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Engineering & Scientific Consulting

Chimba Mkandawire, Ph.D., P.E., CAISS

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Professional Profile

Dr. Mkandawire addresses issues involving the biomechanics of human injury, with expertise in the areas of human tolerance and occupant kinematics. His work includes accident reconstruction, analysis of traumatic injuries associated with transportation, sport and racing activities, heavy equipment, falls, consumer products, and the workplace.

Dr. Mkandawire's experience includes pedestrian/cyclist accident reconstruction; evaluation of racing and sports equipment; electric shock/burn accident reconstruction; traumatic brain injury; injuries involving recreational, industrial, construction or agricultural equipment; advanced airbag systems, child restraint systems, and biomechanical reconstruction of automotive accidents (e.g., rollover accidents, frontal and rear end collisions, lateral or T-bone collisions, sideswipes and low-speed collisions).

Dr. Mkandawire has published research in soft-tissue biomechanics, foot-ankle biomechanics, injury biomechanics, and gait analysis. His current research interests include balance retention and postural stability, occupant kinematics, airbag system effectiveness, biomechanics of the extremities, biomechanics of the spine, and evaluating trauma and pathologies from a biomechanical etiology. Dr. Mkandawire has successfully worked within Exponent’s cross-disciplinary structure. For example, he has provided a biomedical engineering perspective in consulting assignments with the Center for Chemical Regulation and Food Safety, evaluating hazards associated with swallowing and pediatric airway protection. Dr. Mkandawire has extensive experienced with using the FOCUS head form, a specialized head form that measures injury potential to the head.

Dr. Mkandawire held academic appointments in the School of Biomedical Engineering, Science and Health Systems at Drexel University; in the School of Engineering at Temple University; and lectured for the Mechanical and Aerospace Engineering Department at Princeton University. Prior to joining Exponent, Dr. Mkandawire was a Research Assistant at the Harborview Orthopaedic Biomechanics Laboratory and the Applied Biomechanics Laboratory of the University of Washington, and a Research Engineer for the Center for Excellence in Prosthetic Engineering and Limb-Loss Prevention of the Puget Sound Veterans Administration Medical Center. Dr. Mkandawire has also worked as a Research Assistant for the MIT Lab for Manufacturing and Productivity and the MIT Lab of Tribology. Dr. Mkandawire has been an invited Lecturer to Rice University and the University of Notre Dame, teaching about Biomechanics.

Academic Credentials & Professional Honors

Ph.D., Bioengineering, University of Washington, 2002

S.B., Mechanical Engineering, Massachusetts Institute of Technology (MIT), 1994

Department of Education GAANN Fellow

VA Pre-Doctoral Associated Health Rehabilitation Research Fellow

New Jersey State Distinguished Scholar

Licenses and Certifications

Professional Engineer, Florida, #75909

Professional Engineer, Georgia, #PE036902

Professional Engineer, New York, #089340

Professional Engineer, Pennsylvania, #PE077569

Professional Engineer Mechanical, Texas, #150995

Certified Forklift Operator (CFO)

OSHA #2255 Principles of Ergonomics

OSHA #7115 Lockout/Tagout

Academic Appointments

Visiting Lecturer, Department of Mechanical and Aerospace Engineering, Princeton University, Princeton, NJ, 2004-2019

Research Assistant Professor, School of Biomedical Engineering, Science, and Health Systems, Drexel University, Philadelphia, PA, 2004-2019

Professional Affiliations

American Society of Mechanical Engineers (member)

- Safety Engineering and Risk Analysis (Session Chair), 2005
- Safety Engineering and Risk Analysis Executive Committee (Vice Track Chair), 2011-2016
- Safety Engineering and Risk Analysis Executive Committee (Chair), 2016-2017

American Society of Biomechanics (member)

Society of Automotive Engineers (member)

Biomedical Engineering Society (member)

Association for the Advancement of Automotive Medicine (member)

Board Memberships

University of Washington Pharmaceutical Bioengineering Master's Degree

- Advisory Board Member: 9/2024 – 9/2026

Publications

Davis M, Mkandawire C, Brown T, Pasquesi S. Incidence of Head, Cervical Spine, Lumbar Spine, and Lower Extremity Injuries for Occupants in Low- to Moderate-Speed Frontal Collisions. SAE 2021 World Congress & Exhibition, 2021 01 0902, April 13 15, 2021.

Davis M, Mkandawire C, Brown T, Pasquesi S. Incidence and Mechanisms of Head, Cervical Spine, Lumbar Spine, and Lower Extremity Injuries for Occupants in Low- to Moderate-Speed Rear-End Collisions. SAE 2021 World Congress & Exhibition, 2021 01 0900, April 13-15, 2021.

Mkandawire C, White NA, Winkel ES, Schatz E. FOCUS headform testing used to evaluate head injury risk for ejected riders of personal watercraft. ASME International Mechanical Engineering Congress & Exposition, IMECE2017 72676.

Mkandawire C, Imler S, Smith J. Obese forklift operator neck loads and back loads on a sit down lift truck during a sudden drop. ASME International Mechanical Engineering Congress & Exposition, IMECE2016 65169, Phoenix, AZ, 2016.

Ravi S, Smith J, Mkandawire C. Methods for evaluating occupant kinematics in forklift tipover demonstrations using occupants with high BMI values. ASME International Mechanical Engineering Congress & Exposition, IMECE2013 63366, San Diego, CA, 2013.

Rodowicz KA, Dupont K, Smedley J, Raasch C, Mkandawire C, Fittanto D, Bare C, Smith J. Passenger vehicle occupant response to low-speed impacts with a tractor-semitrailer. SAE 2011 World Congress & Exhibition, 2011 01 0291, Detroit, MI, April 12-14, 2011.

Fittanto D, Bare C, Smith J, Mkandawire C. Passenger vehicle response to low-speed impacts involving a tractor-semitrailer. SAE 2011 World Congress & Exhibition, 2011 01 0291, Detroit, MI, April 12 14, 2011.

Bussone WR, Baxter JN, Mkandawire C. Foot injury patterns with protective footwear after lift truck impact. ASME International Mechanical Engineering Congress & Exposition, IMECE2010 39131, Vancouver, British Columbia, Canada, November 12-18, 2010.

Rodowicz KA, Muhammad R, Heller M, Sala J, Mkandawire C. Biomechanical, perceptual, and cognitive factors involved in maintaining postural control while standing or walking on non moving and moving surfaces: a literature review. ASME International Mechanical Engineering Congress & Exposition, IMECE2010 39276, Vancouver, British Columbia, Canada, November 12-18, 2010.

Muhammad R, Rodowicz KA, Heller M, Sala J, Mkandawire C. Biomechanical, perceptual, and cognitive factors involved in balance recovery following unexpected perturbations: a literature review. ASME International Mechanical Engineering Congress & Exposition, IMECE2010 39285, Vancouver, British Columbia, Canada.

Ledoux WR, Camacho DLS, Ching RP, Rohr ES, Mkandawire C, Sangeorzan B. Finite element foot modeling. United States Department of Veterans Affairs, Center of Excellence for Limb Loss Prevention and Prosthetic Engineering, 2008.

Mkandawire C, Mazzucco DC, Vijayakumar V, Scher I, Heller MF, Morrison H. Head kinematics and upper neck loading during simulated low-speed lateral impact collisions. FISITA 2006 World Automotive

Congress, Paper #F2006T044, Yokohama, Japan, October 22-27, 2006.

Mkandawire C, Ledoux WR, Sangeorzan BJ, Ching RP. Foot and ankle ligament morphometry. Journal of Rehabilitation Research and Development 2005; 42(6):809 820.

Mkandawire C, Nicosia MA, Moore TLA, Corrigan CF. Postural stability of stand-up forklift operators in response to normal braking procedures. ASME International Mechanical Engineering Congress and Exposition, IMECE2005 81013, Orlando, FL, November 5-11, 2005.

Mkandawire C. The relationship between viscoelastic relaxation and ligament morphometry. Doctorate Dissertation, University of Washington, 2002.

Mkandawire C. Solar-powered oven design for underdeveloped third world countries. Bachelor's Thesis, MIT Press, 1990.

Book Chapters

Mkandawire C, Iannuzzi A. Applications of UHMWPE in total ankle replacements. In: UHWMPE Biomaterials Handbook, Second Edition. Academic Press, Burlington, MA, 2009.

Mkandawire C, Kristal P, Tencer AF. A technique for the measurement of tension in small ligaments. In: Musculoskeletal Models and Techniques, Vol. 3. Leondes C (ed), CRC Press LLC, Boca Raton, FL, 2001.

Published Abstracts of Presentations

Heller M, Mkandawire C, Gloeckner DC, Bussone W, Scher I, Cargill RS. Head motion in the coronal plane during low-speed lateral impact collisions. 21st Congress of the International Society of Biomechanics, Taipei, Taiwan, July 1-5, 2007.

Mkandawire C, Ledoux WR, Sangeorzan BJ, Ching RP. The relationship between morphometry and structural properties of foot and ankle ligaments. 50th Annual Meeting of the Orthapaedic Research Society, San Francisco, CA, March 7-10, 2004.

Mkandawire C, Ledoux WR, Sangeorzan BJ, Ching RP. Prediction of viscoelastic relaxation response of foot-ankle ligaments based on ligament morphometry. 49th Annual Meeting of the Orthopaedic Research Society, New Orleans, LA, February 2-5, 2003.

Mkandawire C, Ledoux WR, Sangeorzan BJ, Ching RP. Hierarchical cluster analysis of area and length of foot and ankle ligaments. 25th Annual Meeting of the American Society of Biomechanics, San Diego, CA, August 8-11, 2001.

Mkandawire C, Ledoux WR, Sangeorzan BJ, Ching RP. A quasi-liner viscoelastic model of foot-ankle ligaments. 25th Annual Meeting of the American Society of Biomechanics, San Diego, CA, August 8-11, 2001.

Sangeorzan BJ, Tencer AF, Harrington R, Ching RP, Mkandawire C. Biomechanics of acquired flatfoot deformity and alternative reconstructions. 1998 Rehabilitation R&D Progress Reports.

Selected Invited Lectures and Seminars

Mkandawire C. MSI: Medical scene investigation of musculoskeletal injuries from a biomechanical

perspective — Is that injury really possible? Presented at the American Osteopathic Association 112th Annual Convention and Scientific Seminar, American Osteopathic College of Physical Medicine and Rehabilitation, San Diego, CA, October 2, 2007.

Mkandawire C. Applied biomechanics: Injury biomechanics and occupant kinematics. Presented at The American Society of Mechanical Engineers Philadelphia Chapter meeting, Temple University, Philadelphia, PA, March 29, 2007.

Mkandawire C. Biomechanics of the lower extremities. Department of Mechanical and Aerospace Engineering (MAE 344), Princeton University, Princeton, NJ, April 8, 2003.

Mkandawire C. Introduction to biomechanics. Department of Mechanical Engineering and Aerospace Engineering (MAE 344), Princeton University, Princeton, NJ, April 7, 2004; April 14, 2005; March 30, 2006; April 10, 2007; November 27, 2007; March 12, 2009, March 25, 2010; October 27, 2011; November 10, 2015; October 27, 2016.

Mkandawire C. Biomechanics of lower extremities and applied ligament viscoelasticity. Department of Mechanical Engineering (Engr 520), Temple University, Philadelphia, PA, April 21, 2003; April 19, 2004.

Mkandawire C. Biomechanics of the foot and ankle. Department of Rehabilitation Medicine (Rehab 445), University of Washington, Seattle, WA, March 1997, March 1998, March 1999.

Mkandawire C. Orthopaedic biomechanics of the lower extremity. Department of Bioengineering (Bioen 520), University of Washington, Seattle, WA, June 1999.

Editorships & Editorial Review Boards

ASME Journal of Risk and Uncertainty in Engineering Systems

- Guest Editor, 12/2014 - 12/2015
- Associate Editor, 12/2015 - 12/2019

Peer Reviews

Journal of Bone and Joint Surgery