigated the forces and motions acting on the towed rider. Dr. Suderman has a critical understanding of kinematic and dynamic analyses and mechanics of biomaterials, which she uses to determine forces and motions acting on the human body.

Dr. Suderman is the subcommittee chair of ASTM F27.80 Water Sports and is involved with the Water Sports Industry Association (WSIA). Prior to joining Guidance Engineering, Dr. Suderman was a Postdoctoral Fellow at Washington State University where she conducted research in the field of biomechanical engineering. She developed musculoskeletal models of the cervical spine from magnetic resonance images (MRI) of human subjects to simulate human movement and determine muscle strains and forces, joint kinematics, and compressive forces on intervertebral discs. Dr. Suderman also conducted human subject studies where she measured neck strength and muscle activity of volunteers in different head and neck postures associated with whiplash.

### **Academic Credentials**

Ph.D., Mechanical Engineering, Washington State University, 2012

B.S., Engineering, Biomedical Concentration, LeTourneau University, 2008

## Engineering Licenses and Certifications

Registered Professional Mechanical Engineer, Washington, #55736

Certified *XL* Tribometrist, CXLT, for floor slip resistance measurements

## Publications

Suderman, BL, Stepan, LL, Scher, SS. Examining differences in kinematics and boat loading patterns in towed water sports. *Sports Engineering*, 2023. 26(38), <https://doi.org/10.1007/s12283-023-00432-6>

Canavan, PK, Suderman, B, & Yang, N. A novel approach for baseball pitch analysis using a full body motion analysis suit: A case series study. *Journal of Human Sport and Exercise*, 2021. Volume 16, Issue 3.

Suderman, B, Sklar, A, Stepan, L, Scher, I. Water Ski Binding Release Characteristics In Forward Lean. *Proceedings*, 2020. 49, 76, doi:10.3390/proceedings2020049076

Suderman B, Cruise D, Yang N, Lau E, Stepan L, Scher I. Low-Energy Seat Compression: Characterizing Stiffness in Different Vehicles. *SAE Technical Paper 2020-01-0527*, 2020.

Cruise D, Suderman B, Yang N, Stepan L, Scher I. The Effect of Changing Vehicle Seat Stiffness: A MADYMO Sensitivity Analysis. *SAE Technical Paper 2020-01-0524*, 2020.

Suderman, B, Vasavada, A. Neck Muscle Moment Arms Obtained In-Vivo from MRI: Effect of Curved and Straight Modeled Paths. *Ann Biomed Eng*, 2017. 44, 1–18. doi:10.1007/s10439-017-1830-8

Suderman B, Hoover R, Ching R, Scher I. The Effect of Hardhats on Head and Neck Response to Vertical Impacts from Large Objects. *Accident Analysis and Prevention*, 2014. 73, 116-124.

Suderman B, Ching R, Scher I. Likelihood of Lumbar Spine Injuries for Far-Side Occupants in Low to Moderate Speed Lateral Impacts. *SAE Technical Paper 2014-01-0494*, 2014.

Cox C, Dibb A, Cutcliffe H, Nightingale R, Meyers B, Vasavada A, Suderman B, Bass C. The Influence Of Muscle Modeling Methods And Paths On Head And Neck Response. *11<sup>th</sup> World Congress on Computational Mechanics*, 2014.

Suderman B, Vasavada A. Moving muscle points provide accurate curved muscle paths in a model of the cervical spine. *Journal of Biomechanics*, 2012. 45, 400-404.

Suderman B, Krishnamoorthy B, Vasavada A, Neck muscle paths and moment arms are significantly affected by wrapping surface parameters. *Computer Methods in Biomechanics and Biomedical Engineering*, 2012. 15(7), 735-744.



## **Published Abstracts and Conference Proceedings**

Suderman, B, Sklar, A, Stepan, L, Scher, I. Water Ski Binding Release Characteristics In Forward Lean. *ISEA 2020 The Engineering of Sport 13*, June 22-26, 2020.

Suderman B, Scher I. Upper Extremity Forces During Tubing. *42<sup>nd</sup> Annual Meeting of the American Society of Biomechanics*; Mayo Civic Center, Rochester, MN, August 8-11, 2018.

Yang N, Stepan L, Suderman B, Scher I. Does a Rotating Bar affect the Body Kinematics during a Penny Drop Maneuver? *42<sup>nd</sup> Annual Meeting of the American Society of Biomechanics*; Mayo Civic Center, Rochester, MN, August 8-11, 2018.

Scher I, Suderman B, Stepan L, Shealy J. Helmet Effectiveness: Do Helmets Reduce the Likelihood of Severe Head Injury? *Abstract presented at the Biennial Meeting of the International Society for Skiing Safety*, San Vito di Cadore, Italy, March 2015.

Suderman B, Harley E, Stepan L, Shealy J, Scher, I. Chairlift unloading success: Effects of age and equipment type on likelihood of falling; *20<sup>th</sup> Congress of the International Society for Skiing Safety*; San Carlos de Bariloche, Argentina, August 4 – 10, 2013.

Suderman B, Vasavada A. Effect of Curvature on Sagittal Plane Moment Arms of Human Neck Muscles. *Proceedings of the ASME 2013 Summer Bioengineering Conference*; Sunriver, OR, June 26 – 29, 2013.

Suderman B, Vasavada A. MRI-derived moment arms of neck muscles during sagittal plane motion. *17<sup>th</sup> Biennial Meeting of the Canadian Society of Biomechanics*; Simon Frasier University, Burnaby, BC, Canada, June 6 – 9, 2012.

Suderman B, Vasavada A. MRI-derived moment arms of neck muscles during sagittal plane motion. *Northwest Biomechanics Symposium 2012*, University of Oregon, Eugene, OR, May 18 – 19, 2012.

Suderman B, Vasavada A. Moving muscle points provide accurate curved muscle paths in a model of the cervical spine. *35<sup>th</sup> Annual Meeting of the American Society of Biomechanics*, Long Beach, CA, August 10 – 13, 2011.

Suderman B, Vasavada A. Moving muscle points provide accurate curved muscle paths in a model of the cervical spine. *Northwest Biomechanics Symposium 2011*, University of British Columbia, Vancouver, BC, June 3 – 4, 2011.

Suderman B, Vasavada A. Comparison of moment arm methods for curved muscle paths in a cervical spine model. *Northwest Biomechanics Symposium 2010* University of Washington, Seattle, WA, May 25 – 26, 2010.



Suderman B, Krishnamoorthy B, Vasavada A. Effect of curved muscle paths on neck biomechanics. *Northwest Biomechanics Symposium 2009*. Washington State University, Pullman, WA, June 5 – 6, 2009.

### **Professional Affiliations**

- ASTM International (member)
  - F27.80 Water Sports Equipment subcommittee chair
- American Society of Mechanical Engineers (member)
- Society of Automotive Engineers (member)

