KEITH BUTTON

PhD, PE

248.563.6083
kbutton@explico.com

BIOMECHANICS

EDUCATION

MICHIGAN STATE UNIVERSITY

PhD Engineering Mechanics 2015

VALPARAISO UNIVERSITY

BS Mechanical Engineering 2011

LICENSES & CERTIFICATIONS

Professional Engineer MI
Aerial Lift Operator

AFFILIATIONS

American Society of Mechanical Engineers (ASME)
Society of Automotive Engineers (SAE)
Tau Beta Pi — Engineering Honor Society

PROFESSIONAL PROFILE

Dr. Keith Button is a Professional Engineer and consultant specializing in biomechanics, vehicle accident reconstruction, workplace accident reconstruction, forensic visualization, and video analysis. He employs a variety of forensic techniques in his investigations. These include computational simulations, camera-matching photogrammetry, deconstruction of video evidence, and physical testing. He holds a B.S. in Mechanical Engineering from Valparaiso University and a PhD in Engineering Mechanics from Michigan State University.

Dr. Button has published numerous peer-reviewed journal articles and abstracts. His graduate training and research was conducted in the Orthopedic Biomechanics Laboratories at Michigan State University, which is a joint collaboration with the College of Engineering and the department of Radiology. His research and publications focused on the effect of footwear on the biomechanics and injury tolerance of the lower extremity as well as soft tissue response following traumatic injury. He has presented these scientific findings at biomedical and engineering conferences. More recently, he has performed research on the likelihood of sustaining intervertebral disc injury during a rear-end collision.

Additionally, *Dr. Button* is an Adjunct Professor at Lawrence Technological University in the Biomedical Engineering Department where he teaches a class on Forensic Biomechanics. He teaches undergraduate students how to apply various engineering principles to the investigation of real-world accidents. Topics include the analysis of photographic/video evidence, evidence handling, injury biomechanics, accident reconstruction, and the analysis of restraint systems.

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Areas of Expertise

Biomechanics Engineering
Lower Extremity Injury
Infant Head Injury
Intervertebral Disc Injury
Collision Reconstruction
Slips, Trips, and Falls
Pedestrian — Vehicle Incidents
Forensic Visualization
Workplace Accident Reconstruction and Injury Analysis
Video Analysis / Reconstruction
Evidence Documentation

Experience

Explico
2015 - Present *Managing Engineer*

Lawrence Technological University
2019 - Present *Biomedical Engineering Department Adjunct Professor*

Michigan State University
2012 - 2015 *Graduate Research Assistant*
2014 - 2015 *Tutor*
2011 *Teaching Assistant*

Trigon International
2010 *Mechanical Engineering Intern*

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Awards and Honors

Fitch H. Beach Outstanding Graduate Research Award Finalist, 2015

Michigan State College of Engineering Fellowship, 2011

Captain, Valparaiso University Cross Country, 2010

Caterpillar Endowed Scholarship Recipient, 2007 — 2011

Valparaiso Presidential Scholarship Recipient, 2007 — 2011

Alumni Heritage Scholarship Recipient, 2007 — 2011

Manuscript Reviewer

Applied Bionics and Biomechanics

Journal of Biomechanical Engineering

Computer Methods in Biomechanics and Biomedical Engineering

Annals of Biomedical Engineering

Journal of Orthopaedic Research

Presentations and Published Abstracts

Button KD, Braman JE, Wei F, Haut RC. (2012) Determination of in vivo dynamic human ankle stiffness under external foot rotation. ASME Summer Bioengineering Conf. Fajardo, Puerto Rico. SBC2012-80373.

Button KD, Wei F, Meyer EG, Fitzsimmons K, Haut RC. (2012) Determination of in situ ankle ligament strains in cases of high and medical ankle sprains. ASME Summer Bioengineering Conf. Fajardo, Puerto Rico. SBC2012-80378.

Pauly HM, Larson BE, Button KD, Haut RC, Donahue TL. (2013) Micro-Computed tomography analysis of bone volume following traumatic closed joint injury. Rocky Mountain American Society of Biomechanics Meeting, April, 2013, Estes Park, CO.

Coatney GA, Abraham AC, Button KD, Haut RC, Donahue TL. (2013) P188 efficacy on lapine meniscus preservation following blunt trauma. Rocky Mountain American Society of Biomechanics Meeting, April 2013, Estes Park, CO.

Fischenich KM, Button KD, Fajardo RS, Decamp CD, Haut RC, Donahue TL. (2013) Mechanical evolution of menisci following surgical transection of both menisci and anterior cruciate ligament. Rocky Mountain American Society of Biomechanics Meeting, April, 2013, Estes Park, CO.

Fischenich KM, Button KD, Fajardo RS, Haut RC, Donahue TL. (2013) Evaluation of menisci following a traumatic compressive tibiofemoral load. ASME Summer Bioengineering Conf. Sunriver, Oregon. SBC2013-14193.

Button KD, Leikert K, Donahue TL, Haut RC. (2013) Development of a traumatic anterior cruciate ligament and meniscal rupture model to study osteoarthritis. ASME Summer Bioengineering Conf. Sunriver, Oregon. SBC2013-14287.

Button KD, Davison M, Braman JE, Schaefer MC, Haut RC. (2013) Effect of shoe stiffness on injury produced under external rotation of the foot in human cadavers. ASME Summer Bioengineering Conf. Sunriver, Oregon, 2013. SBC2013-14719.

Fischenich KM, Coatney GA, Haverkamp J, Button KD, DeCamp C, Haut RC, Haut Donahue TL. (2013) Meniscal glycosaminoglycan coverage twelve weeks post injury in two models of knee joint injury. 11th World congress of the International Cartilage Repair Society, Sept. 15-18, 2013, Izmir, Turkey.

Button KD, Steel JP, Karcher DM, Haut RC. (2014) A non-invasive method to predict laying hen bone mechanical properties. Poultry Science Association Annual Meeting. Christi, Texas. PSA-161.

Button KD, Davison M, Braman JE, Schaefer MC, Haut RC. (2014) Investigating the effects of shoe stiffness on ankle injury risk using computational models. 7th World Congress in Biomechanics. Boston, MA. 14-IS-2161-WCB.

Button KD, Leikert KM, DeCamp CD, Donahue TL, Haut RC. (2014) Comparison of a traumatic ACL Rupture and modified transection model to study osteoarthritis. 7th World Congress in Biomechanics. Boston, MA. 14-A-1633-WCB.

Donahue TL, Fischteich KM, Coatney G, Pauly H, Button KD, Haut RC. (2014) Two new experimental models of post-traumatic knee joint injury. 7th World Congress in Biomechanics. Boston, MA. 14-IS-2706-WCB.

Fischenich KM, Button KD, Fajardo RS, Decamp CD, Haut RC, Donahue TL. (2014) A longitudinal comparison of mechanical changes of the menisci in two models of post traumatic osteoarthritis of the knee. 7th World Congress in Biomechanics. Boston, MA. 14-A-1696-WCB.

Pauly HM, Larson BE, Button KD, DeCamp CD, Haut RC, Donahue TL. (2014) Micro-computed tomography comparison of trabecular bone changes in rabbits following surgical transection of anterior cruciate ligament and menisci or traumatic impact to the tibiofemoral joint. 60th Annual Meeting of the Orthopaedic Research Society. March 15-18, 2014. New Orleans, LA.

Button KD, Rossman SM, Weaver BT Sundell SA. (2016) Cervical spine forces and disc herniation risk during standardized rear-end impact testing. 2016 Summer Biomechanics, Bioengineering and Biotransport Conference. June 29-July 2, 2016. National Harbor, MD. Poster #258.

Sproule D, Rossman SM, Button KD, Rundell SA. (2018) Simulation of Occupant Kinematics in Low-Speed Lateral Collisions using Articulated Total Body. 8th World Congress in Biomechanics. Dublin. #4252.

Rossman SM, Sproule D, Button KD, Rundell SA. (2018) Intervertebral Disc Herniation Risk During Low-Speed Lateral Collisions. 8th World Congress in Biomechanics. Dublin. #4390.

Sproule D, Rossman SM, Button KD, Rundell SA. (2018) Simulation of Occupant Kinematics in Low-Speed Lateral Collisions using Articulated Total Body. 2018 American Society of Biomechanics Conference. #427.

Rossman SM, Sproule D, Button KD, Rundell SA. (2018) Intervertebral Disc Herniation Risk During Low-Speed Lateral Collisions. 2018 American Society of Biomechanics Conference. #429.

Button KD, Davison MD, Weaver BT, Rundell SA (2018) Inertial Loading of the Pediatric Head Exceeds Neck Injury Tolerance Prior to Head Injury Tolerance. 2018 American Society of Biomechanics Conference. #418.

Sproule D, Rossman S, Snyder P, Button KD, Weaver B, Rundell S. Biomechanical Analysis of a Low Speed Rear-End Collision Using a Subject-Specific MADYMO Simulation. XXVII Congress of the International Society of Biomechanics held in conjunction with the 43rd Annual Meeting of the American Society of Biomechanics, 2019.

Sproule D, Rossman S, Snyder P, Button Kd, Weaver B, Rundell S. Subject-Specific MADYMO Analysis of a Low Speed Rear-End Collision. Summer Biomechanics, Bioengineering and Biotransport Conference, 2019.

Demma DR, Button KD, Kappler EH, Rossman SM, Rundell SA (2021). A Strategy for Validating the Kinematics of a Vehicle-Specific MADYMO Model of a Low-Speed Rear-End Collision. Summer Biomechanics, Bioengineering, and Biotransport Conference. #239.

PEER REVIEWED MANUSCRIPT

Dutcheshen N, Maerz T, Rabban P, Haut RC, Button KD, Baker KC, Guettler J. (2012) The acute effect of bipolar radiofrequency energy thermal chondroplasty on intrinsic biomechanics properties and thickness of chondromalacic human articular cartilage. Journal of Biomechanical Engineering. 134(8):081007.

Meyer EG, Wei F, Button KD, Haut RC. (2012) Determination of ankle ligament strain using a rigid body computational model for sports injury scenarios. Proceedings-International Research Council on the Biomechanics of Injury. 227—288.

Button KD, Wei F, Meyer EG, Haut RC. (2012) Specimen-specific computational models of ankle sprains produced in a laboratory setting. Journal of Biomechanical Engineering. 135(4), 041001.

Button KD, Braman JE, Wei F, Haut RC. (2013) A method of determining in vivo dynamic human ankle stiffness under external foot rotation. Journal of Sports Engineering and Technology. 228(2), 120-124.

Fischenich KM, Button KD, DeCamp CD, Haut RC, Donahue TL. (2014) Evaluation of meniscal mechanics and proteoglycan content in a modified ACL transaction model for osteoarthritis. Journal of Biomechnical Engineering, 136(7), 071001. **Editors' Choice Paper for 2014**

Button KD, Braman JE, Davison MA, Wei F, Schaeffer MC, Haut RC. (2014) Rotational stiffness of American football shoes affects ankle biomechanics and injury severity. Journal of Biomechanical Engineering. 137(6), 061004.

Fischenich KM, Button KD, Coatney GA, Fajardo RS, Leikert KM, Haut RC, Donahue TL. (2014) Chronic changes in the articular cartilage and meniscus following traumatic impact to the lapine knee. Journal of Biomechanics. 48 (2), 246-253.

Wheatley BB, Fischenich KM, Button KD, Haut RC, Haut Donahue TL. (2015) An optimized transversely isotrophic, hyper-poro-viscoelastic finite element model of the meniscus to evaluate mechanical degradation. Journal of Biomechanics. Dot:10.1016/j.jbiomech.2015.02.028.

Coatney GA, Abraham AC, Fischenich KM, Button KD, Haut RC, Haut Donahue TL. (2014) Efficacy of P188 on lapine meniscus preservation following blunt trauma. Journal of the Mechanical Behavior of Biomedical Materials. 47: 57-64.

Pauly HM, Larson BE, Coatney GA, Button KD, DeCamp CE, Fajardo RS, Haut RC, Haut Donahue TL. (2015) Assessment of cortical and trabecular bone changes in two models of post-traumatic osteoarthritis. Journal of Orthopaedic Research. 33(12), 1835-1845.

Button KD, Braman JE, Davison MA, Wei F, Haut RC. (2014) Unlocking the talus by eversion limits medical ankle injury risk during external rotation. Journal of Biomechanics. 48(13), 3724-3727.

Fischenich KM, Button KD, Fajardo RS, DeCamp CE, Haut RC, Haut Donahue TL. (2015) A study of acute and chronic tissue changes in surgical and traumatically-induced experimental models of knee joint injury using magnetic resonance imaging. Journal of Magnetic Resonance. Osteoarthritis and Cartilage. DOI: 10.1016/j.joca.2016.10.010

Button KD, Thornton PA, Braman JE, Wei F, Haut RC. (2015) The effect of rotational stiffness on ankle tibiocalcaneal motion and ligament strain during external rotation. Journal of Sports Engineering and Technology DOI: 10.1177/1754337115623886.

Fischenich KM, Button KD, DeCamp CE, Haut RC, Haut Donahue TL. (2016) Comparison of two models of post-traumatic osteoarthritis; temporal degradation of articular cartilage and menisci. Journal of Orthopaedic Research DOI: 10.1002/jor.23275

Davison MA, Button KD, Benzel EC, Weaver BT, Rundell SA. (2021) A biomechanical assessment of shaken baby syndrome: what about the spine? World Neurosurgery. DOI: 10.1016/j.wneu.2022.03.104

FORMAL PRESENTATIONS

Determination of in situ ankle ligament strains in cases of high and medial ankle sprains. ASME Summer Bioengineering Conf. June 25, 2012. Fajardo, Puerto Rico.

Development of a traumatic anterior cruciate ligament and meniscal rupture model to study osteoarthritis. ASME Summer Bioengineering Conf. June 29, 2013. Sunriver, Oregon.

Investigating the effects of shoe stiffness on ankle injury risk using computational models. 7th World Congress in Biomechanics. July 11, 2014. Boston, Massachusetts. (Invited Paper)

Professional Development

Pennsylvania Amusement Ride Safety Seminar

Extreme Sports Training — Spring 2024

- *Intro to Trampoline Parks. ASTM 2970*
- *Examination of Incidents/Accidents in Trampoline Parks*
- *Overview of Risk Management in Trampoline Parks*
- *ASTM 2970 Trampoline Courts*

Society of Automotive Engineers

Photography for Accident Reconstruction, Product Liability, and Testing — April 2023

Applying Automotive EDR Data to Traffic Crash Reconstruction — April 2020

Michigan State University Highway Safety Traffic Programs

Virtual Crash Live Classroom Training Course — December 2018

vCrash Americas, Inc.

A1-9: Accident Reconstruction — December 2016

Professional Service

Guest Lecturer, Forensic Biomechanics, Lawrence Technological University, 2017
Guest Lecturer, Introduction to Biomedical Engineering, Lawrence Technological University, 2017
Guest Lecturer, Engineering Applications in Orthopaedics, Lawrence Technological University, 2017
Guest Lecturer, Engineering Applications in Orthopaedics, Lawrence Technological University, 2016
Guest Lecturer, Engineering Applications in Orthopaedics, Lawrence Technological University, 2015
Guest Lecturer, Engineering Applications in Orthopaedics, Lawrence Technological University, 2014
Judge, University Undergraduate Research and Arts Forum, Michigan State University, 2012
Mentor, University Undergraduate Research and Arts Forum, Michigan State University, 2011
Judge, University Undergraduate Research and Arts Forum, Michigan State University, 2011