

# SOL LIM

Engineering 268, 1127 E. James E. Rogers Way, Tucson, AZ 85721

650-842-0393 ◊ lims@email.arizona.edu

Webpage: <http://www.solielim.com/>

## ACADEMIC POSITION

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**Assistant Professor, Systems and Industrial Engineering** 8/2019 - current  
The University of Arizona

## EDUCATION

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**Ph.D., Industrial and Operations Engineering** 5/2019  
University of Michigan, Ann Arbor, Michigan

**Graduate Certificate in Data Science, Michigan Institute for Data Science** 4/2018  
University of Michigan, Ann Arbor, Michigan

**M.S., Biomedical Engineering** 4/2015  
University of Michigan, Ann Arbor, Michigan

**M.S., Industrial Engineering** 2/2011  
Seoul National University, South Korea

**B.S., Clothing and Textiles**, College of Human Ecology 2/2009  
Yonsei University, South Korea

## RESEARCH INTERESTS

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Ergonomics & Human factors, wearable technology, predictive modeling, occupational health & safety, healthcare ergonomics, biomechanics in disability and inclusive design

## GRANTS, HONORS AND AWARDS

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- UM Rackham Graduate Student Research Grant (\$3,000) 2018
- 1st Place (Inaugural Outstanding Team Grant Proposal) at the NIOSH Funded Research Capacity Building Workshop, University of Cincinnati 2018
- UM Education and Research Center (ERC) Travel Grant Award to attend the NIOSH Funded Research Capacity Building Workshop, University of Cincinnati 2018
- 1st Place (poster) at the Industrial, Operations, and Financial Engineering session, UM Engineering Graduate Symposium 2017
- HFES Student Author Presentation Support Award (SAPSA) 2017
- COHSE Directors' Award (poster), Regional Research Symposium, Education and Research Center (ERC) 2017
- UM Rackham Graduate School Travel Grant Award 2015, 2016, 2017, 2018
- People's Choice Award (poster), Regional Research Symposium, Education and Research Center (ERC) 2016
- Pilot Project Research Training Program (PPRT) award from NIOSH. (\$20,000) 2015-2016
- Industrial and Operations Engineering Departmental Fellowship, University of Michigan. Fellowship includes monthly stipend, tuition, and required fees. (\$66,671) 2015
- Jungsong Foundation Scholarship. Scholarship supports a two-year of master's program. (\$110,000) 2013-2014

- University designated scholarship, Yonsei University 2004-2007
- Awarded the Highest Honors, Yonsei University 2005
- Awarded Honors, Yonsei University 2008

## RESEARCH EXPERIENCE

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### Graduate Student Researcher 10/2014 - 4/2019

*Inclusive Mobility Laboratory*

*University of Michigan, Department of Industrial and Operations Engineering*

- Faculty Advisor: Clive D'Souza, Ph.D.
- Dissertation title: "Combining Inertial Sensing and Predictive Modeling for Biomechanical Exposure Assessment in Non-Repetitive Work" (Funding: Pilot project research training program award from NIOSH, Grant # T42-OH008455)
- Project: "Novel methods to track changes in health and function, before and after adult bariatric surgery" (Funding: MCubed program from University of Michigan)
- Project: "Field-based usability evaluation of public transit vehicles" (Funding: National Institute on Disability, Independent Living, and Rehabilitation Research, Grant # 90IF0094-01-00)

### Independent Research Project 1/2013 - 5/2013

*Direct Brain Interface Laboratory*

*University of Michigan, Department of Industrial and Operations Engineering*

- Faculty Advisor: Jane Huggins, Ph.D.
- Project: "P300 latency variation in Amyotrophic Lateral Sclerosis (ALS) patients"

### Research Assistant 8/2011 - 6/2012

*Brain-Computer Interface Laboratory*

*North Carolina State University, Department of Industrial and Systems Engineering*

- Faculty Advisor: Chang Nam, Ph.D.
- Project: "The effects of individual's mood state and personality trait on the cognitive processing of emotional stimuli"

### Research Assistant 12/2008 - 2/2011

*Human Factors Laboratory*

*Seoul National University, Department of Industrial Engineering*

- Faculty Advisor: Myun Lee, Ph.D.
- Project: "Assessment of emotional state by combinatorial analysis of neurophysiological signals"

### Research Assistant 5/2007 - 10/2007

*Clothing Sensibility Development Research Laboratory*

*Yonsei University, College of Human Ecology*

- Faculty Advisor: Gilsoo Cho, Ph.D.
- Project: "Development of sound and temperature responsive clothings"

## PUBLICATIONS

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### Journal Publication

- [J.1] Lim, S., & D'Souza, C. (2019). Statistical Prediction of Load Carriage Mode and Magnitude from Inertial Sensor Derived Gait Kinematics, *Applied Ergonomics*, 76, 1-11. DOI: 10.1016/j.apergo.2018.11.007

## Journal Publications in Progress

- [JP.4] **Lim, S.**, & D'Souza, C. (under revision. Submitted to *Ergonomics*) Measuring Effects of Two-handed Side and Anterior Load Carriage on Gait Kinematics using Wearable Inertial Sensors.
- [JP.3] **Lim, S.**, & D'Souza, C. (in progress) A Systematic Review of Inertial Sensing-Based Approaches to Ergonomic Exposure Assessment.
- [JP.2] **Lim, S.**, Luo, Y.\*, & D'Souza, C. (in progress) Task Performance and Stepping Adaptation during Obstacle Clearance Task in Individuals with High Body Mass Index.
- [JP.1] **Lim, S.**, & D'Souza, C. (in progress) Field-based Usability and Performance Evaluation of wheeled mobility users during boarding and disembarking of public transit bus.

## Peer-Reviewed Conference Proceedings

- [C.11] **Lim, S.**, & D'Souza, C. (2019, accepted). Gender and Parity in Statistical Prediction of Anterior Carry Hand-Loads from Inertial Sensor Data. Proceedings of the 63rd Annual Meeting of the Human Factors and Ergonomics Society (HFES)
- [C.10] **Lim, S.**, & D'Souza, C. (2018). Inertial Sensor-based Measurement of Thoracic-Pelvic Coordination Measures Predicts Hand-Load Levels in Two-handed Anterior Carry. Proceedings of the 62nd Annual Meeting of the Human Factors and Ergonomics Society (HFES), Philadelphia, PA, October 2018, pg: 798 - 799. DOI: 10.1177/1541931218621181
- [C.9] **Lim, S.**, Luo, Y.\*, Ebert, S., Johns, M., Varban, O., & D'Souza, C. (2018). Preliminary Study of Obstacle Clearance and Compensatory Movements in Individuals with High Body Mass Index. Proceedings of the 62nd Annual Meeting of the Human Factors and Ergonomics Society (HFES), Philadelphia, PA, October 2018, pg: 388 - 392. DOI: 10.1177/1541931218621089
- [C.8] **Lim, S.**, & D'Souza, C. (2017). Statistical Prediction of Hand Force Exertion Levels in a Simulated Push Task using Posture Kinematics. Proceedings of the 61st Annual Meeting of the Human Factors and Ergonomics Society (HFES), Austin, TX, October 2017. DOI: 10.1177/1541931213601741
- [C.7] **Lim, S.**, Case, A.\*, & D'Souza, C. (2016). Comparative Analysis of Inertial and Optical Motion Capture Derived Kinematics during Isometric Push-Pull Exertions. Proceedings of the 60th Annual Meeting of the Human Factors and Ergonomics Society (HFES), Washington, DC, September 2016, pg: 970 - 974. DOI: 10.1177/1541931213601224
- [C.6] **Lim, S.**, Case, A.\*, & D'Souza, C. (2016). Comparing Postural Responses to Push and Pull Task Demands using Optical Motion vs. Inertial Measurement. Proceedings of the 9th International Scientific Conference on the Prevention of Work-Related Musculoskeletal Disorders (PREMUS), Toronto, Canada, June 2016.
- [C.5] **Lim, S.**, Woo, J., Bahn, S., & Nam, C. (2012). The Effects of Individuals Mood State and Personality Trait on the Cognitive Processing of Emotional Stimuli. Proceedings of the 56th Annual Meeting of the Human Factors and Ergonomics Society (HFES), Santa Monica, September 2012. DOI:10.1177/1071181312561231
- [C.4] **Lim, S.**, Bahn, S., Woo, J., & Nam, C. (2012). Hemispheric Asymmetries in the Perception of Emotion. Proceedings of the International Conference on Applied Human Factors and Ergonomics (AHFE), San Francisco, July 2012.
- [C.3] **Lim, S.**, & Lee, M. (2010). Towards a Systematic Approach to Assess Emotional State by Combinatorial Analysis of Neurophysiological Signals. Proceedings of 2010 Fall Symposium of Korea Institute of Industrial Engineers (KIIE), Seoul, Korea.

- [C.2] **Lim, S.**, & Lee, M. (2010). Towards a Quantitative Measure of Facial Expression. Proceedings of 2010 Spring Symposium of Korea Institute of Industrial Engineers (KIIE), Jeju, Korea.
- [C.1] Kim, Y., Park, J., Rhiu, I., Kim, W., **Lim, S.**, You, K., & Lee, M. (2009). Facial EMG, Skin Conductance, Heart Beat and Respiration Changes to Short Downhill Cart Riding. Proceedings of 2009 Fall Conference of Ergonomics Society of Korea (ESK), Daegu, Korea.

\* Students supervised

### Technical Reports

- [T.1] **Lim, S.** & D'Souza, C. (2016). Inertial Sensor-based Postural Demand Profiles for Cumulative Physical Workload Estimation: Final Project Report. Center for Ergonomics, University of Michigan, Ann Arbor, MI, July 2016.

### Grant Proposals

- [G.2] **Lim, S.** (Doctoral Trainee) & D'Souza, C. (PI) (2015). Pilot Project Research Program (PPRT) award from NIOSH through Center for Occupational Health & Safety Engineering, Project title: Inertial Sensor-based Postural Demand Profiles for Cumulative Physical Workload Estimation. \$ 20,000 total award (2015 - 2016).
- [G.1] **Lim, S.** (PI) (2018). Rackham Graduate Student Research Grant, Project title: Combining Inertial Sensing and Predictive Modeling for Ergonomic Exposure Assessment in Non-Repetitive Work. \$3,000 total award.

## PRESENTATIONS

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### Conference Presentations

- [CP.8] **Lim, S.** (2018). Inertial Sensor-based Measurement of Thoracic-Pelvic Coordination Measures Predicts Hand-Load Levels in Two-handed Anterior Carry. Paper presented at the 62nd Annual Meeting of the Human Factors and Ergonomics Society (HFES), Philadelphia, PA, October 2018.
- [CP.7] **Lim, S.** (2018). Preliminary Study of Obstacle Clearance and Compensatory Movements in Individuals with High Body Mass Index. Paper presented at the 62nd Annual Meeting of the Human Factors and Ergonomics Society (HFES), Philadelphia, PA, October 2018.
- [CP.6] **Lim, S.** (2017). Statistical Prediction of Hand Force Exertion Levels in a Simulated Push Task using Posture Kinematics. Paper presented at the 61st Annual Meeting of the Human Factors and Ergonomics Society (HFES), Austin, TX, October 2017.
- [CP.5] **Lim, S.** (2016). Comparative Analysis of Inertial and Optical Motion Capture Derived Kinematics during Isometric Push-Pull Exertions. Paper presented at the 60th Annual Meeting of the Human Factors and Ergonomics Society (HFES), Washington, DC, September 2016.
- [CP.4] **Lim, S.** (2016). Comparing Postural Responses to Push and Pull Task Demands using Optical Motion vs. Inertial Measurement. Paper presented at the 9th International Scientific Conference on the Prevention of Work-Related Musculoskeletal Disorders (PREMUS), Toronto, Canada, June 2016.
- [CP.3] **Lim, S.** (2012). Hemispheric Asymmetries in the Perception of Emotion. Paper presented at the International Conference on Applied Human Factors and Ergonomics (AHFE), San Francisco, July 2012.
- [CP.2] **Lim, S.** (2010). Towards a Systematic Approach to Assess Emotional State by Combinatorial Analysis of Neurophysiological Signals. Paper presented at the 2010 Fall Symposium of Korea Institute of Industrial Engineers (KIIE), Seoul, Korea.

[CP.1] **Lim, S.** (2010). Towards a Quantitative Measure of Facial Expression. Paper presented at the 2010 Spring Symposium of Korea Institute of Industrial Engineers (KIIE), Jeju, Korea.

### Poster Presentations

- [P.12] **Lim, S.†**, & D’Souza, C. (2018). Predicting Hand-load Carrying Strategy and Load Level from Gait Kinematics Obtained from Wearable Inertial Sensor. Poster presented at the Michigan Institute for Computational Discovery and Engineering (MICDE) 2018 Annual Symposium, Ann Arbor, MI, March 2018.
- [P.11] Luo, Y.\*†, **Lim, S.**, Futerman, S.\*, Grider, J.\*, Ebert, S., Jones., M., Varban, O., & D’Souza, C. (2018). Dynamic Balance and Measures of Obstacle Clearance Performance in Individuals with High Body Mass Index. Poster presented at the Education and Research Center (ERC) Regional Research Symposium, University of Illinois at Chicago, Illinois, March 2018.
- [P.10] **Lim, S.†**, & D’Souza, C. (2017). Statistical Prediction of Hand-load Carrying Strategy and Load Level from Wearable Inertial Sensor Data. Poster presented at the 2017 Engineering Graduate Symposium, Ann Arbor, MI, November 2017. - **Won “1st Place at the Industrial, Operations, and Financial Engineering session”**
- [P.9] **Lim, S.†**, & D’Souza, C. (2017). Statistical Prediction of Hand-load Carrying Strategy and Load Level from Wearable Inertial Sensor Data. Poster presented at the 60th IOE Anniversary Poster Reception, Ann Arbor, MI, November 2017.
- [P.8] **Lim, S.†**, Ebert, S., Malik, L., Luo, Y.\*, Futerman, S.\*, Lin, S.\*, D’Souza, C., Jones, M., & Varban, O. (2017). Novel Methods to Track Changes in Health and Function of Individuals with High Body Mass Index (BMI). Poster presented at the MCubed Symposium 2017, Ann Arbor, MI, November 2017.
- [P.7] **Lim, S.†**, Bixler, K.\*, Chiang, J.\*, & D’Souza, C. (2017). Preliminary Investigation of External Load Prediction in Manual Material Handling. Poster presented at the Education and Research Center (ERC) Regional Research Symposium, Ann Arbor, Michigan, March 2017. - **Won “Center for Occupational Health & Safety Engineering (COHSE) Director’s Award”**
- [P.6] **Lim, S.†**, Bixler, K.\*, Chiang, J.\*, & D’Souza, C. (2016). Preliminary Investigation of External Load Prediction in Simulated Manual Tasks. Poster presented at the Center for Ergonomics open house, Ann Arbor, Michigan, December 2016.
- [P.5] **Lim, S.†**, Case, A.\*, & D’Souza, C. (2016). Development of Classification Algorithm for Estimating Physical Task Demands Using Inertial Sensors. Poster presented at the Education and Research Center (ERC) Regional Research Symposium, Ann Arbor, Michigan, March 2016.
- [P.4] Case, A.\*†, **Lim, S.**, & D’Souza, C. (2016). Accuracy and Precision of Inertial Sensors in Ergonomics Evaluations of Static vs. Dynamic Work Posture. Poster presented at the Education and Research Center (ERC) Regional Research Symposium, Ann Arbor, Michigan, March 2016. - **Won “People’s Choice Award”**
- [P.3] **Lim, S.†**, Case, A.\*, Chung, C.\*, Keci, A.\*, & D’Souza, C. (2015). Methodology for Validating Inertial Sensors in Ergonomics Posture Assessment. Poster presented at the Center for Ergonomics open house, Ann Arbor, Michigan, December 2015.
- [P.2] Keci, A.\*†, **Lim, S.**, & D’Souza, C. (2015). Validating Inertial Sensors for Ergonomics Posture Assessment. Poster presented at the 2015 UROP Summer Symposium, August 2015.
- [P.1] Chimbala, N.\*†, **Lim, S.**, Diaz, G., & D’Souza, C. (2015). Preliminary Validation of IMUs for Ergonomics Posture Assessment. Poster presented at the 2015 UROP Winter Symposium, April 2015.

\* Students supervised, † Presenter

### Invited Lectures

- [L.8] **Lim, S.** (2019). Wearables at Work: Inertial Sensing and Predictive Modeling for Ergonomic Exposure Assessment. Invited Seminar at Industrial and Management Systems Engineering, West Virginia University, West Virginia. April.
- [L.7] **Lim, S.** (2019). Wearables at Work: Inertial Sensing and Predictive Modeling for Ergonomic Exposure Assessment. Invited Seminar at Grado Department of Industrial and Systems Engineering, Virginia Tech, Virginia. March.
- [L.6] **Lim, S.** (2019). Wearables at Work: Inertial Sensing and Predictive Modeling for Ergonomic Exposure Assessment. Invited Seminar at the Department of Systems and Industrial Engineering, University of Arizona, Arizona. February.
- [L.5] **Lim, S.** (2019). Wearables at Work: Inertial Sensing and Predictive Modeling for Ergonomic Exposure Assessment. Invited Seminar at the School of Industrial and Systems Engineering, University of Oklahoma, Oklahoma. February.
- [L.4] **Lim, S.** (2019). Wearables at Work: Inertial Sensing and Predictive Modeling for Ergonomic Exposure Assessment. Invited Seminar at the Department of Mechanical and Materials Engineering, Miami university, Ohio. January.
- [L.3] **Lim, S.** (2012). Hemispheric asymmetries in the perception of emotions. Invited lecture at the Human Factors Brownbag series. North Carolina State University, NC. March.
- [L.2] **Lim, S.** (2012). The Effects of Individuals Mood State and Personality Trait on the Cognitive Processing of Emotional Stimuli. Invited lecture in IE: Ergonomics. Hongik University, Seoul, Korea. June.
- [L.1] **Lim, S.** (2012). The Effects of Individuals Mood State and Personality Trait on the Cognitive Processing of Emotional Stimuli. Invited lecture in HFE 304: High Touch Design. Ulsan Institute of Science and Technology (UNIST), Seoul, Korea. June.

### Invited Presentations

- [E.2] **Lim, S.** (2018). Investigating Performance Indicators in Accessible and Inclusive Public Transportation - Field-based Usability Evaluation. Presented at the Advisory Board and Steering Committee Meeting for NIDILRR Field-Initiated Project, grant # 90IF0094-01-00.
- [E.1] Haney, J. and **Lim, S.** (2017). Ergonomic Guidelines for Proper Seated Posture. Poster presented at FDA and PTO 3rd Annual Wellness Fair. Detroit, Michigan. July.

## TEACHING EXPERIENCE

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### Instructor

*The University of Arizona, Dept. of Systems and Industrial Engineering*

SIE410A: Human Factors & Ergonomics in Systems Design

Fall, 2019

### Module Instructor & Guest Lecturer

*University of Michigan, Ann Arbor, Dept. of Industrial and Operations Engineering*

IOE 591: Ergonomics Research Methods Laboratory

- Developed a lab module for 'Physiology and Wearable Devices'

Winter, 2018

- Led lab sessions

Winter, 2018, 2019

- Guest lecture a module for 'Posture and Force Production'

Winter, 2019

## Graduate Student Instructor

*Seoul National University, Dept. of Industrial Engineering*

Leadership and Management  
Organization Theory

Spring, 2009/2010  
Fall, 2009/2010

## MENTORING EXPERIENCE

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### IOE Ph.D. Mentor Program

*University of Michigan, Dept. of Industrial and Operations Engineering*

Geunyeong Byeon, IOE, Ph.D. candidate	2016 - 2017
Chenlan Wang, IOE, Ph.D. student	2017 - 2018
Julia Coxen, IOE, Ph.D. student	2018 - 2019

### Research Supervisor

*Inclusive Mobility Laboratory*

*University of Michigan, Department of Industrial and Operations Engineering*

Yue Luo, BME, IOE, Graduate Research Assistant (9/2017 - 5/2019)	[J.4],[C.9],[P.8],[P.11]
Caroline Kim, IOE, UG Research Assistant (1/2019 - 4/2019)	
Jordan Keeley, IOE, UG Research Assistant (2/2018 - 4/2019)	
Dylan Plummer, IOE, UG Research Assistant (10/2018 - 1/2019)	
Claire Stemper, IOE, UG Research Assistant (5/2018 - 12/2018)	
Hannah Brown, IOE, UG Research Assistant (4/2018 - 12/2018)	
Sidnie Futerman, IOE, UG Research Assistant (9/2017 - 4/2018)	[P.8]
Joelle Grider, IOE, UG Research Assistant (9/2017 - 4/2018)	[P.11]
Ayano Nakamura, IOE, UG Research Assistant (9/2017 - 1/2018)	
Zhining Zhou, IOE, UG Research Assistant (9/2017 - 12/2017)	
Sabrina Lin, IOE, UG Research Assistant (9/2017 - 12/2017)	[P.8]
Allison Winnik, IOE, SURE program (5/2017 - 7/2017)	
Kellen Bixler, CS, UG Research Assistant (5/2016 - 6/2017)	[P.6],[P.7]
Mary Owczarczak, IOE, UG Research Assistant (1/2017 - 5/2017)	
Joanna Chiang, Kinesiology, Graduate Research Assistant (9/2016 - 12/2016)	[P.6],[P.7]
Maggie Hafers, IOE, SURE program (5/2016 - 8/2016)	
Andrea Case, IOE, SURE program (5/2015 - 4/2016)	[C.6],[C.7],[P.3],[P.4],[P.5]
Angjela Keci, IOE, UROP program (5/2015 - 4/2016)	[P.2],[P.3]
Chanmee Chung, IOE, UG Research Assistant (4/2015 - 10/2015)	[P.3]
Naboth Chimbala, ME, UROP program (1/2015 - 4/2015)	[P.1]

## PROFESSIONAL DEVELOPMENT

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### Preparing Future Faculty Seminar

*Rackham School of Graduate Studies and the Center for Research on Learning and Teaching  
University of Michigan, Ann Arbor*

Selected to attend a 5-week seminar to advance teaching in higher education Summer, 2018  
and academic professionalism. Learned and practiced topics in inclusive teaching,  
active learning techniques, course design, and assessment tools in higher education.

### Grant Proposal Writing

Attended two full-day 14th Annual Research Capacity Building Workshop 3/2018  
sponsored by Pilot Research Project Training Program of the NIOSH Funded Education  
and Research Center, University of Cincinnati, College of Medicine

## PROFESSIONAL SERVICE ACTIVITIES

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### University-related Service

UM Chapter of the Human Factors and Ergonomics Society (HFES)	
<i>Acting President</i>	2017
<i>Vice-President</i>	2016 - 2017
<i>Treasurer</i>	2015 - 2016

### Review Service

Reviewer, Applied Ergonomics	2018 - present
Reviewer, International Journal of Industrial Ergonomics	2018 - present
Reviewer, Human Factors and Ergonomics Society (HFES) Annual Meeting	2017 - present

### Community Service

Led workshop "ErgOlympics: Human Factors & Ergonomics" with local elementary students	2017
Discover Engineering, University of Michigan, Ann Arbor	

### Other Service

Session Chair, Environmental Design, Human Factors and Ergonomics Society (HFES)	2018
Annual Meeting	
Student volunteer, Human Factors and Ergonomics Annual Meeting	2016
Student volunteer, AutomotiveUI Conference	2016
Student volunteer, Applied Human Factors and Ergonomics International Conference	2012

## PROFESSIONAL AFFILIATION

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Human Factors and Ergonomics Society (HFES)	2012 - present
Occupational Ergonomics Technical Group	
Healthcare Technical Group	
Institute of Industrial and Systems Engineers (IISE)	2018 - present
International Society of Biomechanics (ISB)	2018 - present