

Chimbaugona Mkandawire, Ph.D., P.E., CAISS
Principal Engineer

Professional Profile

Dr. Chimbaugona Mkandawire is a Principal Engineer in Exponent's Biomechanics practice. Dr. Mkandawire addresses issues involving the biomechanics of human injury, with expertise in the areas of human tolerance, occupant kinematics, and rigid body dynamics. His work includes accident reconstruction, analysis of traumatic injuries associated with transportation, sport and racing activities, heavy equipment, falls, consumer products, and the workplace. His experience includes pedestrian accident reconstruction, evaluation of racing and sports equipment, electric shock/burn accident reconstruction, traumatic brain injury, forklift operator injury potential, injury potential associated with advanced airbag systems, pediatric injuries involving 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 ligament biomechanics, quasilinear viscoelastic theory, foot-ankle 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 holds an academic appointment in the School of Biomedical Engineering, Science and Health Systems at Drexel University, is a guest lecturer for the Mechanical and Aerospace Engineering Department at Princeton University, and formerly held an academic appointment in the School of Engineering at Temple 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.

Academic Credentials and Professional Honors

Ph.D., Bioengineering, University of Washington, 2002
S.B., Mechanical Engineering, Massachusetts Institute of Technology, 1994

Department of Education GAANN Fellow; VA Pre-Doctoral Associated Health Rehabilitation Research Fellow; New Jersey State Distinguished Scholar

Licenses and Certifications

Registered Professional Engineer, Pennsylvania, #PE077569

Registered Professional Engineer, New York, #089340

Certified Forklift Operator on Standup Electric Trucks, December 2005

Authorized OSHA Trainer in General Industry, February 2006

Certified AIS Specialist, April 2007

Certified Forklift Operator on Sitdown Internal Combustion and Electric Trucks, October 2007

Publications

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.

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.

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: UHMWPE 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 Orthopaedic 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-linear 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.

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.

Academic Appointments

- Visiting lecturer, Department of Mechanical and Aerospace Engineering, Princeton University, Princeton, NJ, 2004–present
- Research Assistant Professor, School of Biomedical Engineering, Science, and Health Systems, Drexel University, Philadelphia, PA, 2004–present

Peer Reviewer

- *Journal of Bone and Joint Surgery*

Professional Affiliations

- American Society of Mechanical Engineers (member)
 - Safety Engineering and Risk Analysis (Session Chair), 2005
 - Safety Engineering and Risk Analysis (Vice Track Chair), 2011
- American Society of Biomechanics (member)
- Society of Automotive Engineers (member)
- Biomedical Engineering Society (member)
- Association for the Advancement of Automotive Medicine (member)