

**MATTHEW BURGE**  
**Curriculum Vitae**

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**Academic Degrees**

2017 Ph.D. Fluid/Thermal Sciences, University at Buffalo (*Buffalo, New York*)  
2012 M.A. Teaching Physics, Stony Brook University (*Stony Brook, New York*)  
2011 M.S. Mechanical Engineering, University at Buffalo (*Buffalo, New York*)  
2007 B.S. Applied Physics, SUNY Geneseo (*Geneseo, New York*)  
2007 B.A. Mathematics, SUNY Geneseo (*Geneseo, New York*)

**Teaching Experience**

2016 -present Teaching Assistant Professor, University at Buffalo  
2013 - 2016 Undergraduate Course Instructor, University at Buffalo  
2013 - 2014 Teaching Assistant, University at Buffalo  
10 - 12/2012 Student Teaching at Walt Whitman High School (Honors and AP Physics)  
09 - 10/2012 Student Teaching at Brentwood South Middle School (General Science)  
2011 - 2012 Teaching Assistant, Stony Brook University

**Courses Taught**

*University at Buffalo*

MAE 339 Aerodynamics Laboratory (71 students)  
MAE 335 Fluid Mechanics (270 students)  
MAE 336 Heat Transfer (300 Students)  
MAE 499 Independent Study (12 students)  
MAE 498 Undergraduate Research & Creative Activity (3 students)  
MAE 277 Introduction to Mechanical Engineering Practice (160 students)  
MAE 231 Engineering Applications using MATLAB (10 students, Winter '14-'16)  
MAE 424 Aerodynamics Laboratory (TA, 96 students, Spring Semesters 2013-2014)

*SUNY Stony Brook*

PHY 123 Physics for Life Sciences Laboratory I (TA, 26 students, Summer 2012)  
PHY 134 Classical Physics Laboratory II (TA, 2 sections, 50 students, Spring 2012)  
PHY 252 Modern Physics Laboratory (TA, 20 students, Fall 2011)

**Honors, Awards, Grants & Fellowships**

MAE Ph.D. Teaching Fellow 2014 (Courses taught: MAE 336, Summer 2014)

**Employment History**

*University at Buffalo, Buffalo, New York (August 2016 – present)*

**Teaching Assistant Professor**

- Prepared notes and led lecture.
- Assigned homework and designed content examinations.
- Served on undergraduate excellence and diversity committee.
- Served as a faculty mentor for undergraduates with interest in research.

*University at Buffalo, Buffalo, New York (September 2013 – August 2016)*

**Research Assistant (Ph.D. thesis advisor: M. Ringette)**

- Ph. D. work investigating the relationship among vortex formation, and reduced pitching frequency for two-degree-of-freedom (2DOF) flapping wings in normal hover. Objective is to understand parametric effects on the 3D flow structures

- which influence flapping-wing propulsion via a simplified experimental model, to develop preliminary design guidelines for a micro-air vehicle.
- Designed a 3D-printed wing with an internal dye-delivery manifold as a novel approach to a dye-flow visualization experiment. Objective was to qualitatively observe the interactions of flow structures generated from each DOF during the unsteady stroke-reversal of a reciprocating and pitching flat plate under parametrically varied motions.
  - Developed a stereo digital particle image velocimetry (S-DPIV) system for a 2DOF flapping wing. Objective was to quantitatively study the effect of parametrically varied reduced pitching frequencies on the unsteady vortex formation during stroke-reversal to understand wing performance.

*University at Buffalo, Buffalo, New York (Winter 2014, 2015, 2016)*

**Instructor: MAE 231 Applications Using MATLAB**

- Developed a newly offered course as preparation for MAE 376, a MATLAB intensive course.
- Implemented the class in a computer laboratory setting as a combination of student mimicry of my code, individual practice and projects.
- Developed real-world themed projects to demonstrate the application of MATLAB as a practical tool.
- Topics included loops, logic, user interface, importing/exporting data, numerical curve fitting, custom functions, root finding and solving linear sets of ordinary differential equations.

*University at Buffalo, Buffalo, New York (Summer 2013, 2014)*

**Instructor: MAE 336 Heat Transfer**

- Prepared notes and led lecture introducing the fundamentals of heat transfer by conduction, convection and radiation.
- Assigned homework and designed content examinations.
- Position was funded by appointment as an MAE Ph.D. Teaching Fellow.

**Service History**

**Institution Service**

*Marshall for SEAS Commencement Ceremonies (May 2018)*

*'Impossible Engineering' Rocket Car Demonstration (September 2018)*

- Designed and fabricated a monopropellant rocket-powered cart on wheels.
- Demonstration was filmed on location for 'Impossible Engineering – The Real Iron Man Suit' (S05E05), and aired on the Discovery Science channel (01/31/19).
- Credit: School of Engineering & Applied Sciences, University at Buffalo, SUNY.

**Department Service**

*MAE Student Mentor (2017 - 2019)*

- Guest speaker for EAS 202
- Held Q&A session for incoming MAE freshmen.
- Held in-person meetings with assigned mentees.

#### *MAE Freshman Orientation (June 2018)*

- Held Q&A session for incoming MAE freshmen.

#### *Laboratory Upgrade Committee (2017 – 2019)*

- Restored the closed circuit water channel.
- Fabricated a cart to mount a 20-tube manometer bank.
- Investigated the drag coefficient on a new bluff body shape in the wind tunnel.
- Planned the (2018 – 2019) budget.
- Replaced the water channel's dye delivery system.
- Developed smoke streaklines to visualize aerodynamic stall in the wind tunnel.
- Developing new 2D heat conduction experiment measured with IR cameras.

#### *MAE Open House Tour of the Aerodynamics Lab (2017 – 2018)*

- Setup highly visual demonstrations of aerodynamic laboratory exercises (pressure profile along an airfoil in a wind tunnel using the manometer bank, multi-color dye visualization of vortex formation/shedding in the water channel, smoke visualization of a streamlined body in the wind tunnel) and trained undergraduates to setup and perform demonstrations.
- Trained undergraduate student assistants (Stephen Gagnon *October 2017*, Caitlin Mitchell *March 2018*, Seth Messer *April 2018*, Danielle Johnson *October 2018*) to operate laboratory equipment and run demonstrations for open house tour groups.

#### *WiSE Tour of MAE Teaching Labs (March 2018)*

- Co-lead the demonstration of highly visual demonstrations of aerodynamic laboratory exercises (pressure profile along an airfoil in a wind tunnel using the manometer bank, multi-color dye visualization of vortex formation/shedding in the water channel) with undergraduate assistant (Caitlin Mitchell) to a group of high school girls interested in pursuing education in STEM fields.

#### *Student Excellence and Diversity Committee (2016 – 2019)*

- Acting committee coordinator (2018 – 2019).
- Investigated causes of low enrollment of underrepresented groups and strategized efforts to improve enrollment.
- Organized annual awards ceremony recognizing outstanding MAE student achievement.

### **Community Service**

#### *Science is Elementary (2018)*

- Lead educational scientific demonstration with 2 undergraduate assistants at local high-needs elementary school.

#### *WiSE and TechPREP Mentor Program (2012)*

- Assisted in leading underrepresented middle school females in completing creative, engineering-type activities to promote interest of younger girls in the STEM fields.

### *Bay Scallop Bowl (2012)*

- Volunteered to judge and moderate a marine biology themed trivia contest held between high schools in Long Island.

### *Science Olympiad (2012)*

- Volunteered to judge a regional high school science and engineering competition.
- Responsible for scoring each entry and ensuring participants adhered to testing guidelines.

## **Research Supervision**

### *Undergraduates*

**Danielle Johnson**, Summer 2018, fabricated a new dye- reservoir/delivery system and dye-rakes for the water channel, developed smoke injection system to form streaklines used to visualize the streamlined flow past an airfoil in the wind tunnel, funded by the lab upgrade budget. Fall 2018, designed and fabricated an electro-mechanical ping-pong ball launcher as a model for a MAE499: Independent Study pilot course offered Spring 2019, lead tour of the Aerodynamics lab and presented demonstrations of smoke-visualization in the wind tunnel and dye-visualization in the water channel.

**Seth Messer**, Spring 2018, investigated the drag coefficient on a blunt-nose cone in support of the MAE339: Aerodynamics Laboratory class, lead tour of the Aerodynamics lab and presented demonstrations in the wind tunnel and dye-visualization in the water channel, funded by the MAE Zimmer Award. Summer 2018: began development on a new 2D heat conduction experiment using infrared cameras to compare to simulations, funded by the lab upgrade budget.

**Gavin Amos**, Fall 2018, designed, fabricated and tested a low-cost human-powered bicycle water pump to aid irrigation that can be produced with materials available to developing countries.

**Caitlin Mitchell**, Spring 2018, made further improvements/repairs to ELD water channel incurred during semester use, lead tour of the Aerodynamics lab and presented demonstrations in the wind tunnel and dye-visualization in the water channel, funded by the lab upgrade budget.

**Philip Lennon**, Summer 2017, restored the ELD water channel to an operational state for use in MAE339, funded by the lab upgrade budget.

## **Journal Papers**

**Burge, M.** and Ringuette, M.J. “The Effect of Pitch Phase and Rate on the Three-Dimensional Vortex Structure of a Flapping Wing in Hover.” *Experiments in Fluids*  
To be submitted.

## **Conference Presentations**

**Burge, M.** and Ringuette, M.J. “The Effect of Pitching Phase on the Vortex Circulation for a Flapping Wing During Stroke Reversal” 70<sup>th</sup> *APS Division of Fluid Dynamics*, Denver CO, 19-21 November 2017

**Burge, M.** and Ringuette, M.J. “Circulation Produced by a Flapping Wing During Stroke Reversal” 69<sup>th</sup> *APS Division of Fluid Dynamics*, Portland OR, 20-22 November 2016

**Burge, M.** Wysochanski, C. and Ringuette, M.J. “Vortex Loop Topology During the Stroke Reversal of a Flapping Wing” 68<sup>th</sup> *APS Division of Fluid Dynamics*, Boston MA, 22-24 November 2015

**Burge, M.** Favale, J. and Ringuette, M.J. “Flow Structure and Force Variation with Aspect Ratio for a Two-Degree-of-Freedom Flapping Wing” 67<sup>th</sup> *APS Division of Fluid Dynamics*, San Francisco, CA, 23-25 November 2014

### **Invited Talks**

“Vortex Loop Topology and Forces for Flapping Wing Stroke-Reversal.” Department of Physics, University of Maryland, College Park, May 24, 2016.