



Joseph D. Towles, PhD

Bio

BIO

THIS SITE IS NO LONGER MAINTAINED BY ME AS OF 2022. PLEASE GO TO MY NEW SITE AT <https://sites.google.com/swarthmore.edu/biomechanics>

Joseph D Towles

Associate Professor of Engineering

Swarthmore College

Joseph Towles is a Lecturer jointly appointed in the Mechanical Engineering and Bioengineering Departments at Stanford University. Joe's teaching interests are in the areas of solid mechanics, neuromuscular biomechanics, dynamical systems and control, and engineering design. His scholarship interests are in the areas of neuromuscular biomechanics and educational practices in engineering.

A Mechanical Engineer by training, Joe earned his BS degree in Mechanical Engineering from the University of Maryland Baltimore County and his MS and PhD degrees both in Mechanical Engineering from Stanford University (1996-2003). Following graduate school, Joe was a research post-doctoral fellow and subsequently a research scientist and then a research assistant professor in neuromuscular biomechanics in the Sensory Motor Performance Program at the Rehabilitation Institute of Chicago and in the Physical Medicine and Rehabilitation Department at Northwestern University (2003-2012). Additionally, Joe was a research health scientist for the Rehabilitation R&D Service in the Department of Veterans Affairs (Hines, IL) during that time and later a scientist in the neuromuscular biomechanics lab in the Mechanical Engineering Department at the University of Wisconsin-Madison (2012-2014). At the time, Joe led projects that addressed the broad question of how to restore hand function (ability to grasp objects) following cervical spinal cord injury and hemiparetic stroke using experimental and computational techniques in biomechanics. As a complement to intensively teaching within the undergraduate and graduate curricula in Biomedical Engineering at the University of Wisconsin-Madison (2014-2018), and now teaching intensively and broadly within the undergraduate curricula of Mechanical Engineering and Bioengineering at Stanford, Joe's scholarship interests include both biomechanics and educational practices in engineering. Recent educational projects have investigated factors that influence K-12 students' engagement/interest in bioengineering, integration of CATME into an undergraduate mechanical engineering design course that enhances student experience and performance, analytical tool for improving intra- and inter-team communication in an engineering design course, and factors important for teaching undergraduate students how to identify healthcare needs worth pursuing in the context of health technology innovation efforts.

ACADEMIC APPOINTMENTS

- Member, Wu Tsai Human Performance Alliance

BOARDS, ADVISORY COMMITTEES, PROFESSIONAL ORGANIZATIONS

- Member, American Society of Biomechanics (1998 - present)
- Member, Biomedical Engineering Society (2012 - present)
- Member, American Society for Engineering Education (2014 - present)

PROFESSIONAL EDUCATION

- Postdoctoral Fellow, Northwestern University , Physical Medicine and Rehabilitation
- PhD, Stanford University , Mechanical Engineering (2003)
- MS, Stanford University , Mechanical Engineering (1998)
- BS, University of Maryland Baltimore County , Mechanical Engineering (1996)

Teaching

COURSES

2021-22

- Design Thinking in Human Performance Research: BIOE 190 (Spr)
- Dynamic Systems, Vibrations and Control: ME 161 (Aut)
- Mechanics of Materials: ME 80 (Win)
- Senior Capstone Design I: BIOE 141A (Aut)
- Senior Capstone Design II: BIOE 141B (Win)

2020-21

- Bioengineering Systems Prototyping Lab: BIOE 123 (Win)
- Dynamic Systems, Vibrations and Control: ME 161 (Aut)
- Mechanics of Materials: ME 80 (Aut)
- Senior Capstone Design I: BIOE 141A (Aut)
- Senior Capstone Design II: BIOE 141B (Win)

Publications

PUBLICATIONS

- **Building a Framework to Support Student Decision-Making In Instrumentation Lab Courses** *Biomedical Engineering Society*
Ahrar, S., Venook, R., Towles, J., Li, D.
2021
- **Trace Matrix: A Framing Tool to Improve Communication and Debugging in Remote Instrumentation Lab Courses** *Journal of Biomedical Engineering Education*
Ahrar, S., Li, D., Towles, J., Venook, R.
2021; 1: 5
- **WORK IN PROGRESS: First-Time Use of CATME in a Design Course. American Society of Engineering Education. Virtual Meeting.** *American Society for Engineering Education - Biomedical Engineering Division*
Towles, J., Wood, J.
2021

- **Intervention designed to increase interest in engineering for low-interest, K-12 girls did so for boys and girls** *American Society for Engineering Education - Women in Engineering Division*
Acuna, S. A., Michaelis, J. E., Roth, J. D., Towles, J. D.
2018: <https://peer.asee.org/30713>
- **Impact of biomechanics-based activities on situational and individual interest among K-12 students** *American Society for Engineering Education - Biomedical Engineering Division*
Francis, C. A., Michaelis, J. E., Acuna, S. A., Towles, J. D.
2017: <https://peer.asee.org/28459>
- **Development of a Graduate Project Management Course Where Graduate Students Manage Undergraduate Biomedical Engineering Design Teams (Work in Progress)** *American Society for Engineering Education - Biomedical Engineering Division*
Towles, J., Davis, J. G., Frushour, B.
2017: <https://peer.asee.org/27793>
- **Work in Progress: Evaluation of Biomechanics Activities at a College-Wide Engineering Outreach Event** *American Society of Engineering Education - Biomedical Engineering Division*
Francis, C. A., Lenhart, R. L., Franz, J. R., Kaiser, J., Towles, J.
2016: <https://peer.asee.org/27224>
- **Fabric Force Sensors for the Clinical Breast Examination Simulator**
Laufer, S., Rasske, K., Stopfer, L., Kurzynski, C., Abbott, T., Platner, M., Towles, J., Pugh, C. M., Westwood, J. D., Westwood, S. W., FellanderTsai, L., Fidopiastis, C. M., Liu, et al
IOS PRESS.2016: 193–98
- **Multiaxis Grip Characteristics for Varying Handle Diameters and Effort** *HUMAN FACTORS*
Irwin, C. B., Towles, J. D., Radwin, R. G.
2015; 57 (2): 227–37
- **Finger-thumb coupling contributes to exaggerated thumb flexion in stroke survivors.** *Journal of neurophysiology*
Kamper, D. G., Fischer, H. C., Conrad, M. O., Towles, J. D., Rymer, W. Z., Triandafilou, K. M.
2014; 111 (12): 2665-74
- **Diminished capacity to modulate motor activation patterns according to task contributes to thumb deficits following stroke** *JOURNAL OF NEUROPHYSIOLOGY*
Triandafilou, K. M., Fischer, H. C., Towles, J. D., Kamper, D. G., Rymer, W. Z.
2011; 106 (4): 1644–51
- **Lack of Hypertonia in Thumb Muscles After Stroke** *JOURNAL OF NEUROPHYSIOLOGY*
Towles, J. D., Kamper, D. G., Rymer, W. Z.
2010; 104 (4): 2139–46
- **Effect of finger posture on the tendon force distribution within the finger extensor mechanism** *JOURNAL OF BIOMECHANICAL ENGINEERING-TRANSACTIONS OF THE ASME*
Lee, S., Chen, H., Towles, J. D., Kamper, D. G.
2008; 130 (5): 051014
- **Use of intrinsic thumb muscles may help to improve lateral pinch function restored by tendon transfer** *CLINICAL BIOMECHANICS*
Towles, J. D., Hentz, V. R., Murray, W. M.
2008; 23 (4): 387-394
- **Estimation of the effective static moment arms of the tendons in the index finger extensor mechanism** *JOURNAL OF BIOMECHANICS*
Lee, S., Chen, H., Towles, J. D., Kamper, D. G.
2008; 41 (7): 1567–73
- **The effect of percutaneous pin fixation of the interphalangeal joint on the thumb-tip force produced by the flexor pollicis longus: a cadaver study.** *journal of hand surgery*
Towles, J. D., Murray, W. M., Hentz, V. R.
2004; 29 (6): 1056-1062

- **The effect of percutaneous pin fixation of the interphalangeal joint on the thumb-tip force produced by the flexor pollicis longus: A Cadaver study** *JOURNAL OF HAND SURGERY-AMERICAN VOLUME*
Towles, J. D., Murray, W. M., Hentz, V. R.
2004; 29A (6): 1056-1062
- **Towards a realistic biomechanical model of the thumb: the choice of kinematic description may be more critical than the solution method or the variability/uncertainty of musculoskeletal parameters** *JOURNAL OF BIOMECHANICS*
Valero-Cuevas, F. J., Johanson, M. E., Towles, J. D.
2003; 36 (7): 1019–30