

# Mark Sidebottom

## *Curriculum Vitae*

Assistant Professor  
Department of Mechanical and Manufacturing Engineering  
56 Garland Hall  
650 E. High Street  
Miami University, Oxford, OH 45056

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## Education

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Ph. D **Lehigh University**, Bethlehem, PA 18015  
Mechanical Engineering and Mechanics, May 2018  
Advisor: Brandon Krick

BS **The College of New Jersey**, Ewing, NJ 08628  
Mechanical Engineering, May 2013

## Professional History

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### **Assistant Professor- Miami University (August 2018-Present)**

- Research focuses on evaluation, characterization and modeling of wear and friction of engineering materials.
  - Advance understanding of surfaces in contact to improve materials and designs for use as mechanical, electronic, and biologic interfaces.
  - Engage students through extracurricular research that reinforces topics taught in design and materials science courses while exposing them to academic research and interactions with industrial partners.
- Teaching courses within the Mechanical and Manufacturing Engineering Curriculum
  - Engaged, enthusiastic, and organized instructor looking to improve on pedagogical methods used within engineering to ensure better course outcomes for students.
- Service to the university and the technical community.
  - Remain active within mechanical engineering and tribology research community through volunteer work as a conference technical committee member and journal reviewer.

### **Graduate Research Assistant-Lehigh University Tribology Laboratory (August 2013-June 2018)**

- Work centered on the evaluation, characterization and modeling of engineering materials in tribological applications.
  - Designed, built, and programmed multiple custom instruments to evaluate friction and wear of polymers and metals.
  - Characterized wear of various fluoropolymer-alumina composites through infrared spectroscopy and nanoindentation. Optimized composite was nearly 10,000x more wear resistant than unfilled polymer.
  - Evaluated microstructural and chemical changes of melt-processable fluoropolymer during wear using differential scanning calorimetry and infrared spectroscopy.

- Evaluated environmental effects on MoS<sub>2</sub> coating tribology for space applications with state-of-the-art surface analysis tools
- Developed iterative numerical model to simulate wear of multi-material interfaces. Model was used in interdisciplinary collaboration with paleontologists to evaluate wear and functionality Triceratops teeth.

### **Undergraduate Research (MUSE), The College of New Jersey (June-July 2011, June-July 2012)**

- Worked alongside a professor of the mechanical engineering department on squeaking in ceramic-on-ceramic hip prostheses.
- Analyzed squeaking using acoustic, modal, random vibration and mathematical analyses.

### **Awards**

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- *Society of Tribologists and Engineers-Philadelphia Section Graduate Student Award (2017)*-awarded to students in the Philadelphia area who have contributed significantly to the field of tribology.<sup>2</sup>
- *Society of Tribologists and Engineers Early Career Graduate Student Award (2017)*- recognizes graduate students who have provided significant contributions to the field of tribology through academic research.<sup>1</sup>
- *Harrach Fellowship (Lehigh University Department of Mechanical Engineering and Mechanics, Spring 2017)* - awarded to students based on faculty recommendations and academic accomplishments.<sup>3</sup>
- *Dr. Leslie Sperling Travel Grant Award (2016)*- awarded to doctoral students in field of chemistry, chemical engineering, materials sciences, mechanical engineering, and physics whose research directly relates to polymer science and engineering.<sup>1</sup>
- *P.C Rossin Doctoral Fellow (Spring 2016)*- bestowed to Ph.D students within the PC Rossin College of Engineering who are strongly considering a career in academia after graduation. Fellows participate in two courses that teach the fundamentals of teaching/presenting and the professional responsibilities (i.e research grant proposal writing, time management, etc.)<sup>3</sup>
- *Department Fellowship (Lehigh University Department of Mechanical Engineering and Mechanics, Spring 2016)* - given to students based on faculty recommendations and academic accomplishments.<sup>3</sup>
- *Society of Plastics Engineers-Excellence in Polymer Science and Engineering Research Award (SPE Lehigh Valley Section Meeting, Bethlehem PA, November 2015)* - Award given to top two student researchers in polymer science and engineering. Awardees presented their research at the local chapter's monthly meeting.<sup>2</sup>
- *Student Poster Honors Award Winner (Society of Plastics Engineers-Polymer Nanocomposites Conference, Bethlehem, PA October 2014)*. Top five posters presented were chosen by a panel of conference attendees.<sup>1</sup>
- *Dr. Harold W. Eickhoff Outstanding Senior Male Scholar-Athlete (April 2013)*- awarded to the senior The College of New Jersey male athlete with the highest GPA of amongst all nine varsity sports teams.<sup>3</sup>

<sup>1</sup> International/National award

<sup>2</sup> Local Chapter/Section award,

<sup>3</sup> University Level award

## Research

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Surface interactions are present in many mechanical/biological/electrical systems (aircraft engines, locomotives, automobiles, pumps, orthopedic, MEMS/NEMS, cells, electronics). These interactions are also often sources of failure or inefficiency, causing increased energy consumption or potential failure of the entire mechanical system. A 2017 report released by the Advanced Research Projects Agency (ARPA) states that the US currently consumes about 97.2 Quads (~28.5 trillion kWh) per year, and postulates that tribological materials could reduce US energy demand by nearly 11%! One of the largest areas of energy consumption is the Transportation Sector, which accounts for a quarter of all US energy consumption. In Passenger cars for example, 16 % of all fuel energy is consumed by frictional losses in the engine and transmission.

My research aims to understand the fundamental mechanisms of friction and wear. By understanding these fundamentals, I hope to design better materials to reduce frictional losses and increase lifetime of mechanical interfaces. To properly investigate these systems, an interdisciplinary approach including aspects of mechanical engineering, material science, chemistry, and surface science is often required. Material system performance is evaluated by student designed and controlled instrumentation called tribometers. These tribometers are often designed to mimic contact conditions seen in common mechanical components such as journal bearings. Characterization methods, including Infrared, Raman, SEM, stylus profilometry, optical profilometry, XPS, and nanoindentation, are used to correlate differences in wear or friction performance to changes in chemistry or mechanical properties of the materials at the sliding interface. Materials of interest include engineering polymer composites & blends, thin coatings, soft materials, and multi-material surfaces.

### Journal Papers (Published)

- 11) **Sidebottom, M.A.**, Junk, C.P., Salerno, H.S., Blackman, G.S., Burch, H.E., and Krick, B.A., "Wear-Induced Microstructural and Chemical Changes in Poly[tetrafluoroethylene-co-(perfluoroalkyl vinyl ether)] (PFA)". *Macromolecules*. 2018 51 (23), 9700-9709. DOI: 10.1021/acs.macromol.8b01564

#### Before August 2018

- 10) Curry, J.F., Wilson, M.R., Luftman, H.S., Strandwitz, N.C., Argibay, N., Chandross, M., **Sidebottom, M.A.**, Krick, B.A., "The Impact of Microstructure on MoS<sub>2</sub> Oxidation and Friction". *ACS Applied Materials & Interfaces*. 2017.
- 9) **Sidebottom, M.A.**, Pitenis, A.A., Junk, C.P., Kasprzak, D.J., Blackman, G.S., Burch, H.E., Sawyer, W.G., and Krick, B.A., "Ultralow Wear Perfluoroalkoxy Polymer Alumina Composites". *Wear*. 2016.
- 8) Feppon, F., Michailidis, G., **Sidebottom, M.A.**, Allaire, G., Krick, B.A., Vermaak, N., "Introducing a level-set based shape optimization method for the wear of composite materials with geometric constraints" *Structural and Multidisciplinary Optimization*. 2016.
- 7) **Sidebottom, M.A.**, Feppon, F., Vermaak, N., Krick, B.A. "Modeling of multi-material composite wear surfaces" *ASME Journal of Tribology*. 2016.
- 6) **Sidebottom, M.A.**, Allan, D., and Paliwal, M., "Analysis of a retrieved squeaking ceramic-on-ceramic hip arthroplasty bearing" *Journal of Mechanical Engineering Science*. 2016.
- 5) Erickson, G.M., **Sidebottom, M.A.**, Curry, J.F., Kay, D.I., Kuhn-Hendricks, S., Norell, M.A., Sawyer, W.G., and Krick, B.A., "Paleo-tribology: Development of wear measurement techniques and a three-dimensional model revealing how grinding dentitions self-wear to enable functionality" *Surface Metrology*. 2016.
- 4) Feppon, F., **Sidebottom, M.A.**, Michailidis, G., Krick, B.A., Vermaak, N., "Efficient steady-state computation for wear of multi-material composites" *ASME Journal of Tribology*. 2015.

- 3) Harris, K.L., Curry, J.F., Pitenis, A.A., Rowe, K.G., **Sidebottom, M.A.**, Sawyer, W.G., and Krick, B.A., "Wear debris mobility, aligned surface roughness and the low wear behavior of filled polytetrafluoroethylene" *Tribology Letters*. 2015.
- 2) Erickson, G.M., **Sidebottom, M.A.**, Kay, D.I., Turner K.T, Ip, N., Norell, M.A., Sawyer, W.G., and Krick, B.A., "Complex Dental Architecture with Preserved Wear Properties Reveal the Biomechanics of Slicing in the Giant Horned Dinosaur, Triceratops" *Science Advances*. 2015.
- 1) **Sidebottom, M.A.**, Krick, B.A. "Sources of Error in Friction Measurement for Small Diameter Pin-on-Disk Experiments: Considering Pressure Distributions and Transducer Misalignment". *Tribology Letters*. 2015

### Journal Papers (Submitted/In Preparation)

- 15) Campbell, K.L., **Sidebottom, M.A.**, Atkinson, C.C., Junk, C.P., Krick, B.A. "Ultralow Wear PTFE-Based Polymer Composites – The Role of Water". *Tribology International*. In Preparation. 2019
- 14) Atkinson, C.C., **Sidebottom, M.A.**, Burch, H.E., Junk, C.P., Blackman, G.S., Krick, B.A. "Effects of Fountain Flow on Wear of Injection Molded PFA-alumina composites". *Tribology Letters*. In Preparation, 2019.
- 13) **Sidebottom, M.A.**, Cui, F., Kolavonic, C.A., Junk, C.P., Blackman, G.S., Burch, H.E., Vinci, R.P., and Krick, B.A., "Effect of Alumina Particle Strength on Wear of PTFE-Alumina Composites". In Preparation *Wear*. 2019
- 12) **Sidebottom, M.A.**, Junk, C.P., Blackman, G.S., Burch, H.E., and Krick, B.A., "Effect of Environment on tribofilm formation of Perfluoroalkoxy Polymer (PFA)-Alumina Composites". In Preparation. *Tribology Letters* 2019.

### Conference Presentations

- 18) **Sidebottom, M.A.**, Junk, C.P., Salerno, H.L.S. , Burch, H.E., Blackman G.S., and Krick, B.A., "Chemical and Microstructural Changes Promote Ultralow Wear of Perfluoroalkoxy Polymer (PFA)-Alumina Composites" *Materials Research Society Spring Meeting, April 21-25, 2019, Phoenix, AZ.*
- 17) **Sidebottom, M.A.**, Campbell, K.L., Atkinson, C.C., Junk, C.P., Blackman G.S., and Krick, B.A., "Ultralow Wear PTFE and Alumina Composites: The Role of Tribochemistry and Nanomechanics". *Society of Tribologists and Lubrication Engineers. Tribology Frontiers, October 28-31, 2018, Chicago , IL.*
- 16) **Sidebottom, M.A.**, Junk, C.P., Salerno, H.L.S. , Burch, H.E., Blackman G.S., and Krick, B.A., "Microstructural and chemical changes in perfluoroalkoxy polymer (PFA) improve lifetime of PFA-alumina composite materials by 10,000x". *Society of Tribologists and Lubrication Engineers. Tribology Frontiers, October 28-31, 2018, Chicago , IL.*

### Before August 2018

- 15) Atkinson, C.C., Babuska, T.F., Kirk, K., **Sidebottom, M.A.**, Burch, H.E., Blackman G.S., Junk, C.P., and Krick, B.A., "Testing the Practical Limits of Fluoropolymer-Alumina Composites". *Society of Tribologists and Lubrication Engineers. STLE Annual Meeting, May 20-24, 2018, Minneapolis , MN.*
- 14) Campbell, K.L., **Sidebottom, M.A.**, Junk, C.P., Atkinson, C.C., and Krick, B.A., "Ultralow wear of PTFE-Based Polymer Composites: The Role of Water". *Society of Tribologists and Lubrication Engineers. STLE Annual Meeting, May 20-24, 2018, Minneapolis , MN.*
- 13) **Sidebottom, M.A.**, Junk, C.P., Salerno, H.L.S. , Burch, H.E., Blackman G.S., and Krick, B.A., "Effects of Sliding on the Microstructure of Perfluoroalkoxy Polymer (PFA)". *Society of Tribologists and Lubrication Engineers. STLE Annual Meeting, May 20-24, 2018, Minneapolis , MN.*
- 12) **Sidebottom, M.A.**, Junk, C.P., Kolanovic, C.A., Blackman G.S., Burch, H.E., and Krick, B.A., "Effect of Alumina Particle Strength on Wear of PTFE-Alumina Composites". *Society of Tribologists and Lubrication Engineers. STLE Annual Meeting, May 21-25, 2017, Atlanta, GA.*

- 11) **Sidebottom, M.A.**, Junk, C.P., Blackman G.S., Burch, H.E., and Krick, B.A., "Developing a Mechanistic Framework for Wear of PFA Fluoropolymer / Alumina Composites". Society of Tribologists and Lubrication Engineers. STLE Annual Meeting, May 15-19, 2016, Las Vegas, NV.
- 10) **Sidebottom, M.A.**; Goldstein, M.A.; Jia, X.I.; Feppon, F.; Vermaak, N.; Krick, B.A., "Topology Optimization of a Composite Surface to Minimize Run-in Wear Volume". Society of Tribologists and Lubrication Engineers. STLE Annual Meeting, May 15-19, 2016, Las Vegas, NV.
- 9) Curry, J.F., Luftman, H., Strandwitz, N., **Sidebottom, M.A.**, Argibay, N., Krick, B.A., "Environmental Sensitivity of MoS<sub>2</sub> Coatings: Probing the First Few Layers". Society of Tribologists and Lubrication Engineers. STLE Annual Meeting, May 15-19, 2016, Las Vegas, NV.
- 8) Schulze, K., Uruena, J., Pitenis, A., Curry, J.F., **Sidebottom, M.A.**, Krick, B.A., Angelini, T., Sawyer W.G., "Slow Rise, Take it Easy: Local Mesh Size Control of Thermal Fluctuation Lubrication" Society of Tribologists and Lubrication Engineers. STLE Annual Meeting, May 15-19, 2016, Las Vegas, NV.
- 7) Curry, J. F., Ling, J. , Luftman, H.S. , Strandwitz, N.C., **Sidebottom, M.A.**, Argibay, N. and Krick, B.A., "Environmental Sensitivity of MoS<sub>2</sub> Coatings: Probing the First Few Layers". Materials Research Society. Materials Research Society Spring Meeting, 2016. Phoenix, AZ.
- 6) **Sidebottom, M.A.**, Junk, C.P., Blackman G.S., Burch, H.E., and Krick, B.A., "Ultra-Low Wear Melt Processable Perfluorocopolymer Nanocomposites". Society of Tribologists and Lubrication Engineers. STLE Annual Meeting, May 17-21, 2015, Dallas, TX.
- 5) Zeng, G., Tansu, N., Curry, J.F., Krick, B.A., and **Sidebottom, M.A.** "Nanoscale Mechanisms in Ductile Wear of Brittle Material". Society of Tribologists and Lubrication Engineers. STLE Annual Meeting, May 17-21, 2015, Dallas, TX.
- 4) Krick, B.A., Pitenis, A.A, Harris, K.L., **Sidebottom, M.A.**, and Sawyer, W.G., "Ultralow Wear PTFE and Alumina Composites: The Role of Tribochemistry and Nanomechanics ". Society of Tribologists and Lubrication Engineers. STLE Annual Meeting, May 17-21, 2015, Dallas, TX.
- 3) Curry, J.F., **Sidebottom, M.A.**, Krick, B.A., and Counts, M. "Uncertainties in Tribometry: A Multi-Functional Thrustwasher, Block-on-Ring, Rotary Pin-on-Disk and Reciprocating Tribometer" J. Curry, M. Sidebottom, B. Krick, Lehigh University, Bethlehem, PA, M. Counts, WD-40 Company, Summit, NJ Society of Tribologists and Lubrication Engineers. STLE Annual Meeting, May 17-21, 2015, Dallas, TX.
- 2) **Sidebottom, M.A.**, and Paliwal, M., "Ceramic-on-Ceramic Hip Implants: Analysis of Friction induced squeal". American Society of Mechanical Engineers(ASME) 2014 International Mechanical Engineering Congress & Exposition, November 14-20, 2014, Montreal, Canada.
- 1) **Sidebottom, M.A.**, and Paliwal, M., "Friction-induced squeak of Ceramic-on-Ceramic Hip Implants: A stability design criteria". American Society of Mechanical Engineers(ASME) 2012 International Mechanical Engineering Congress & Exposition, November 9-15, 2012, Houston, TX.

## Invited Presentations

### Before August 2018

- 8) Sidebottom, M.A. "Going No Wear: How Mechanical Structure and Chemical Reactions Lead to a 10,000x Increase in Lifetime of Polymer Nanocomposites". Purdue University-Northwest Mechanical and Civil Engineering Department Seminar. March 6<sup>th</sup>, 2018 Hammond, IN.
- 7) Sidebottom, M.A. "Going No Wear: How Mechanical Structure and Chemical Reactions Lead to a 10,000x Increase in Lifetime of Polymer Nanocomposites". Texas Tech University Mechanical Engineering Department Seminar. February 12<sup>th</sup>, 2018 Lubbock, TX.
- 6) Sidebottom, M.A. "Going No Wear: How Mechanical Structure and Chemical Reactions Lead to a 10,000x Increase in Lifetime of Polymer Nanocomposites". Miami University Mechanical and Manufacturing Engineering Department Seminar. February 9<sup>th</sup>, 2018 Oxford, OH.

- 5) **Sidebottom, M.A.**, Junk, C.P., Blackman G.S., Burch, H.E., Salerno H.S., and Krick, B.A., "Effects of Sliding on the Microstructure of Perfluoroalkoxy Polymer". Philadelphia STLE Section Meeting, September 28th, 2017, Oreland, PA.
- 4) **Sidebottom, M.A.**, Junk, C.P., Blackman G.S., Burch, H.E., and Krick, B.A., "Developing a Mechanistic Framework for Wear of PFA Fluoropolymer / Alumina Composites". Emulsion Polymer Institute. Emulsion Polymer Institute Annual Review Meeting, June 2-3, 2016, Bethlehem, PA.
- 3) **Sidebottom, M.A.**, Junk, C.P., Blackman G.S., Burch, H.E., and Krick, B.A., "Ultra-Low Wear Melt Processable Perfluorocopolymer Nanocomposites". Society of Plastics Engineers, Lehigh Valley Section Meeting, November 17, 2015, Bethlehem, PA.
- 2) **Sidebottom, M.A.**, Junk, C.P., Blackman G.S., Burch, H.E., and Krick, B.A., "Ultra-Low Wear Melt Processable Perfluorocopolymer Nanocomposites". The College of New Jersey-Mechanical Engineering Seminar, September 30, 2015, Ewing, NJ.
- 1) **Sidebottom, M.A.**, Curry, J.F., and Krick, B.A., "Evaluating Wear Using Scanning White Light Interferometry". Bruker Co. Technical Conference, January 21, 2015, Bethlehem, PA.

## Poster Presentations

### Before August 2018

- 10) **Sidebottom, M.A.**, Junk, C.P., Salerno, H.L.S., Burch, H.E., Blackman, G.S. and Krick, B.A. "Wear-Induced Microstructural and Tribochemical Changes in Perfluoroalkoxy Polymer (PFA)" Poster Presentation. Gordon Tribology Research Conference. June 2018. Lewiston, ME.
- 9) Campbell, K.L., **Sidebottom, M.A.** and Krick, B.A. "Exploring the Parameters and Wear Mechanisms of PTFE- Based TriboBlends" Poster Presentation. National Organization for the Professional Advancement of Black Chemists and Chemical Engineers (NOBCChE) National Conference. November 2017. Minneapolis, MN.
- 8) Campbell, K.L., **Sidebottom, M.A.**, Junk, C.P., and Krick, B.A. "Exploring the Parameters and Wear Mechanisms of PEEK-PTFE based TriboBlends" Poster Presentation. Society of Tribologists and Lubrication Engineers. May 2017. Atlanta, GA.
- 7) Kolavonic, C.A, **Sidebottom, M.A.**, Junk, C.P., Burch, H.E., Blackman, and Krick, B.A. "PTFE-Alumina Composites: Effect of Particle Properties on Wear" Poster Presentation. Society of Tribologists and Lubrication Engineers. May 2017. Atlanta, GA. \*Won "Silver" award
- 6) **Sidebottom, M.A.**, Junk, C.P., Burch, H.E., Blackman, G.S., Salerno, H.S. and Krick, B.A. "Ultralow wear of PFA Composites and sub Tg relaxations within wear debris" Poster Presentation. Gordon Tribology Research Conference. June 2016. Lewiston, ME.
- 5) Smith, J.C., Curry, J.F., **Sidebottom, M.A.**, Krick, B.A., "Effects of Relative Motion on Friction and Wear: Unidirectional vs Reciprocating Rotary Contacts" Poster Presentation. Society of Tribologists and Lubrication Engineers. May 2016. Las Vegas, NV.
- 4) **Sidebottom, M.A.** and Krick, B.A. "Ultra Low Wear, Melt Processable Fluoropolymer Composites" Poster Presentation. Society of Plastics Engineers. October 2014. Bethlehem, PA.
- 3) **Sidebottom, M.A.** and Krick, B.A. "Numerical Wear Model of a Two-Material Composite Surface" Poster Presentation. Society of Tribologists and Lubrication Engineers. May 2014. Orlando, FL.
- 2) **Sidebottom, M.A.**, and Paliwal, M., "Influence of coupling stiffness on friction-induced squeak of Ceramic-on-Ceramic Hip Implants", Poster presentation, Orthopedic Research Society (ORS) 2013 ORS Annual Meeting, January 28-29, 2013, San Antonio, TX.

- 1) **Sidebottom, M.A.**, and Paliwal, M., "Design criteria for preventing friction-induced squeak of Ceramic-on-Ceramic Hip Implants", Poster presentation, Biomedical Engineering Society (BMES) 2011 Annual Meeting, October 12-15, 2011, Hartford, CT.

## Teaching Experience

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**Instructor**-Advanced Mechanics of Materials (MME 412/512, Miami University, Fall 2018, Spring 2019)- class focuses on advanced study of stress and strain, yield and failure criteria, torsion and bending of structural elements, thick-walled cylinders, spinning discs, energy methods, and buckling.

**New Faculty Teaching Enhancement Program**- Miami University, Fall 2018- program exposes new faculty at Miami to different teaching, evaluation, and course design methods as well as an introduction to the science of learning. As part of this program, all members were required to create a project for their class to enhance student learning.

### Before August 2018

**Co-Instructor**- Mechanical Engineering Elements (ME 252, Lehigh University) -focuses on the design of mechanical systems such as linkages, cams, and gears. Taught the course for 8 weeks while instructor was out with family emergency. Also developed a design project on fasteners and added a supplement to an existing design project for the class.

**Teaching Assistant**- Mechanical Engineering Lab 1 (ME 021, Lehigh University)- course focuses on calculation of uncertainties, sources of experimental error, data acquisition, and basic experimental tools such as strain gauges, thermocouples, and LVDTs.

**Guest Lecturer**- Integrated Product Development (ME 401, Lehigh University)-taught graduate level students about robust design and what methods have been developed to ensure the final product will perform as intended. These methods included the Taguchi Method of optimization.

**Teacher Development Series**- (Lehigh University) The lecture series is designed to help graduate students teach lectures and recitation hours. Topics include how to build a curriculum, craft an engaging presentation, and design writing assignments to facilitate learning for their students. Obtained Level I and II certification. Each level included six lectures on different aspects of teaching collegiate courses.

## Community Involvement and Outreach

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**Volunteer Coach, Miami University Cross Country and Track and Field (Fall-2018-present)**- assists Miami's Cross Country and Track and Field coaching staff at practice. Also helps advise student athletes on their training and/or their academic program.

### Before August 2018

**President, The College of NJ Cross Country and Track & Field Alumni Chapter (Spring 2015-Spring 2018)**- alumni chapter improves connections of all college's cross country and/or track and field programs alumni. The president helps his executive board organize fundraising events and promotes the current program.

**Volunteer Coach, Lehigh University Cross Country and Track and Field (Spring 2015-Spring 2018)**- assists Lehigh's head men's cross country coach at practice and meets. Also helps advise student athletes on their training and/or their academic program.

**American Society of Materials Materials Camp (Summer 2017)**- taught a group of 16 high school age students about the basics of friction and wear of materials. Concept of wear rate was taught by determining "How many licks does it takes to reach the center of a Tootsie ® Pop?".

**STLE STEM Camp (2014-2018)**- worked along academics and industry professionals to give quick tutorials about the importance of friction, wear, and lubrication. Example activities included repeating Leonardo Da Vinci's friction experiments and "How did the Egyptians Build the Pyramids".

## Professional Service

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## **Department Service**

**Governance Document Committee Member(Fall 2018-2019)**- Defined responsibilities and rules of operations for Miami University faculty & staff in the Mechanical and Manufacturing Engineering Department.

## **External Service (Outside Miami University)**

### **Reviewer**

**2018-Present**- Journal of Testing and Evaluation (ASTM)

**2018-Present**- Journal of Polymer Composites (SPE)

**2018-Present**- Tribology Letters

**2018-Present**- Wear

**2016-Present**- Tribology International

**2014-Present**- Tribology Transactions (STLE)

### **Professional Societies**

**2013-Present**- *Society of Tribologists and Lubrication Engineers*

-*Vice Paper Solicitation Chair, Materials Tribology Session, STLE Annual Meeting 2019*

-*Session Vice-Chair, Materials Tribology, STLE Annual Meeting 2018*

-*Session Chair, Materials Tribology, STLE Annual Meeting 2017*

-*Session Vice-Chair, Materials Tribology, STLE Annual Meeting 2016*

-*Session Vice-Chair, Materials Tribology, STLE Annual Meeting 2015*