

Kenn Oldham  
Associate Professor  
Mechanical Engineering  
University of Michigan  
2380C G.G. Brown  
Office Phone: 734-615-6327  
Cell Phone: 734-358-5846  
oldham@umich.edu  
<https://microsystems.engin.umich.edu/>

## Education

PhD, 05/2006, Mechanical Engineering, University of California at Berkeley, Berkeley, CA, United States of America  
Title of Dissertation: Micro-devices for Vibration Suppression in Computer Hard Disk Drives  
Advisor: Roberto Horowitz

BS, 05/2000, Mechanical Engineering, Carnegie Mellon University, Pittsburgh, PA, United States of America

## Appointments

### Positions at U of M

1. Professor, Mechanical Engineering, University of Michigan - Ann Arbor, 09/2019 - Present
2. Associate Chair for Undergraduate Education, Mechanical Engineering, University of Michigan - Ann Arbor, 07/2017 - Present
3. Associate Professor, Mechanical Engineering, University of Michigan, Ann Arbor, MI, 09/2013 - 08/2019
4. Assistant Professor, Mechanical Engineering, University of Michigan, Ann Arbor, MI, 08/2007 - 08/2013

### Positions at other institutions or organizations

1. Visiting Scholar, Department of Mechanical Engineering, University of British Columbia, Vancouver, BC, Canada, 08/2014 - 12/2014
2. Post-Doctoral Fellow, Sensors and Electronic Devices Division, U.S. Army Research Laboratory, Adelphi, MD, United States of America, 07/2006 - 08/2007

## Honors and Awards

### International

1. Best Paper, Andrija Milojevic and Kenn Oldham, "Synthesis of Micro-robotic Appendages Considering Different Performance Properties," 2020 Conference on Microactuators and Micromechanisms, Ilmenau, Germany, 11/2020

### National or Local

1. NSF CAREER Award, 2010
2. DARPA Young Faculty Award, 2008

### Institutional

1. ORAU Post-Doctoral Fellow, 2006 - 2007
2. Berkeley ADEPT Fellow, 2005 - 2006

### Student Awards

1. Nominated, Best Student Paper, International Conference on Manipulation, Automation, and Robotics at Small-Scales: Ketul Patel, 2018
2. UM Mechanical Engineering RISE Best Paper Award, Fall 2015: Clark Teeple, 2015
3. Best Poster: Lurie Nanofabrication Facility User Symposium: Jongsoo Choi, 2013

## Teaching

### New courses introduced at U of M

### Major course revisions

Courses taught at U of M

<i>Course #</i>	<i>Course Title</i>	<i>Teaching Role</i>	<i>Term</i>	<i>Enrollment/ Response</i>
ME360	Modeling, Analysis, and Control of Dynamic Systems	Instructor	Fall 2020	67/15
ME360	Modeling, Analysis, and Control of Dynamic Systems	Instructor	Winter 2020	72/24
ME 395	Laboratory 1	Co-Instructor	Winter 2019	172/33
ME240	Dynamics and Vibration	Instructor	Winter 2017	18/10
ME395	Laboratory I	Co-Instructor	Fall 2016	97/25
ME240	Dynamics and Vibrarion	Instructor	Winter 2016	93/33
ME360	Modeling, Analysis, and Control of Dynamic Systems	Instructor	Winter 2016	90/37
ME395	Laboratory I	Co-Instructor	Fall 2015	110/28
ME561	Digital Control Systems	Instructor	Winter 2014	58/29
ME395	Laboratory I	Co-Instructor	Fall 2013	93/49
ME561	Digital Control Systems	Instructor	Winter 2013	41/20
ME395	Laboratory I	Co-Instructor	Fall 2012	109/36
ME395	Laboratory I	Co-Instructor	Fall 2011	66/25
ME561	Digital Control Systems	Instructor	Winter 2011	45/25
ME395	Laboratory I	Co-Instructor	Fall 2010	78/54
ME561	Digital Control Systems	Instructor	Winter 2010	49/34
ME360	Modeling, Analysis, and Control of Dynamic Systems	Instructor	Fall 2009	57/22
ME553	MEMS	Instructor	Winter 2009	14/5

Course #	Term	Enrollment/ Response	Q1	Q1631	Q1632	Q1633	Course Quality Avg. (Q1631, Q1632, Q1633)	Q2	Q199	Q217	Q230	Instructor Quality Avg. (Q199, Q217, Q230)	Q4	Q891
ME360	Fall 2020	67/15	4.3	4.8	4.4	4.8	4.67	4.8	4.9	4.9	4.9	4.90	3.3	2.6
ME360	Winter 2020	72/24	4.3	4.6	4.3	4.5	4.47	4.8	4.7	4.8	4.7	4.73	3.7	2.6
ME 395	Winter 2019	172/33	3.0	4.1	2.8	2.3	3.07	3.9					2.0	
ME240	Winter 2017	18/10	4.17					3.90					3.90	
ME395	Fall 2016	97/25	3.50					4.15					3.30	
ME240	Winter 2016	93/33	3.83					3.64					3.79	
ME360	Winter 2016	90/37	4.16					4.36					3.54	
ME395	Fall 2015	110/28	3.63					4.10					3.00	
ME561	Winter 2014	58/29	4.34					4.53					4.46	
ME395	Fall 2013	93/49	3.54					4.21					3.97	
ME561	Winter 2013	41/20	4.33					4.50					4.50	
ME395	Fall 2012	109/36	3.96					4.31					3.50	
ME395	Fall 2011	66/25	4.14					4.19					3.79	
ME561	Winter 2011	45/25	4.00					3.73					4.18	
ME395	Fall 2010	78/54	3.85					3.97					3.23	
ME561	Winter 2010	49/34	3.71					3.88					4.09	
ME360	Fall 2009	57/22	4.25					4.63					4.08	
ME553	Winter 2009	14/5	4.13					4.00					4.00	

Evaluations are on a 5 point scale where 5 is Strongly Agree and 1 is Strongly Disagree.

Q1. This was an excellent course.

Q1631. This course advanced my understanding of the subject matter.

Q1632. My interest in the subject has increased because of this course.

Q1633. I knew what was expected of me in this course.

Q2. The instructor was an excellent teacher.

Q199. The instructor explained material clearly.

Q217. The instructor treated students with respect.

Q230. The instructor seemed well prepared for class meetings.

Q4. I had a strong desire to take this course.

Q891. As compared with other courses of equal credit, the workload for this course was (5 = Much Lighter, 4 = Lighter, 3 = Typical, 2 = Heavier, 1 = Much Heavier).

#### **Courses taught at other institutions**

#### **Ph.D. committee activity (chair)**

1. Joonyoung Yu, 2024.  
Student Current Position: Current Ph.D. student
2. Tayebah Sahraeibelverdi, 2023.

Student Current Position: Current Ph.D. student

3. Mayur Birla, 2021.  
Student Current Position: Current PhD Student
4. Lu Wang, 2019, "Dynamics of Cardiovascular Monitoring with a Compliant, Non-Invasive Piezoelectric Sensor".  
Student Current Position: Research Fellow , Place of Employment: Michigan Medicine, Ann Arbor, MI, United States of America
5. Yi Chen, 2018, "Active Gyroscope Calibration with a Vibratory Piezoelectric Micro-Stage".  
Student Current Position: AI Engineer: Computer Vision , Place of Employment: Midea Emerging Technology Center
6. Kendall Teichert, 2017, "Integrated Power Systems for Autonomous Micro-Robots".  
Student Current Position: Assistant Professor , Place of Employment: Trine University, Angola, IN
7. Jinhong Qu, 2017, "Optimal Control and Trajectory Reconstruction for a Magnetoelastic Calibration Stage".  
Student Current Position: Engineer, Place of Employment: Apple, Inc., Cupertino, CA, United States of America
8. Jongsoo Choi, 2016, "Design, Fabrication, and Control of Large Displacement Multi-axis Piezoelectric Microactuators for Endoscopic Microscopy".  
Student Current Position: Engineer, Place of Employment: Vesper MEMS, Boston, MA
9. Jeong-Hoon Ryou, 2013, "Design of Efficient Locomotion for Piezoelectric Terrestrial Micro-Robots".  
Student Current Position: Principal Engineer, Place of Employment: Samsung, South Korea
10. Biju Edamana, 2012, "Optimal Low-Power Control Strategies for an Autonomous Piezoelectric Micro-Robot".  
Student Current Position: Control Design and Development Engineer , Place of Employment: General Motors, Warren, MA
11. Choong-Ho Rhee, 2012, "Design and Fabrication of Robust High Performance Piezoelectric Micro-Devices".  
Student Current Position: Senior Researcher , Place of Employment: Samsung, South Korea
12. Bongsu Hahn, 2012, "Energy Efficient Iterative Adaptive On-Off Control of Capacitively Loaded Actuators for Micro-Robots".  
Student Current Position: Assistant Professor , Place of Employment: Kyungil University, South Korea

#### **Ph.D. committee activity (co-chair)**

1. Tse-Shao Chang, 2023, Co-Chair/s: Thomas Wang.  
Student Current Position: Current Ph.D. student

#### **Ph.D. committee activity (member)**

1. Tong Li, 2022
2. Yi Zhu, 2022
3. Alison Hake, 2021
4. Hsueh-Tsung Lu, 2021
5. Amin Ghadami, 2020
6. Adegbenga Odofin, 2020
7. Christopher Boyd, 2019
8. Hao Lei, 2019
9. Jauching Lu, 2018
10. Molong Duan, 2018
11. Ali Darvishian, 2018
12. Wanyeong Jung, 2017
13. Mainak Mitra, 2017
14. Wubing Qu, 2017
15. Xiyu Duan, 2016
16. Vekatram Pepakayala, 2015
17. Zhen Qiu, 2014
18. Yejoong Kim, 2014
19. Jun Tang, 2014
20. Zhengzheng Wu, 2013
21. Hae-Won Park, 2012
22. Chulwoo Jung, 2012
23. Jung Hwan Seo, 2012
24. Daeyoon Kim, 2011
25. Robert Littrell, 2009
26. Steven Truxal, 2009

#### **M.S. students advised**

1. Joonyoung Yu, 2018 - 2019, Semi-automated alignment correction for a multi-photon endomicroscope
2. Tse-Shao Chang, 2017 - 2018, Large deformation of benders with low damping ratio in meso-scale to mimic behaviors in micro-scale
3. Buyi Zhang, 2017 - 2017, Sensing and control of micro-robot locomotion
4. Ketul Patel, 2017 - 2017, Design and rapid prototyping of miniaturized robots

5. Yingjie Cai, 2017 - 2017, Air pump control systems for piezoelectric arterial pulse sensors
6. Lingfan Liang, 2016 - 2017, Fabrication and dynamic modeling of small soft pneumatic actuators
7. Zahra Afkhami, 2016 - 2017, Large deflection dynamic modeling of thin-film piezoelectric and polymer cantilevers
8. Bingbing Wu, 2015 - 2016, Modular Design of Piezoelectric and Polymer Micro-Robot Appendages
9. Daniel Slavin, 2014 - 2015, Piezoelectric Cardiovascular Monitoring System
10. Urveen Puri, 2014 - 2014, Adaptive Control of Vertical Micro-robot Walking Gait
11. Andrew Kuo, 2013 - 2013, Miniature Piezoelectric Cardiovascular Monitor
12. Meng Dong, 2013 - 2013, Low-power Voltage Conversion and Control for a Piezoelectric Micro-Robot
13. Eric Sihite, 2011 - 2011, Simulation and Analysis of Adaptive On-Off Heating for House Heating and a Thermal Micro-Actuator
14. Wajjha Shahid, 2010 - 2012, Dynamics and Control of a Parametrically-Excited Micro-Mirror for Dual-Axes Confocal Endoscopy
15. Sung Tu Ho, 2010 - 2011, The Design of a Sliding Mode Controller for a Piezoelectric Microactuator with Saturation Constraints
16. Ryan Rudy, 2009 - 2010, Optimization of Layer Thicknesses for Improved Weight Bearing and Mobility of mm-Scale Ground Mobile Robotics
17. Peter Park, 2008 - 2008, Sensing Circuit for PZT Controller Testbed
18. Choong-Ho Rhee, 2007 - 2008, Design, Analysis, and Microfabrication of Micro-Robotic Leg Bearing and PDMS Joint Structure

#### **Co-Advised**

1. Marius Clad, 2010 - 2011, Design of an out-of-plane Micro-Joint Based on Piezoelectric Thin-Film Actuation
2. Johannes Domke, 2009 - 2010, Design and Optimization of a Large Stroke Z-Stage for Two Photon Endoscopic Imaging

#### **Undergraduate students advised**

1. Jiwen Chen, 2020, SURE: Modeling feedback dynamics in the arterial system
2. Seonyoung Han, 2020, RISE: Installing a cardiovascular sensor into new ring materials
3. Jimin Yang, 2020, RISE: Analysis of the relationship between brain pressure waveforms and artery parameters
4. Cameron Harris, 2020, RISE: Interpreting distorted capacitive sensing data from an endoscopy device
5. Nicholas Chan, 2020, RISE: Designing novel scanning patterns for laser scanning in endoscopy instruments
6. Aaron Youmans, 2020, RISE: Analyzing cardiovascular swine data for internal feedback relationships
7. Jason Smyth, 2019 - 2020, RISE: Microfluidic blood flow controller for Labyrinth device used to isolate circulating tumor cells
8. Congkai Shen, 2019, RISE: Design of underwater microrobots based on piezoelectric actuators
9. Junjie Luo, 2019, RISE: Modeling of underwater robots based on PZT actuator
10. Siyuan Yu, 2019, RISE: Wireless controller design for a walking robot
11. Jonathan Cathapermal, 2019, RISE: Modeling peripheral arterial flow in swine
12. Gage Smith, 2019, RISE: Piezoelectric headphone monitor for the temple
13. Miguel Erro Garza, 2019, SURE: Parameter estimation in simple cardiovascular model with reflection waves
14. Alexa Brzezinski, 2019, RISE: Traumatic brain injury sensing through MATLAB graphical analysis
15. Larissa Werners, 2019, RISE: Movement transitions on a curved-beam robot
16. Ari Levinson, 2019, RISE: Design analysis of piezoelectric actuators for micro-scale robots
17. Caroline Woody, 2019, RISE (co-chair): Optimizing a motor controller for an Interior Permanent Magnet Machine
18. Ki Yun Lee, 2018 - 2019, Designing and modeling of a milli-robot with bending legs
19. James Kennan, 2018, RISE: Optical sensor design and assembly for a traumatic brain injury hemodynamic sensor
20. Ki Yun Lee, 2018, RISE: Meso-scale prototyping and modeling of a micro-robot based on large deflection beam bending
21. Alvaro Visaguerre de Benito, 2018, Thesis: Arterial Ultrasound Analysis for Vascular Resistance Estimation
22. George Tsiрукis, 2017, RISE: Phantom for Piezoelectric Digital Artery Pressure Sensor Validation
23. Andrew Holmes, 2017, RISE: PVDF REM Sleep Sensor for Intensive Care
24. Issac Loo, 2017, RISE: Fixturing and Testing of Thin-Film Endomicroscopy Stages
25. Kritin Arya, 2017, RISE: Design and Prototyping of a Microrobot Power Conversion Circuit
26. Aaron Christenson, 2017, RISE: Characterization of Payload Vibrations in a Hexacopter Application
27. Eric Harding, 2017, RISE: Modeling micro mirror resonance given perturbations to design parameters
28. Danielle Park, 2016, RISE: Splint Design for a Piezoelectric Cardiovascular Sensor for Detecting Intradialytic Hypotension
29. Yudong Chen, 2016, RISE: Dynamic Modeling of a Highly-Compliant Piezoelectric Micro-Robot
30. Bo Tian, 2016, College of Engineering Honors Program: Circuit Design for a Portable PPG/Piezoelectric Peripheral Vascular Tone Monitor
31. Clark Teeple, 2015, RISE: 3D Printing for Prototypes of Thin-Film PZT/Polymer Microstructures
32. Nadim Bari, 2015, RISE: Modeling Micro Mirror Resonance given Perturbations to Design Parameters
33. Tong Zhang, 2008, Thesis: Simulation of Friction Effects on an Insect-Like Micro-Robot

#### **Mentoring activities involving post-doctoral scholars**

1. Training grant mentor, Sardar Ansari, Research Fellow, Emergency Medicine (advisor: Kayvan Najarian). I am serving as one of Dr. Ansari's mentors under a MICHR training grant, providing advice on dynamic modeling of piezoelectric sensing, 2014 - Present
2. Co-Advisor, Jeong Ryou, Research Fellow, University of Michigan / National Institute of Standards and Technology (co-advisor: Jason Gorman, NIST). I provided advice on dynamic modeling methods and parameter identification techniques for micro-electromechanical resonators being studied by Dr. Ryou at NIST in Gaithersburg, MD through a joint UM/NIST partnership, 2013 - 2016
3. Sponsor/Advisor, Minchul Shin, Research Fellow, Mechanical Engineering. Under my guidance, Dr. Shin studied the integration of thin-film piezoelectric materials with high-aspect ratio polymer micro-structures. Current position: Assistant Professor, Georgia Southern University, 2013 - 2014
4. Sponsor/Advisor, Biju Edamana, Research Fellow, Mechanical Engineering: Dr. Edamana studied novel control strategies and fundamental analysis of in situ calibration of MEMS inertial instruments using a novel piezoelectric 6-axis calibration stage, 06/2012 - 12/2012
5. Sponsor / Advisor, Choong-Ho Rhee, Research Fellow, Mechanical Engineering: Dr. Rhee completed a brief post-doctoral appointment in my laboratory to finish characterization of two novel multi-axis scanning actuators based on thin-film lead-zirconate-titanate (PZT) that he developed late in his doctoral studies, 06/2012 - 08/2012
6. Collaborator, Haijun Li, Research Fellow, Internal Medicine (advisor: Thomas Wang): I have been mentoring Dr. Liu on modeling and dynamics of micro-mirrors driven by parametric electrostatic resonance for use in endoscopic microscopy systems, 2011 - Present

#### **Short courses and workshops taught**

#### **Outreach directly related to teaching**

1. "Inner Engineering," University of Michigan XPlore Engineering Camp., 06/2017
2. "Inner Engineering," University of Michigan XPlore Engineering Camp, 06/2016
3. "Inner Engineering," University of Michigan XPlore Engineering Camp, 06/2015
4. "Forces, friction, and robot walking," outreach unit for Ypsilanti Community Middle School 8th grade science classroom, 2015
5. "Forces, friction, and robot walking," outreach unit for Ypsilanti Middle School 8th grade science classroom, 2013
6. "Micro-robots, biomimicry, and simple machines," outreach unit for Ypsilanti Middle School 8th grade science classroom, 04/2012

#### **Other (e.g., scholarly work in education)**

1. Advisor, volunteer undergraduate research assistant, Jiajie Qiu, 2020
2. Advisor, volunteer undergraduate research assistant, Dingkun Guo, 08/2019 - Present
3. Mentor, Visiting Scholar, Tayebah Sahraeibelverdi, 09/2018 - 08/2019
4. Advisor, graduate volunteer research assistant Nikhil Potu Surya Prakash, 2017 - 2018
5. Faculty Mentor, Summer Research Opportunities Program: Xinlu (Hermione) Li, "Swarm optimization of micro-robotic locomotion", 2017
6. Work Study Advisor for Joseph Tenbroek, 2017
7. Faculty Mentor, Undergraduate Research Opportunities Program: Vladimir Krokmal, "Modeling and CAD for piezoelectric-polymer actuation units", 2016 - 2017
8. Advisor, volunteer undergraduate research assistant Jiawei Zhang, 2016
9. Work Study Advisor for Clark Teeple, 2016
10. University of Michigan Whitaker Award: "Increasing and assessing technical argument integration into Mechanical Engineering ME395 laboratory 1 via writing workshops and report review," \$6,000, January 1, 2014 – December 31, 2015. PI: Oldham. Co-PI: Bowden, Rohan, Sick, 01/2014 - 12/2015
11. Work Study Advisor for Joseph Jang, 2014 - 2016
12. Faculty Mentor, National Nanotechnology Infrastructure Network (NNIN) Research Experience for Undergraduates (REU): Samantha Kang, University of Washington, "Fabrication and testing of permalloy microactuators for endomicroscopy", 2014
13. Work Study Advisor for Paul Barnes, 2013 - 2014
14. ME490 Undergraduate Independent Study Advisor: Daniel Slavin, "Testing and dynamic modeling of a piezoelectric calibration stage", 2013
15. Faculty Mentor, Summer Research Opportunities Program: Wenran Chen, "Circuit design and testing for a micro-robotic tactile sensor", 2013
16. Faculty Mentor, National Nanotechnology Infrastructure Network (NNIN) Research Experience for Undergraduates (REU): Joseph Rivas, Stony Brook University, "Deposition and characterization of a permalloy film", 2013
17. Work Study Advisor for Daniel Slavin, 2013
18. Faculty Mentor, Undergraduate Research Opportunities Program: Henrietta Cho, "Experimental testing of instrumented surgical needle", 2012 - 2013
19. Faculty Mentor, Undergraduate Research Opportunities Program: Kyle Liepelt, "Testing of piezoelectric actuators for microrobotics", 2012 - 2013
20. Faculty Mentor, Summer Undergraduate Research in Engineering: Carlos Casarez, University of Maryland, 2012
21. Faculty Mentor, Summer Research Opportunities Program: Adam Cohen, "Testing and analysis of a tactile sensor for a piezoelectric micro-robot", 2012
22. Faculty Mentor, National Nanotechnology Infrastructure Network (NNIN) Research Experience for Undergraduates (REU): Ramon Alonso, San Joaquin Delta College, "Characterization of critical release processes for thin-film piezoelectric micro-robots", 2012
23. Work Study Advisor for Christopher Kao, 2011 - 2013
24. ME490 Undergraduate Independent Study Advisor: Ran Lin, "MEMS surgical needle fixture and sensing circuit", 2011
25. ME490 Undergraduate Independent Study Advisor: Chengyun Hua, "Study of dry etch release process for a millipede micro-robot", 2010 - 2011
26. ME490 Undergraduate Independent Study Advisor: Jinhong Qu, "Modeling and layout of micro-robotic leg joints using high-aspect ratio polymer beams", 2010 - 2011
27. Faculty Mentor, Undergraduate Research Opportunities Program: Christopher Kao, "Design and testing of micro-robotic leg joints.", 2010 - 2011

28. ME490 Undergraduate Independent Study Advisor: Jongsoo Choi, "Mechanical modeling and simulation of micro-robot appendages", 2009 - 2010
29. ME490 Undergraduate Independent Study Advisor: Ryan Rudy, "Design of a tactile sensor for mm-scale ground-mobile robot", 2008 - 2009
30. Faculty Mentor, Undergraduate Research Opportunities Program: Christopher Smock, "Design and testing of micro-robotic leg joints", 2008 - 2009
31. Faculty Mentor, Undergraduate Research Opportunities Program: Shira Bennett, "Design and testing of micro-robotic leg-joint arrays", 2007 - 2008
32. Faculty Mentor, Undergraduate Research Opportunities Program: Paul Jones, "Modeling deflection of robotic leg joints subject to applied forces and moments", 2007 - 2008

## Research

### Research programs underway

#### 1. Robust, highly-mobile terrestrial micro-robots

The goal of this research is to increase mobility of small-scale autonomous terrestrial robots, particularly those based on microelectromechanical system (MEMS) technology. We are studying novel actuation and sensing mechanisms, opportunities for dynamic locomotion, and appropriate power and control strategies to enhance robot capability. Current focus areas include robust micro-robot fabrication, system design to maximize power source lifetime, integration of on-board sensing with dynamic locomotion gaits, and meso-scale prototyping methods. Focal research area of former Ph.D. students Bongsu Hahn, Biju Edamana, Kendall Teichert, and Jinhong Qu.

#### 2. Actuation and control for advanced endomicroscopy instruments.

The goal of this work is to develop and operate compact, high-performance laser scanning actuators in small diameter endomicroscopy tools. Our current focus is development of a two-photon endomicroscope based on thin-film piezoelectric axial scanning for real-time vertical cross-sectional imaging. Other instruments under development include single- and dual-axis confocal endomicroscopes. Scientific investigation includes derivation and analysis of large deflection micro-mirror dynamics based on various transduction mechanisms, including piezoelectric, electrostatic, electromagnetic, and electrothermal actuation, and design of novel sensing and control strategies to perform high accuracy motion tracking. Focal research area of former and current Ph.D. students Choong-Ho Rhee, Jongsoo Choi, Yi Chen, and Mayur Birla. Collaborative effort with Thomas D. Wang, UM Internal Medicine.

#### 3. Non-invasive measurement of hemodynamic compensation mechanisms

The goal of this research is to extract measurements of discrete hemodynamic compensation mechanisms, and model dynamic changes in compensation effectiveness among critical care patients and in response to medical interventions. We are using combined piezoelectric and optical sensing with local models for tissue dynamics to infer changes in arterial radius and other properties from peripheral arteries. This information is used alongside other conventional vital signs to develop both machine learning and model-based indicators for changes in cardiovascular function. Focal research area of Ph.D. student Lu Wang. Collaborative effort with K. Najarian and K.R. Ward, UM Emergency Medicine.

### Past grants and contracts

1. *Massey Foundation*, "Intracranial pressure monitor enhancement for cerebral hemodynamic monitoring," 07/2018 - 10/2019, Total: 104,433, K.R. Oldham (PI), M.H. Tiba (Co-PI), C. Williamson (Co-I), K.R. Ward (Co-I). Candidate's Share: 75,000.
2. *Coulter Foundation*, "Dynamic arterial morphology analysis for prediction of intradialytic hypotension," 09/2016 - 10/2017, Total: \$118,276, K. Oldham (PI), K. Ward (Co-PI), K. Najarian (Co-PI), M. Heung (Co-PI). Candidate's Share: \$50,000.
3. *University of Michigan MTRAC*, "Dynamic arterial morphology analysis for prediction of intradialytic hypotension," 05/2016 - 04/2017, Total: \$50,000, K. Ward (PI), K. Oldham (Co-PI), K. Najarian (Co-PI). Candidate's Share: \$23,000.
4. *National Science Foundation*, "Controller design for robust piezoelectric micro-robots in uncertain environments," 09/2014 - 08/2017, Total: \$299,999, K. Oldham (PI). Candidate's Share: \$299,999.
5. *National Institute for Standards and Technology*, "Optical measurement of electrostatic resonator dynamics," 09/2014 - 08/2016, Total: \$194,670, K. Oldham (PI), J. Gorman (Co-PI). Candidate's Share: \$194,670.
6. *UM MCIRCC*, "Non-invasive portable system for continuous monitoring of sepsis," 09/2014 - 02/2015, Total: Unknown, K. Najarian (PI), K. Oldham (Co-PI). Candidate's Share: \$25,000.
7. *University of Michigan MTRAC*, "A portable real-time monitoring system for detection of cardiovascular events," 03/2014 - 03/2015, Total: \$25,000, K. Najarian (PI), K. Oldham (Co-PI). Candidate's Share: \$17,000.
8. *University of Michigan Whitaker Fund*, "Increasing and assessing technical argument integration into Mechanical Engineering ME395 laboratory 1 via writing workshops and report review," 01/2014 - 12/2015, Total: \$6,000, K. Oldham (PI), T. Bowden (Co-PI), V. Sick (Co-PI). Candidate's Share: \$6,000.
9. *National Science Foundation*, "Robust Design and Control of Multi-Axis Thin-Film Piezoelectric Scanning Actuators for Deep-Tissue Endomicroscopy," 09/2013 - 08/2017, Total: \$249,991, K. Oldham (PI). Candidate's Share: \$249,991.
10. *National Institute for Standards and Technology*, "Dynamic Modeling and Characterization of Electrostatic, Electrothermal, and Graphene Resonators using Nanoscale-Motion Optical Measurements," 04/2013 - 04/2014, Total: \$95,140, K. Oldham (PI). Candidate's Share: \$95,140.
11. *National Science Foundation*, "NRI-Small: Robust, Highly-Mobile MEMS Micro-Robots based on Integration of Piezoelectric and Polymer Materials," 09/2012 - 08/2014, Total: \$195,195, K. Oldham (PI). Candidate's Share: \$195,195.
12. *Defense Advanced Research Projects Agency*, "Microsystem for Elimination of Rotation, Inertial and Timing Errors (MERITE)," 12/2011 - 12/2014, Total: \$2,673,897, K. Najafi (PI), K. Oldham (Co-PI), Y. Gianchandani (Co-PI). Candidate's Share: ~\$500,000.
13. *Defense Advanced Research Projects Agency*, "Rotary Actuation Technology for Tethered Rotary Stages," 09/2010 - 08/2011, Total: \$298,528, K. Najafi (PI), K. Oldham (Co-PI), Y. Gianchandani (Co-PI). Candidate's Share: \$85,963.
14. *Rackham Graduate School*, "Optimal Control of Micro-Robotic Power using Micromechanical Switches," 03/2010 - 05/2011, Total: \$26,771, K. Oldham (Co-PI). Candidate's Share: \$26,771.
15. *National Institutes of Health*, "Targeted Multi-Spectral Dual Axes Confocal Imaging of In Vivo Molecular Expression," 02/2010 - 12/2015, Total: \$3,413,743, T. Wang (PI), K. Kurabayashi (Co-PI), K. Oldham (Co-PI), G. Luker (Co-PI). Candidate's Share: ~\$600,000.
16. *National Science Foundation*, "CAREER: Power Optimization in Autonomous Microsystems via Integrated Motion Control," 02/2010 - 01/2015, Total: \$400,132, K. Oldham (PI). Candidate's Share: \$400,132.
17. *Michigan Institute for Clinical and Health Research*, "Novel Two-Photon Microscope Fluorescence System for Detection of Eosinophilic Disease," 02/2010 - 12/2010, Total: \$50,000, K. Oldham (PI), E. Wang (PI). Candidate's Share: \$25,000.
18. *University of Michigan Office of the Vice President for Research*, "Instrumented Needles for Surgical and Life Science Applications through MEMS Fabrication Processes," 06/2009 - 12/2009, Total: \$14,800, K. Oldham (PI). Candidate's Share: \$14,800.
19. *National Institutes of Health*, "In Vivo Detection of Neoplasia in the Digestive Tract," 09/2008 - 09/2013, Total: \$950,681, T. Wang (PI), K. Kurabayashi (Co-PI), A. Shih (Co-PI), E. Fearon (Co-PI), K. Oldham (Co-PI), R. Kwon (Co-PI). Candidate's Share: ~\$15,000.
20. *Defense Advanced Research Projects Agency*, "DARPA Young Faculty Award: Low Power Control of Piezoelectric Microactuators for Micro-Robotics," 04/2008 - 12/2009, Total: \$149,000, K. Oldham (PI). Candidate's Share: \$149,000.
21. *Army Research Office*, "Design, fabrication, and control of a bio-inspired terrestrial micro-robot based on piezoelectric actuation," 09/2007 - 09/2010, Total: \$160,000, K. Oldham (PI). Candidate's Share: \$160,000.

### Current grants and contracts

Kenn Oldham

1. *National Institutes of Health*, "Microsystems imaging system for epithelial-derived cancer heterogeneity," 09/2019 - 05/2024, Total: 2,903,555, Wang, T.D. (PI), Oldham, K.R. (Co-PI). Candidate's Share: 965,000.
2. *DARPA*, "Functional Small Scale Actuation with Origami Inspired Assemblages," 07/2018 - 07/2021, Total: \$500,000, E. Filipov (PI), K. Oldham (Co-PI). Candidate's Share: ~\$66,000.
3. *National Science Foundation*, "Modeling and identification of peripheral artery behavior using compliant wearable sensors," 07/2016 - 06/2020, Total: \$374,999, K. Oldham (PI), K. Najarian (Co-PI), K. Ward (Co-PI). Candidate's Share: \$225,000.
4. *National Institutes of Health*, "Multi-photon endomicroscope for real-time in vivo vertical sectioning," 07/2015 - 12/2020, Total: \$1,335,458, K. Oldham (PI), T.D. Wang (Co-PI). Candidate's Share: \$700,000.

### New research directions

1. **Hemodynamic compensation tracking with modified intracranial pressure monitors.**  
The goal of this research is to apply methods for extracting information on arterial dynamics from miniature piezoelectric and optical sensors to invasive measurements during traumatic brain injury (TBI). Successful implementation of sensors as enhancements to conventional intracranial pressure (ICP) monitors is expected to provide tracking of blood flow and autoregulatory arterial response after TBI interventions, to allow personalization of ICP targets. Collaborative work with C. Williamson, UM Neurology and Neuroscience, and M.H. Tiba and K.R. Ward, UM Emergency Medicine.
2. **Piezoelectrically-actuated origami MEMS**  
The goal of this research is to integrate thin-film piezoelectric microactuators with origami microelectromechanical system (MEMS) structures. We will use the high work density of thin-film piezoelectric materials to perform active excitation of folded micro-structures. Collaborative effort with E. Filipov, UM Civil and Environmental Engineering.
3. **Flow control for microfluidic cell trapping**  
The goal of this research is to develop compact, low-cost solutions for flow control in portable microfluidic devices, with primary application to capture of circulating tumor cells from blood. Collaborative work with S. Nagrath, UM Chemical Engineering.

### Pending grants and contracts

1. *National Institutes of Health*, "Bivalent fluorescence imaging methods for early detection of colorectal cancer," 08/2020, Total: \$2,670,258, T.D. Wang (PI), K.R. Oldham (Co-I), J.R. Spence (Co-I). Candidate's Share: \$35,000.
2. *National Institutes of Health*, "Critical care engineering training program (CCETP)," 05/2020, Total: \$2,215,971, K.R. Oldham (PI), K. Kurabayashi (Co-PI), K.R. Ward (Co-PI). Candidate's Share: TBD (sub-awards made by student application).

## Publications and Scholarly Presentations

### Full articles in refereed journals, transactions, or archives

1. Chen, Y., Lee, M., Birla, M.B., Li, H., Li, G., Duan, X., Wang, T.D., **Oldham, K.R.** "Motion estimation for a compact electrostatic micro-scanner via shared driving and sensing electrodes in endomicroscopy". *IEEE/ASME Transactions on Mechatronics*. 03/2020; 25(2): 661-672
2. Li, G., Duan, X., Lee, M., Birla, M., Chen, J., **Oldham, K.R.**, Wang, T.D., Li, H. "Ultra-compact microsystems-based confocal endomicroscope". *IEEE Transactions on Medical Imaging*. 02/2020; 39(7): 2406-2414
3. Yi Zhu, Mayur Birla, **Kenn Oldham**, Evgueni Filipov "Elastically and plastically foldable electro-thermal micro-origami for controllable and rapid shape morphing". *Advanced Functional Materials*. 2020; PP, Accepted, in press
4. M. Birla, X. Duan, H. Li, M. Lee, G. Li, T.D. Wang, **K. R. Oldham** "Mechanical phase identification from imaging feedback for a parametrically-resonant MEMS endomicroscopy scanner". *IEEE/ASME Transactions on Mechatronics*. 2020; PP, Accepted, in press
5. Ansari, S., Golbus, J.R., Tiba, M.H., McCracken, B., Wang, L., Aaronson, K.D., Ward, K.R., Najarian, K., **Oldham, K.R.** "Detection of low cardiac index using a polyvinylidene fluoride-based wearable ring and convolutional neural networks". *IEEE Sensors Journal*. 2020; PP, Accepted, in press
6. H. Li, P. Barnes\*, E. Harding\*, X. Duan, T.D. Wang, **K.R. Oldham** "Large-displacement vertical electrostatic microactuator dynamics using duty-cycled softening/stiffening parametric resonance". *Journal of Microelectromechanical Systems*. 04/2019; 28(3): 351-361
7. Chen, Y., Li, H., Qiu, Z., Wang, T.D., **Oldham, K.R.** "Improved extended Kalman filter estimation using threshold signal detection with a MEMS electrostatic micro-scanner". *IEEE Transactions on Industrial Electronics*. 2019; 67(2): 1328-1336
8. H. Li, **K.R. Oldham**, T.D. Wang "Three degree-of-freedom resonant scanner with full-circumferential range". *Optics Express*. 2019; 27(11): 16296-16307
9. Y. Chen, E.E. Aktakka, J.-K. Woo, K. Najafi, **K.R. Oldham** "On-chip capacitive sensing and tilting motion estimation of a micro-stage for in situ MEMS gyroscope calibration". *Mechatronics*. 2018, Accepted, in press
10. J. Qu, B. Zhang, **K.R. Oldham** "Design and analysis of varied gaits in elastic vibratory milli-robots". *International Journal of Intelligent Robotics and Applications*. 2018; 2: 400-412
11. G. Li, H. Li, X. Duan, Q. Zhou, **K. R. Oldham**, T.D. Wang "Visualizing epithelium molecular expression with optical sections in vertical plane using dual axes confocal microscope". *IEEE Transactions on Medical Imaging*. 2017; 36(7): 1482-1490
12. J. Choi, T. Wang, **K. Oldham** "Dynamics of thin-film piezoelectric microactuators with large vertical stroke subject to multi-axis coupling and fabrication asymmetries". *Journal of Micromechanics and Microengineering*. 2017; 28(1)
13. X. Duan, H. Li, F. Wang, X. Li, **K. R. Oldham**, T.D. Wang "Three-dimensional side-view endomicroscope for tracking individual cells in vivo". *Biomedical Optics Express*. 2017; 8(12): 5533-5545
14. K. Teichert, **K. Oldham** "Simulation of thin-film battery response to periodic loading by a transition matrix approximation using boundary and nonlinearity error analysis". *Journal of Energy Storage*. 2017; 14(1): 94-105
15. J. Qu, J. Choi, **K. R. Oldham** "Dynamics structural and contact modeling for a silicon hexapod microrobot". *ASME Journal of Mechanisms and Robotics*. 2017; 9(6): 2017
16. L. Wang, S. Ansari, D. Slavin\*, K. Ward, K. Najarian, **K. R. Oldham** "Non-invasive vascular resistance monitoring with a piezoelectric sensor and photoplethysmogram". *Sensors and Actuators A: Physical*. 2017; 263: 198-208
17. J. Choi, X. Duan, H. Li, T.D. Wang, **K. R. Oldham** "Multi-photon vertical cross-sectional imaging with a dynamically-balanced thin-film PZT z-axis microactuator". *Journal of Microelectromechanical Systems*. 2017; 26(5): 1018-1029
18. J. Qu, C.B. Teeple\*, **K. R. Oldham** "Modeling legged micro-robot locomotion based on contact dynamics and vibration in multiple modes and axes". *ASME Journal of Vibration and Acoustics*. 2017; 139(3): 031013



19. J. Choi, M. Shin, R. Q. Rudy\*, C. Kao\*, J. S. Pulskamp, R. G. Polcawich, **K. R. Oldham** "Thin-film piezoelectric and high-aspect ratio polymer leg mechanisms for millimeter-scale robotics". *International Journal of Intelligent Robotics and Applications* . 2017; 1(2): 180-194
20. X. Duan, H. Li, G. Li, **K. R. Oldham**, T. D. Wang "Axial beam scanning in multiphoton microscopy with MEMS-based actuator". *Optics Express*. 2017; 25(3): 2195-2205
21. K. Teichert, **K. R. Oldham** "Modeling cyclic capacitive loading of thin-film batteries". *Journal of the Electrochemical Society* . 2017; 164(2): A360-A369
22. H. Li, X. Duan, G. Li, **K. R. Oldham**, T.D. Wang "An electrostatic MEMS translational scanner with large out-of-plane stroke for remote axial-scanning in multi-photon microscopy". *Micromachines*. 2017; 8(5): 159
23. X. Duan, H. Li, J. Zhou, Q. Zhou, **K. R. Oldham**, T. D. Wang "Visualizing epithelial expression of EGFR in vivo with a distal scanning side-viewing confocal endomicroscope". *Scientific Reports*. 2016; 6(37315)
24. H. Li, X. Duan, Z. Qiu, Z. Quan, K. Kurabayashi, **K. R. Oldham**, T. D. Wang "Integrated monolithic 3D MEMS scanner for switchable real-time vertical/horizontal cross-sectional imaging". *Optics Express*. 2016
25. X. Duan, H. Li, Z. Qiu, B. P. Joshi, A. Pant, A. Smith, K. Kurabayashi, **K. R. Oldham**, T. D. Wang "MEMS-based multiphoton endomicroscope for repetitive imaging of mouse colon". *Biomedical Optics Express*. 2015; 6(8): 3074-3083
26. J. Qu, J. Tang, Y. Gianchandani, **K. R. Oldham**, S. R. Green "Dynamic modeling of a bidirectional magnetoelastic rotary micro-motor". *Sensors and Actuators A: Physical*. 2015; 223(1): 49-60
27. B. Edamana, Y. Chen, D. Slavin\*, E. E. Aktakka, **K. R. Oldham** "Estimation with threshold sensing for gyroscope calibration using a piezoelectric microstage". *IEEE Transactions on Control Systems Technology* . 2015; 23(5): 1943-1951
28. J. Choi, Z. Qiu, C.-H. Rhee, T. D. Wang, **K. R. Oldham** "A three-degree-of-freedom thin-film PZT-actuated microactuator with a large out-of-plane displacement". *Journal of Micromechanics and Microengineering* . 2014; 24(7): 075017
29. W. Shahid, X. Duan, Z. Qiu, H. Li, T. D. Wang, **K. R. Oldham** "Modeling, simulation, and control of a parametrically resonant micro-mirror with duty-cycled excitation". *IEEE Journal of Microelectromechanical Systems* . 2014; 23(6): 1440-1453
30. J.H. Ryou, **K. R. Oldham** "Dynamic characterization of contact interaction of micro-robotic leg structures". *Journal of Smart Materials and Structures* . 2014; 23(5): 055014
31. Z. Qiu, S. Khondee, X. Duan, H. Li, M. J. Mandella, B. P. Joshi, Q. Zhou, S.R. Owens, K. Kurabayashi, **K. R. Oldham**, T. D. Wang "Vertical cross-sectional imaging of colonic dysplasia in vivo with multi-spectral dual axes confocal endomicroscopy". *Gastroenterology*. 2014; 146(3): 615-617
32. Z. Qiu, C.-H. Rhee, J. Choi, T. D. Wang, **K. R. Oldham** "Large stroke vertical PZT microactuator with high-speed rotational scanning". *Journal of Microelectromechanical Systems*. 2014; 23(2): 256-258
33. B. Edamana, **K. R. Oldham** "A near-optimal sensor scheduling strategy for an on-off controller with an expensive sensor". *IEEE/ASME Transactions on Mechatronics*. 2014; 19(1): 158-170
34. B. Hahn, **K. R. Oldham** "Convergence and energy analysis for iterative adaptive On-Off control of piezoelectric microactuators". *IEEE Transactions on Control Systems Technology*. 2013; 23(3): 1052-1060
35. B. Edamana, **K. Oldham** "Optimal low-power piezoelectric actuator control with charge recovery for a micro-robotic leg". *IEEE/ASME Transactions on Mechatronics*. 2013; 18(1): 251-262
36. Z. Qiu, Z. Liu, X. Duan, B. Joshi, M. Mandella, **K. Oldham**, K. Kurabayashi, T. Wang "Targeted vertical cross-sectional imaging with handheld near-infrared dual axes confocal fluorescence microscope". *Biomedical Optics Express*. 2012; 4(1): 322-330
37. J. H. Ryou, **K. Oldham** "Model identification for impact dynamics of a piezoelectric microactuator". *Journal of Micromechanics and Microengineering* . 2012; 22(11)
38. C.H. Rhee, J. S. Pulskamp, R. G. Polcawich, **K. R. Oldham** "Multi-degree-of-freedom thin-Film PZT actuated micro-robotic leg". *IEEE Journal of Microelectromechanical Systems*. 2012; 21(6): 1492-1503
39. B. Hahn, **K. Oldham** "A model-free on-off iterative adaptive controller based on stochastic approximation". *IEEE Transactions on Control Systems Technology*. 2012; 20(1): 196-204
40. B. Hahn, **K. Oldham** "On-off iterative adaptive controller for low-power micro-robotic step regulation". *Asian Journal of Control*. 2012; 14(3): 624-640
41. J. F. Domke, C.-H. Rhee, Z. Liu, T. D. Wang, **K.R. Oldham** "Amplifying transmission and compact suspension for a low-profile, large displacement piezoelectric actuator". *Journal of Micromechanics and Microengineering* . 2011; 21(6): 067004
42. B. Edamana, B. Hahn, **K. Oldham** "Modeling and optimal low-power On-Off control of thin-film piezoelectric actuators". *IEEE/ASME Transactions on Mechatronics*. 2011; 16(5): 884-896
43. Z. Qiu, J. S. Pulskamp, X. Lin, C.-H. Rhee, T. Wang, R. G. Polcawich, **K. Oldham** "Large displacement vertical translational actuator based on piezoelectric thin-films". *Journal of Micromechanics and Microsystem Engineering* . 2010; 20(7): 075016
44. **K. Oldham**, J. Pulskamp, R. Polcawich, M. Dubey "Thin-film piezoelectric lateral actuators with extended stroke". *IEEE Journal of Microelectromechanical Systems*. 2008; 17(4): 890-899
45. **K. Oldham**, J. Pulskamp, R. Polcawich, P. Ranade, M. Dubey "Thin-film piezoelectric actuators for bio-inspired micro-robotic applications". *Integrated Ferroelectrics*. 2008; 95(1): 54-65
46. R. Horowitz, Y. Li, **K. Oldham**, S. Kon, X. Huang "Dual-stage servo systems and vibration compensation in computer hard disk drives". *Control Engineering Practice*. 2007; 15(3): 291-305
47. T.-L. Chen, Y. Li, **K. Oldham**, R. Horowitz "MEMS applications in computer disk drive dual-stage servo systems". *Japanese Society of Instrument & Control Engineers (Japan)*. 2002; 41(6): 412-420

#### Shorter communications, letters, notes or briefs in refereed publications

1. Gorman, J., **Oldham, K.R.**, M'Closkey, R.T. "Introduction to the special issue on MEMS dynamics and control". *Mechatronics*. 01/2020
2. S. Ansari, M.H. Tiba, **K. Oldham**, K.R. Ward, K. Najarian "Patterns of oxygen debt repayment during resuscitation of hemorrhage". *Circulation*. 2016; 134(S1): A19409
3. S. Ansari, D. Slavin, M.H. Tiba, H. Derksen, **K. Oldham**, K.R. Ward, K. Najarian "A novel portable polyvinylidene fluoride based sensor for hemorrhage". *Circulation*. 2015; 132(3): A18257
4. Z. Liu, N. Safdarian, **K. Oldham**, C. H. Rhee, E. T. Wang, T. D. Wang "Mo15331 two-photon excited fluorescence for in vivo detection of eosinophilic esophagitis". *Gastrointestinal Endoscopy*. 2011; 73(4): AB377

## Refereed conference or symposium proceedings papers

1. Milojevic, Andrija, **Oldham, Kenn** "Synthesis of Micro-Robotic Appendages Considering Different Performance Properties". *Microactuators, Microsensors, and Micromechanisms*, Ilmenau, Germany, 11/2020
2. **J. Yu, M. Birla, M. Lee, G. Li, H. Li, T.D. Wang, K.R. Oldham** "Estimating Perturbations to Laser Position on Tissue for Lissajous Scanning in Endomicroscopy". *IEEE/ASME International Conference on Advanced Intelligent Mechatronics*, Boston, MA, United States of America, 07/2020, Accepted, in press
3. **Smyth, J.\***, Smith, K., Nagrath, S., **Oldham, K.** "Modeling, Identification, and Flow Control for a Microfluidic Device using a Peristaltic Pump". *American Controls Conference*, Denver, CO, United States of America, 07/2020, Accepted, in press
4. **Wang, L.**, Ansari, S., **Cai, Y.**, Ward, K.R., Najarian, K., **Oldham, K.R.** "Modeling peripheral artery behavior beneath a non-invasive wearabel sensor subject to varying outside pressure". *ASME Dynamic Systems and Controls Conference*, Park City, UT, United States of America, 10/2019, Accepted, in press
5. A. Milojevic, **V. Krokhamal\***, **B. Wu, K. Oldham** "Topology optimization of micro-robotic appendages combining piezoelectric, polymer, and silicon beams". *International Conference on Manipulation, Automation and Robotics at Small-Scales*, Helsinki, Finland, 07/2019, Accepted, in press
6. **Lee, K.Y.\***, **Qu, J., Wang, L., Oldham, K.** "Milli-scale biped vibratory water strider". *Internagional Conference on Manipulation, Automation, and Robotics at Small Scales*, Helsinki, Finland, 07/2019, Accepted, in press
7. **Wang, L.**, Ansari, S., Najarian, K., Ward, K.R., **Oldham, K.R.** "Decompensation prediction in hemodialysis by a feedback model as identified by miniature wearable sensors". *IEEE/ASME International Conference on Advanced Intelligent Mechatronics*, Hong Kong, China, 07/2019, Accepted, in press
8. **K. Teichert, K. Oldham** "Solid-state battery modeling case studies for the analysis of a micro-robot power system". *ASME Dynamic Systems and Control Conference*, Atlanta, GA, United States of America, 10/2018
9. **L. Wang, S. Ansari, K.R. Ward, K. Najarian, K.R. Oldham** "Identification of compensatory arterial dynamics in swine using a non-invasive sensor for local vascular resistance". *ASME Dynamic Systems and Control Conference*, Atlanta, GA, United States of America, 10/2018
10. **N.P. Surya Prakash, K.R. Oldham** "Modeling large deformation impact dynamics for legged microrobot locomotion: A preliminary formulation". *ASME International Design Engineering Technical Conferences*, Quebec City, QC, Canada, 08/2018
11. **K. Patel, J. Qu, K.R. Oldham** "Tilted leg design for a rapid-prototyped low-voltage piezoelectric running robot". *International Conference on Manipulation, Automation, and Robotics at Small Scales*, Nagoya, Japan, 07/2018
12. **J. Qu, C.B. Teeple\*, B. Zhang, K.R. Oldham** "Passive steering of miniature walking robot using the non-uniformity of robot structure". *International Conference on Manipulation, Automation and Robotics at Small Scales*, Nagoya, Japan, 07/2018
13. **Y. Chen, E.E. Aktakka, J.-K. Woo, K. Najafi, K. Oldham** "Error contributions during MEMS gyroscope calibration by chip-scale micro-stage with capacitive motion sensor". *IEEE Advanced Intelligent Mechatronics*, Auckland, New Zealand, 07/2018
14. **B. Zhang, J. Qu, K.R. Oldham** "Experimental evaluation of piezoelectric self-sensing during terrestrial locomotion of a miniature legged robot". *IEEE/ASME International Conference on Advanced Intelligent Mechatronics*, Auckland, New Zealand, 07/2018
15. **J. Qu, X.H. Li\*, K.R. Oldham** "Clustered optimization of a small-scale robot swarm with minimal on-board sensing". *American Control Conference*, Milwaukee, WI, United States of America, 06/2018
16. S. Ansari, S. Molaei, **K. Oldham**, M. Heung, K. E. Ward, K. Najarian "A Kalman filter approach with state inequality constraints for real-time prediction of intradialytic hypotension using a PVDF sensor". *39th Annual International Conference of the IEEE Engineering in Medicine & Biology Society*, JeJu Island, South Korea, 07/2017, (Journal Quality)
17. **J. Zhang\*, C.B. Teeple\*, J. Choi, J.E. Rivas\*, S. Kang\*, K.R. Oldham** "Design, fabrication, and dynamics of an electromagnetic microactuator for endomicroscopy". *IEEE Advanced Intelligent Mechatronics*, Munich, Germany, 07/2017
18. **J. Qu, C.B. Teeple\*, K.R. Oldham** "Dynamics of millimeter-scale hexapod microrobotics with PZT-polymer micro-actuators". *IEEE Advanced Intelligent Mechatronics*, Munich, Germany, 07/2017
19. **L. Wang, S. Ansari, K. Najarian, K. R. Ward, K. R. Oldham** "Estimation of peripheral artery radius using non-invasive sensor and Kalman filtering of local dynamics". *American Controls Conference*, TBA, United States of America, 05/2017
20. **J. Qu, K. R. Oldham** "Multiple-mode dynamic model for piezoelectric micro-robot walking". *ASME International Design Exposition and Technical Conferences*, Charlotte, NC, 08/2016
21. **K. Teichert, K. R. Oldham** "Dynamics and characteristics of thin-film batteries cycled over capacitive load". *Proceedings of IEEE International Conference on Advanced Intelligent Mechatronics*, Banff, AB, Canada, 07/2016
22. **Y. Chen, E. E. Aktakka, J.-K. Woo, K. Oldham** "Threshold sensing signal construction from a capacitive sensor for MEMS gyroscope calibration". *Proceedings of IEEE International Conference on Advanced Intelligent Mechatronics*, Banff, AB, Canada, 07/2016
23. **J. Qu, K. Oldham** "Estimators for micro-robot leg dynamics with uncertain jump conditions and infrequent sampling". *Proceedings of 2016 American Controls Conference*, Boston, MA, 07/2016
24. **Y. Chen, K. Oldham** "Kalman filter estimation with edge detection-based hybrid sensing". *Proceedings of 2016 American Controls Conference*, Boston, MA, 07/2016
25. S. Ansari, N. Farzaneh, M. Heung, **K. R. Oldham**, H. Derksen, K. R. Ward, K. Najarian "Real-time detection of intradialytic hypotension using a novel polyvinylidene fluoride based sensor". *IEEE-EMBS International Conference on Biomedical and Health Informatics*, Las Vegas, NV, 02/2016, (Journal Quality)
26. **C.-H. Rhee, Z. Qiu, J. Choi, T. D. Wang, K. R. Oldham** "Dynamics of thin-film piezoelectric scanning actuator". *ASME International Design Exposition and Technical Conferences*, Boston, MA, 08/2015
27. **J. Choi, R. Lin\*, H. Cho\*, C.-H. Rhee, K. R. Oldham** "Instrumentation of steel syringe needles with shadow-masked thin-films". *Proceedings of the ASME International Design Engineering Technical Conferences*, Buffalo, NY, 08/2014
28. M. Shin, **J. Choi, R. Q. Rudy\*, C. Kao\***, J. S. Pulskamp, R. G. Polcawich, **K. R. Oldham** "Micro-robotic actuation units based on thin-film piezoelectric and high-aspect ratio polymer structures". *Proceedings of the ASME International Design Engineering Technical Conferences*, Buffalo, NY, 08/2014
29. Z. Qiu, C.-H. Rhee, J. Choi, T. D. Wang, **K. R. Oldham** "Thin-film PZT based monolithic translational/tilt microscanner for vertical cross sectional imaging with dual axes confocal endomicroscope". *Proceedings of Hilton Head Conference on MEMS*, Hilton Head, SC, 06/2014
30. H. Li, **Z. Qiu, K. R. Oldham**, K. Kurabayashi, T. D. Wang "2D resonant microscanner for dual-axes confocal fluorescence microscopy". *IEEE International Conference on Micro Electro Mechanical Systems (MEMS 2014)*, San Francisco, CA, 01/2014
31. **J. Qu, K. R. Oldham** "Position estimation for a capacitively-sensed magnetoelastic rotary microstage using an extended Kalman smoother". *Proceedings of the American Controls Conference*, Portland, OR, 2014
32. **B. Edamana, D. Slavin\***, E. E. Aktakka, K. Najafi, **K. R. Oldham** "Control and estimation with threshold sensing for inertial measurement unit

- calibration using a piezoelectric microstage". *Proceedings of the American Controls Conference*, Portland, OR, 2014
33. **B. Edamana, K. Oldham** "An iterative learning controller for high-precision calibration of an inertial measurement unit using a piezoelectric platform". *Proceedings of the ASME Dynamic Systems and Control Conference*, Stanford, CA, 10/2013
  34. **J. Choi, C.-H. Rhee, Z. Qiu, T. Wang, K. Oldham** "Static and dynamic modeling of a multi-axis thin-film piezoelectric micro-actuator". *Proceedings of the ASME Dynamic Systems and Control Conference*, Stanford, CA, 10/2013
  35. **R. Rudy\*, A. J. Cohen\***, J. S. Pulskamp, R. G. Polcawich, **K. R. Oldham** "Antenna-like tactile sensor for thin-film piezoelectric micro-robots". *Proceedings of the 2013 ASME International Design Exposition and Technical Congress*, Portland, OR, 08/2013
  36. **C. S. Casarez\*, J. H. Ryou, K. R. Oldham** "Dimensional analysis of dynamic MEMS micro-robotic walking subject to orthogonal actuation and small-scale forces". *Proceedings of the 2013 ASME International Design Exposition and Technical Congress*, Portland, OR, 08/2013
  37. **W. Shahid, Z. Qiu, X. Duan, H. Li, T. D. Wang, K. R. Oldham** "Modeling and simulation of a parametrically-excited micro-mirror with duty-cycled square-wave excitation". *Proceedings of the 2013 ASME International Design Exposition and Technical Congress*, Portland, OR, 08/2013
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  39. **B. Hahn, K. R. Oldham** "Sensing strategies to reduce Power Consumption of Recursive Least Squares Parameter Identification of Autonomous Microsystems". *Proceedings of the 2013 American Controls Conference*, Washington, DC, 07/2013
  40. **E. N. Sihite, Z. Qiu, K. R. Oldham** "Modeling and control of optical fiber micropositioning in a thermal adhesive". *Proceedings of the 2013 American Controls Conference*, Washington, DC, 07/2013
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  42. **B. Hahn, K. Oldham** "Convergence time estimation for iterative adaptive on-off control of a micro-robotic leg". *Proceedings of ASME Dynamic Systems and Control Conference*, Fort Lauderdale, FL, 10/2012
  43. **J. H. Ryou, K. Oldham** "System identification of contact dynamics for a piezoelectric microactuator". *Proceedings of ASME Dynamic Systems and Control Conference*, Fort Lauderdale, FL, 10/2012
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  45. **J.-H. Ryou, K. Oldham** "Foot-terrain interaction for a prototype silicon micro-robot". *Proceedings of ASME Dynamic Systems and Control Conference*, Arlington, VA, 10/2011
  46. **K. Oldham, B. Edamana, B. Hahn** "Coordinated voltage conversion and low-power micro-actuator switching". *Proceedings of ASME Dynamic Systems and Control Conference*, Arlington, VA, 10/2011
  47. **B. Edamana, K. Oldham** "Optimal on-off Controller with charge recovery for thin-film piezoelectric actuators for an autonomous mobile micro-robot". *Proceeding of the American Controls Conference*, San Francisco, CA, 07/2011
  48. **C.-H. Rhee, K. Oldham** "Robust finite-duration transient response of micro-electromechanical system". *Proceeding of the American Controls Conference*, San Francisco, CA, 07/2011
  49. **C.-H. Rhee, K. Oldham** "Robust design of a micro-electromechanical system in the presence of assembly uncertainty,". *Proceedings of the ASME Dynamic Systems and Control Conference*, Boston, MA, 10/2010
  50. **J. Ryou, K. Oldham** "Simulation study and experimental testing of foot-terrain dynamics in piezoelectric micro-robots". *Proceedings of the ASME Dynamic Systems and Control Conference*, Boston, MA, 10/2010
  51. **K. Oldham, Z. Qiu, X. Lin, J. S. Pulskamp, R. G. Polcawich** "Dynamics, sensing, and control of a thin-film piezoelectric vertical micro-stage". *Proceedings of the ASME Dynamic Systems and Control Conference*, Boston, MA, 10/2010
  52. **B. Hahn, K. Oldham** "A model-free on-off iterative adaptive controller based on stochastic approximation". *Proceedings of the American Controls Conference*, Baltimore, MD, 07/2010
  53. **B. Hahn, K. Oldham** "Model-free adaptive on-off step controller for piezoelectric micro-robotics". *Proceedings of the ASME Dynamic Systems and Control Conference*, Los Angeles, CA, 10/2009
  54. **J. Pulskamp, R. Polcawich, K. Oldham** "Millimeter-scale robotics research at the army research laboratory". *Proceedings of the ASME 2009 International Design Engineering Technical Conference*, San Diego, CA, 08/2009
  55. **K. Oldham, C.-H. Rhee, J.-H. Ryou, R. Polcawich, J. Pulskamp** "Lateral thin-film piezoelectric actuators for micro-robotic locomotion". *Proceedings of the ASME 2009 International Design Engineering Technical Conference*, San Diego, CA, 08/2009
  56. **K. Oldham, B. Edamana, B. Hahn** "Low-power control strategies for thin-film piezoelectric micro-robotic actuators". *Proceedings of the ASME Smart Materials, Adaptive Structures, and Intelligent Systems Conference*, Oxnard, CA, 08/2009
  57. **B. Edamana, K. Oldham** "An optimal on-off controller with switching costs using non-linear binary programming". *Proceedings of the American Controls Conference*, St. Louis, MO, 06/2009
  58. **K. Oldham, B. Hahn, B. Edamana, J. Pulskamp, R. Polcawich** "Low-power switching control schemes for piezoelectric micro-robotic actuators". *Proceedings of the ASME Smart Materials, Adaptive Structures and Intelligent Systems*, Ellicott City, MD, 10/2008
  59. **K. Oldham, B. Hahn, P. Park** "On-off control for low-power servo control in piezoelectric micro-robotics". *Proceedings of the ASME 2008 Dynamic Systems and Control Conference*, Ann Arbor, MI, 10/2008
  60. **K. Oldham, S. Felix, R. Conway, R. Horowitz** "Design and control of a dual-stage disk drive servo system with a high-aspect ratio electrostatic microactuator". *Proceedings of the 2008 American Controls Conference*, Seattle, WA, 07/2008
  61. **S. Kon, K. Oldham, R. Horowitz** "Piezoresistive and piezoelectric MEMS strain sensors for vibration detection". *Proceedings of the SPIE Conference on Sensors and Smart Structures*, San Diego, CA, 02/2007
  62. **K. Oldham, X. Huang, R. Horowitz** "Design, fabrication, and control of a high-aspect ratio microactuator for vibration suppression in a hard disk drive". *Proceedings of the 16th IFAC World Congress*, Prague, Czech Republic, 07/2006
  63. **S. Kon, K. Oldham, R. Ruzicka, R. Horowitz** "Design and fabrication of a piezoelectric instrumented suspension for hard disk drives". *Proceedings of the SPIE Smart Structures & Materials Conference*, San Diego, CA, 03/2006
  64. **R. Horowitz, Y. Li, K. Oldham, S. Kon, X. Huang** "Dual-stage servo systems and vibration compensation in computer hard disk drives". *Proceedings of the 3rd IFAC Symposium on Mechatronic Systems*, Sydney, Australia, 09/2004
  65. **K. Oldham, S. Kon, R. Horowitz** "Fabrication and optimal strain sensor placement in an instrumented disk drive suspension for vibration suppression". *Proceedings of the 2004 American Control Conference*, Boston, MA, 06/2004
  66. **T.-L. Chen, K. Oldham, Y. Li, R. Horowitz** "Suspension vibration compensation using a MEMS microactuator in hard disk drives". *Proceedings of the*

**Refereed conference summaries or abstracts**

1. E.T. Filipov, Y. Zhu, M. Birla, **K.R. Oldham**, "A simulation framework for the design and fabrication of functional micro-origami", *ASME International Mechanical Engineering Congress and Exposition*, 11/2020
2. S. Ansari, J.R. Golbus, K.D. Aaronson, B.K. Nallamotheu, **K.R. Oldham**, K.R. Ward, J. Gryak, K. Najarian, "Stratification of cardiac index using a novel non-invasive ring and deep learning", *American Heart Association Scientific Sessions*, Chicago, IL, United States of America, 11/2018, Accepted, in press
3. **Z. Afkhami**, **J. Choi**, **J. Jang\***, **K. Liepelt\***, **K.R. Oldham**, "Large deflection dynamics of multi-layer piezoelectric microbeam with piezoelectric gain nonlinearity and parylene-C coating", *ASME International Design Engineering Technical Conferences*, Cleveland, OH, United States of America, 08/2017
4. **J. Choi**, **J. Qu**, **M. Birla**, **K.R. Oldham**, "Integrated PZT-polymer microstructures for micro-robotic applications", *International Conference on Manipulation, Automation and Robotics at Small Scales*, Montreal, QC, Canada, 08/2017
5. X. Duan, H. Li, G. Li, X. Li, **K.R. Oldham**, T.D. Wang, "MEMS based side-view confocal endomicroscope for switchable horizontal and oblique plane imaging", *SPIE Photonics West*, San Francisco, CA, 02/2017
6. G. Li, H. Li, X. Duan, Q. Zhou, **K.R. Oldham**, T.D. Wang, "Targeted sections in either xy or xz plane with dual axes confocal endomicroscope", *SPIE Photonics West*, San Francisco, CA, 02/2017
7. M. Lee, G. Li, H. Li, X. Duan, J. Lee, **K. Oldham**, T.D. Wang, "Dual-axis confocal microscopy: In vivo near-infrared imaging and identification of rat colon epithelial gaps", *SPIE Photonics West*, San Francisco, CA, 02/2017
8. **J. Choi**, X. Duan, H. Li, T.D. Wang, **K.R. Oldham**, "Resonant-mode dynamics of a large displacement thin-film piezoelectric microactuator for endomicroscopy", *ASME International Design Engineering Technical Conferences*, Cleveland, OH, 2017
9. S. Ansari, M.H. Tiba, **K. Oldham**, K.R. Ward, K. Najarian, "Noninvasive peripheral vascular resistance measured by a polyvinylidene fluoride sensor identifies patterns of oxygen debt repayment during resuscitation after hemorrhage", *AHA Resuscitation Science Symposium*, New Orleans, LA, 11/2016
10. S. Ansari, L. Wang, **K. Oldham**, K. Ward, K. Najarian, "Hemorrhage control & resuscitation – a portable non-invasive polyvinylidene fluoride based sensor for detection of hemorrhage", *Military Health System Research Symposium*, Orlando, FL, 08/2016
11. X. Duan, H. Li, A. Pant, G. Li, **K.R. Oldham**, T.D. Wang, "MEMS based side-viewing confocal endomicroscope for vertical/horizontal cross-sectional imaging", *Biomedical Optics Congress*, Orlando, FL, 05/2016
12. **J. Choi**, **Z. Qiu**, **C.H. Rhee**, T.D. Wang, **K.R. Oldham**, "A novel piezoelectric microstage with embedded sensor for dual axes confocal endomicroscopy", *SPIE Photonics West*, San Francisco, CA, 02/2016
13. **J. Jang\***, **K. Liepelt\***, **J. Choi**, **K. R. Oldham**, "Influence of material nonlinearities on dynamics of integrated thin-film lead-zirconate-titanate and parylene microstructures", *ASME International Design Exposition and Technical Conferences*, 2016
14. S. Ansari, D.F. Slavin, H. Tiba, H. Derksen, K. Ward, **K. Oldham**, K. Najarian, "A novel portable polyvinylidene fluoride based sensor for detection of hemorrhage", *American Heart Association Resuscitation Science Symposium*, Orlando, FL, 11/2015
15. **J.H. Ryou**, **K.R. Oldham**, "Foot-terrain impact modeling for a silicon micro-robot", *2015 ASME International Design Exposition and Technical Conferences*, Boston, MA, 08/2015
16. X. Duan, H. Li, Z. Qiu, B.P. Joshi, A. Pant, K. Kurabayashi, **K.R. Oldham**, T.D. Wang, "MEMS-based handheld multiphoton endomicroscope for in vivo imaging", *Photonics West*, San Francisco, CA, 02/2015
17. **Z. Qiu**, X. Duan, B. Joshi, M. Mandella, **K. Oldham**, K. Kurabayashi, T. Wang, "Targeted vertical cross-sectional imaging with a near-infrared dual axes confocal fluorescence endomicroscope", *Digestive Disease Week*, Orlando, FL, 05/2013
18. **J. Choi**, **Z. Qiu**, **C.-H. Rhee**, J.S. Pulskamp, R.G. Polcawich, **K.R. Oldham**, "Thin-film piezoelectric actuators for into-tissue scanning of an endoscope-compatible confocal microscope", *PiezoMEMS*, Washington, DC, 05/2013
19. **J.H. Ryou**, **C.-H. Rhee**, **J. Choi**, J.S. Pulskamp, R.G. Polcawich, **K.R. Oldham**, "Terrestrial micro-robots actuated by piezoelectric thin-films", *PiezoMEMS*, Washington, DC, 05/2013
20. H. Li, **Z. Qiu**, X. Duan, W. Shahid, **K.R. Oldham**, K. Kurabayashi, T.T. Wang, "Developing a compact 2-D MEMS mirror chip for a dual-axes confocal microendoscope", *Photonics West*, San Francisco, CA, 02/2013
21. C.H. Rhee, Z. Qiu, J. Choi, T.D. Wang, **K.R. Oldham**, "Thin-film PZT actuated vertical translational micro-mirror", *Photonics West*, San Francisco, CA, 02/2013
22. J.H. Ryou, C.H. Rhee, J.S. Pulskamp, R.G. Polcawich, **K.R. Oldham**, "Locomotion Development for Terrestrial Micro-Robots Actuated by Piezoelectric Thin-Films", *2012 International Workshop on Acoustic Transduction, Materials, and Devices*, State College, PA, United States of America, 05/2012
23. H. Li, Z. Qiu, Z. Liu, C.H. Rhee, **K. Oldham**, K. Kurabayashi, T.D. Wang, "2D Resonant In-Plane MEMS Scanner for Dual-Axes Confocal Microendoscope", *Photonics West*, San Francisco, CA, United States of America, 2012
24. Z. Qiu, Z. Liu, C.H. Rhee, H. Li, **K. Oldham**, K. Kurabayashi, T.D. Wang, "Vertical cross-sectional imaging by handheld dual-axes confocal microscope", *Photonics West*, San Francisco, CA, United States of America, 2012
25. J. Choi, Z. Qiu, C.H. Rhee, J.S. Pulskamp, R.G. Polcawich, **K.R. Oldham**, "Thin-film Piezoelectric Actuators for Into-Tissue Scanning of an Endoscope Compatible Dual-Axes Confocal Microscope", *2011 International Workshop on Acoustic Transduction, Materials, and Devices*, State College, PA, United States of America, 05/2011
26. **K.R. Oldham**, C.H. Rhee, Z. Qiu, J. Domke, J.S. Pulskamp, R.G. Polcawich, "Large Displacement Piezoelectric Actuators for Into-Tissue Scanning in Endoscopic Microscopy", *2011 International Workshop on Acoustic Transduction, Materials, and Devices*, State College, PA, United States of America, 05/2011
27. **K.R. Oldham**, B. Edamana, B. Hahn, J.H. Ryou, J.S. Pulskamp, R.G. Polcawich, "Ultra-low Power Control Strategies for Thin-Film Piezoelectric Micro-robotic Actuators", *2011 International Workshop on Acoustic Transduction, Materials, and Devices*, State College, PA, United States of America, 2011
28. **K. Oldham**, B. Edamana, B. Hahn, C.H. Rhee, J.H. Ryou, R.G. Polcawich, J.S. Pulskamp, "Ultra-low Power Control and Energy Management Strategies for Thin-film Piezoelectric Devices", *2010 International Workshop on Acoustic Transduction, Materials, and Devices*, State College, PA, United States of America, 05/2010
29. **K. Oldham**, J. Pulskamp, R. Polcawich, P. Ranade, M. Dubey, "Thin-Film Piezoelectric Actuators for Bio-Inspired Micro-Robotic Applications", *International Symposium on Integrated Ferroelectrics*, Bordeaux, France, 05/2007

30. **K. Oldham**, J. Pulskamp, R. Polcawich, E. Zakar, L. Currano, M. Dubey, P. Amirharaj, E. Shaffer, "Enabling Piezoelectric PZT MEMS Devices", *International Symposium on Integrated Ferroelectrics*, Bordeaux, France, 05/2007

### **Abstracts in non-refereed conference proceedings**

### **Books**

### **Chapters in books**

1. **K.R. Oldham**. "Applications of MEMS Technologies to Minimally Invasive Medical Procedures". MEMS for Biomedical Applications, S. Bhansali and A. Vasudev: Woodhead Publishing; 2012
2. R. Horowitz, T.L. Chen, **K. Oldham**, X. Huang, R. Nagamune, Y. Li. "Design, Fabrication and Control of Micro-Actuators for Dual-Stage Servo Systems in Magnetic Disk Files". Springer Handbook of Nanotechnology, Bharat Bushan, Second Edition: Springer; 2006
3. R. Horowitz, T.L. Chen, **K. Oldham**, **Y. Li**. "Design, Fabrication and Control of Micro-Actuators for Dual-Stage Servo Systems in Magnetic Disk Files". Springer Handbook of Nanotechnology, Bharat Bushan: Springer; 2004

### **Book reviews**

### **Government, university, or industrial reports (non-refereed)**

1. **K.R. Oldham**, "Analysis of Potential Terrestrial Micro-Robotic Platforms based on Thin-Film Piezoelectric Actuation", Army Research Laboratory Technical Report, 2007
2. **K.R. Oldham**, X. Huang, R. Horowitz, "Design, Fabrication, and Control of a High-Aspect Ratio Microactuator for Vibration Suppression in a Hard Disk Drive", U.C. Berkeley Computer Mechanics Laboratory Report, 12/2004
3. **K. R. Oldham**, S. Kon, R. Horowitz, "Fabrication and Optimal Strain Sensor Placement in an Instrumented Disk Drive Suspension for Vibration Suppression", CML Report, 10/2003

### **Publications in popular press/magazines**

### **Other submitted publications**

1. A. Milojevic, M. Shin, **K.R. Oldham**, "A novel design approach for micro-robotic appendagees comprised of active and passive elements with disparate properties", *submitted to Smart Materials and Structures*, 07/2020
2. **M. B. Birla**, J. Zou, **Z. Afkhami**, X. Duan, H. Li, T.D. Wang, **K.R. Oldham**, "Multi-photon 3D imaging with an electrothermal actuator with low thermal and inertial mass", *submitted to Small*, 06/2020

### **Invited presentations (10 salient)**

1. "High-accuracy motion estimation for MEMS in complex environments", IEEE/ASME International Conference on Advanced Intelligent Mechatronics, Hong Kong, Keynote, 07/2019
2. "Using dynamics to extend micro-robot capabilities", International Conference on Robotics and Automation, Toronto, ON, Workshop Presentation, 05/2019
3. "Towards highly-mobile terrestrial micro-robots: actuation, dynamics, and control", Arizona State University Mechanical and Aerospace Engineering Seminar Series, Tempe, AZ, 10/07/2016
4. "VATMOS: Vascular Tone Monitoring System", Invited presentation, Apple Inc., Cupertino, CA, Co-presenter, 05/15/2015
5. "Modeling and control of thin-film piezoelectric microactuators for millimetre-scale autonomous walking robots", University of British Columbia Civil and Mechanical Engineering Seminar Series, Vancouver, BC, 09/25/2014
6. "Modeling and control of thin-film piezoelectric microactuators for millimeter-scale autonomous walking robots", Rutgers University Mechanical and Aerospace Engineering Seminar Series, New Brunswick, NJ, 09/18/2013
7. "Dynamic modeling and control of microelectromechanical systems based on thin-film piezoelectric actuators", Michigan State University Mechanical Engineering Seminar Series, East Lansing, MI, 01/29/2013
8. "Enabling MEMS technologies with appropriate measurement and control", ASME International Design Engineering Technical Conferences, Chicago, IL, Panelist, 10/2012
9. "Millimeter-scale robotics using PZT thin films", NIST Workshop on Micro-Robotics, Hilton Head, SC, 06/2008
10. "High-aspect ratio microactuators and instrumented steel suspensions for vibration suppression in computer hard disk drives", University of Pennsylvania MEAM Seminar Series, Philadelphia, PA, 06/13/2006

## **Technology Transfer and Entrepreneurship**

### **US and international patents awarded**

1. Wang, T.D., Li, H., Duan, X., Qiu, Z., Oldham, K., "3D MEMS scanner for real-time cross-sectional endomicroscopy", US10642027B2, 05/05/2020
2. T.D. Wang, K. Kurabayashi, K. Oldham, Z. Qiu, "Targeted dual-axes confocal imaging apparatus with vertical scanning capabilities", US 9,921,406

B2, 03/20/2018

3. K. Oldham, T.D. Wang, "Two-photon endoscopic scanning assembly for inflammatory disease detection (continuation-in-part)", US 9,389,184, 08/12/2016
4. Z. Liu, K. Oldham, T.D. Wang, J.Y. Ye, "Two-photon endoscopy scanning assembly for inflammatory disease detection", US 8,807,801, 08/19/2014

#### **Provisional patents and patents pending**

1. Wang, L., Ward, K.R., Oldham, K.R., "Multi-sensor intracranial pressure monitor for cerebral hemodynamics monitoring", 02/2020
2. Oldham, K., Wang, Thomas D., Birla, Mayur Bhushan, Duan, Xiyu, "Phase detection and correction using image-based processing", 10/2018
3. T.D. Wang, H. Li, X. Duan, Z. Qiu, K. Oldham, "3D MEMS scanner for real Time cross-sectional endomicroscopy", 12/08/2016
4. S. Ansari, A. Belle, K. Najarian, K. Oldham, D. Slavin, K. Ward, "Miniature piezoelectric cardiovascular monitoring system", 10/29/2015

#### **Invention disclosures submitted**

1. Oldham, K., Nagrath, S, Smith, K., Smyth, J., "Microfluidic flow control using direct-current peristaltic pump", 2019
2. Oldham, Ward, Wang, Ansari, "Intracranial pressure monitor enhancement for cerebral hemodynamic monitoring", 2018
3. Ansari, Najarian, Oldham, Ward, "Motion artifact and noise reduction in a portable piezoelectric based ring for hemodynamic monitor", 2017
4. Ansari, Heung, Najarian, Oldham, Ward, "Detection of intradialytic hypotension using a miniature piezoelectric based ring", 2016
5. Ansari, Najarian, Oldham, Wang, Ward, "Estimation of peripheral resistance using a miniature piezoelectric sensor", 2016
6. Wang, Li, Duan, Oldham, "Mechanisms for remote axial scanning in multiphoton microscopy", 2016
7. Qiu, Oldham, Rhee, Wang, "Monolithic focusing microactuators and scanning mirrors for miniaturized imaging systems", 2012

#### **Licensing and technology transfer**

1. Licensed: Miniature Piezoelectric Cardiovascular Monitoring System, Application 30275/48267. Inventors: Ansari, Belle, Najarian, Oldham, Slavin, Ward. To New Vital Signs, Inc., Ann Arbor, MI.  
Additional inventions licensed:  
Estimation of Peripheral Resistance using a Miniature Piezoelectric Sensor (inventors: Ansari, Najarian, Oldham, Wang, Ward)  
Detection of Intradialytic Hypotension using a Miniature Piezoelectric based Ring (inventors: Ansari, Heung, Najarian, Oldham, Ward)
2. Licensed: 3D MEMS Scanner for Real Time Cross-Sectional Endomicroscopy. Inventors: Li, Duan, Oldham, Wang. To Beijing Institute of Collaborative Innovation, Beijing, China, 2017. Additional licenses: Phase Correction for Single Pixel Camera in a Lissajous Pattern, Inventors: Birla, Duan, Oldham, Wang.

#### **Startups and entrepreneurial activities**

#### **Other major technology transfer activities**

#### **Industry interactions**

1. Chair/member, Michigan Robotics Day Planning Committee, 2011-2015
  - o Chair, 2012. Organized state symposium highlighting industrial, academic, and educational efforts in the field of robotics in the state of Michigan, in collaboration with the National Center for Manufacturing Sciences.
  - o Member, 2013-2015.
2. Member, Instrumentation and Industrial Relations Technical Core, NIH Network for Translation Research, 2009-2012.
  - o Assisted in generating draft paper providing guidelines for verification and validation procedures for minimally invasive, multi-modal medical imaging technologies. Collaborative effort between representatives from industry, academia, and government regulatory bodies.
3. Consultant, OptiMetrics, Inc. SBIR Proposal to Office of Naval Research, "MEMS Interferometer for Toxic Chemical Detection," January 2010.
4. Student Member, Information Storage Industry Consortium (INSIC, prev. NSIC), 2001-2006.
5. Member, Wireless Integrated Microsensing and Systems (WIMSS), 2015-present

#### **Outreach directly related to research**

1. "Inner Engineering," outreach unit for Xplore Engineering, University of Michigan, 2014, 2015, 2016
2. "Forces, friction, and robot walking," outreach unit for Ypsilanti Middle School 8th grade science classroom, Ypsilanti, MI, 2013
3. "Micro-robots, biomimicry, and simple machines," outreach unit for Ypsilanti Middle School 8th grade science classroom, Ypsilanti, MI, 2012

#### **Other Service**

#### **Significant service assignments**

## **Department**

1. Member, Strategic Planning Committee, 2020
2. Member, Departmental Advisory Committee, 2016 - 2017
3. Member, Undergraduate Program Committee, 2015 - Present
4. Member, Mechanical Engineering Graduate Admissions Committee, 2013 - 2014
5. Member, Mechanical Engineering Honors and Awards Committee, 2011 - 2013
6. Member, Mechanical Engineering Faculty Search Committee, 2010 - 2011
7. Member, Mechanical Engineering Honors and Awards Committee, 2009
8. Member, Mechanical Engineering Departmental Seminar Series Organizer, 2008 - 2010

## **College**

1. Member, Ad-hoc Committee on Academic Integrity, 2020
2. Member, Ad-Hoc Committee to Review the Lurie Nanofabrication Facility, 2018 - 2019
3. Member, Casebook Committee, Al-Thaddeus Avestruz, 2018 - 2019
4. Member, Casebook Committee, Dr. Scott Green, 2016
5. Member, Casebook Committee, Prof. Kira Barton, 2016
6. Member, Mechanical Engineering Internal Review Committee, 2015 - 2016
7. Member, 2014 Michigan Robotics Symposium Planning Committee, 2013 - 2014
8. Member, Reappointment Committee, Assistant Prof. Kira Barton, 2013 - 2014
9. Co-Organizer, College of Engineering Control Seminar Series, 2013 - 2014
10. Member, 2013 Michigan Robotics Symposium Planning Committee, 2012 - 2013
11. Chair, 2012 Michigan Robotics Symposium Planning Committee, 2011 - 2012
12. Co-Organizer, College of Engineering Control Seminar Series, 2008 - 2010

## **University**

1. Member, STEM Scholarship Nominations Committee, 2018
2. Member, 1931E Scholarship Committee, 2018

## **Administrative duties at U of M**

1. Associate Chair, Associate Chair of Undergraduate Education, 07/2017 - Present

## **Service to government or professional organizations, and service on review board/study panels**

1. Finance Chair, IEEE/ASME International Conference on Advanced Intelligent Mechatronics, 2020
2. Member, Program Committee, IEEE International Workshop on Advanced Motion Control, 2020
3. Program Committee Member, American Control Conference, 2020
4. Program Committee Co-Chair, IEEE/ASME International Conference on Advanced Intelligent Mechatronics, 2019
5. Special Sessions Chair, 2020 ASME Dynamic Systems and Control Conference, 2019
6. Proposal Reviewer, NHLBI, National Institutes of Health, 2018 - 2019
7. Review Panelist, National Science Foundation, 2018
8. Member, Awards Committee, IEEE/ASME International Conference on Advanced Intelligent Mechatronics, 2018
9. Conference Chair, ASME Dynamic Systems and Control Division Technical Committee on Mechatronics, 2018
10. Member, Program Committee, International Conference on Manipulation, Automation, and Robotics at Small-Scales (MARSS), 2018
11. Secretary, ASME Dynamic Systems and Control Division Technical Committee on Mechatronics, 2017
12. Technical Editor, Mechatronics, 2016 - Present
13. Technical Editor, International Journal of Intelligent Robotics and Applications, 2016 - Present
14. Secretary elect, ASME Dynamic Systems and Control Technical Committee on Mechatronics, 2016
15. Publicity Chair, IEEE International Conference on Advanced Intelligent Mechatronics, 2016
16. Program Committee Member, American Controls Council Conference, 2015 - 2018
17. Program Committee Member, IEEE International Conference on Advanced Intelligent Mechatronics, 2015 - 2016
18. Review Panelist, National Science Foundation, 2015
19. Associate Editor, IEEE/ASME Transactions on Mechatronics, 2014 - Present
20. Member, ASME Dynamic Systems and Control Conference Editorial Board, 2012 - 2014
21. Division Liaison Officer to American Controls Conference, ASME Dynamic Systems and Control Division, 2012
22. Member, ASME Dynamic Systems and Control Technical Committee on Mechatronics, 2010 - Present

23. Member, Institute of Electrical and Electronics Engineers (IEEE), 2010 - Present
24. Invited Session Organizer, ASME Dynamic Systems and Controls Conference, 2010
25. Review Panelist, National Science Foundation, 2010
26. Consultant/visiting scholar, Army Research Laboratory, via Oak Ridge Associated Laboratories, 05/2008 - 06/2008
27. Member, American Society for Engineering Education, 2008 - Present
28. Reviewer, International Federation on Automatic Control, 2007 - Present
29. Webmaster, D.C. Chapter, Engineers Without Borders, 2007
30. Journal Reviewer, IEEE/ASME/Other, IEEE/ASME Transactions on Mechatronics; IEEE Transactions on Control Systems Technology; IEEE Control Systems Magazine; Smart Materials and Structures; ASME Journal of Dynamic Systems, ASME Journal of Vibration and Acoustics; Measurement, and Control; Sensors and Actuators A: Physical; Journal of the Royal Society Interface; Strain; Control Engineering Practice; Sensors; Microdevices., 2006 - Present
31. Member, Engineers Without Borders, 2006 - 2014
32. Member, Engineers for a Sustainable World, 2004 - 2010
33. Member, American Society of Mechanical Engineers, 1998 - Present

#### **Contribution to diversity, equity, and inclusion**

1. I have performed substantial undergraduate research mentoring, including for a number of students from underrepresented populations in engineering. Between independent study and summer research programs, I have mentored twelve female mechanical engineering undergraduates and five underrepresented minority students. At least four of these students (Ryan Rudy, Chengyun Hua, Carlos Caballos, and Paul Jones) I know to have gone on to Ph.D. programs in mechanical engineering at other universities.
2. I have engaged in outreach activities to the Ypsilanti School District, developing an engineering unit for use in the 8th grade science classroom. The Ypsilanti School District population is over 60% underrepresented minorities, and the robotics unit developed provides exposure for Ypsilanti Middle School students to concepts of engineering design and current science and engineering research.
3. As chair and member of the Michigan Robotics Day Planning Committee, I helped organize the Michigan Robotics Day even bringing together robotics researchers in academia, government, and industry along with members of secondary and university robotics teams. This included several student teams with predominantly female and/or underrepresented minority membership.
4. In 2017-2018, I was a member of the Mechanical Engineering department's working group on diversity, equity, and inclusion in team classes. We identified opportunities to integrate team training and DEI awareness activities into the department's core design and laboratory courses, to provide an overarching framework to DEI instruction in the mechanical engineering curriculum.
5. As Associate Chair for Undergraduate Education for Mechanical Engineering, I have organized workshop each term since Summer 2018 for external transfer students to the mechanical engineering department, with goals of building a cohort for transfer students and providing reviews of critical prerequisite knowledge required for class success. External transfer students make up a disproportionate fraction of underrepresented minority students in the College of Engineering.
6. In AY 2018-2019, I participated in a teaching circle led by Tershia Pinder-Grover on practices for inclusion in large group classes. As part of this effort, I am working with Robin Fowler, a co-instructor for ME395 in Winter 2019, to develop teaching artifacts focused on inclusiveness of team practices.

#### **Outreach that is not part of research, teaching, or entrepreneurship**

1. Volunteer, Lurie Nanofabrication Laboratory Nanocamp

#### **Mentoring activities involving junior faculty members**

1. Member, Launch Committee, Alex Shorter, Assistant Professor of Mechanical Engineering, 2017 - 2018
2. Mentor/Collaborator, DARPA Young Faculty Award Application, Evgueni Filipov, Assistant Professor of Civil and Environmental Engineering, 2017
3. Mentor, Mechanical Engineering departmental mentoring program, Gabor Orosz, Assistant Professor of Mechanical Engineering, 2011 - 2013

#### **Other**

1. Member, Continuity of Instruction Committee, Office of Associate Dean for Undergraduate Education, 2020
2. Guest Lecturer, ME 599: Grad School 101, 2019
3. Associate Director, Michigan Center for Integrative Research in Critical Care, 2018 - Present
4. UM Mechanical Engineering Delegate, Michigan Transfer Pathways Summit - Phase II, 2018
5. Examiner, Mechanical Engineering Control Systems Research Fundamentals, 01/2015 - 04/2015
6. College of Engineering Representative, Electrical Engineering and Computer Science Faculty Candidate, Mark Scott, 2015
7. College of Engineering Representative, Civil Engineering Faculty Candidate, David Mascarenas, 2015
8. Member, Faculty Council, Lurie Nanofabrication Facility, 2014 - Present
9. Examiner, Mechanical Engineering Control Systems Research Fundamentals, 09/2013 - 12/2013
10. Examiner, Mechanical Engineering MEMs/Control Systems Research Fundamentals, 09/2011 - 12/2011
11. Examiner, Mechanical Engineering Control Systems Research Fundamentals, 01/2010 - 04/2010
12. Examiner, Mechanical Engineering Control Systems Research Fundamentals, 09/2009 - 12/2009
13. Examiner, Mechanical Engineering MEMs Research Fundamentals, 09/2009 - 12/2009
14. Examiner, Mechanical Engineering ME 561 Graduate Core Course, 09/2009 - 12/2009
15. Examiner, Mechanical Engineering Control Systems Research Fundamentals, 09/2008 - 12/2008



16. Civil Engineering Faculty Candidate Gian Paolo Cimellaro, College of Engineering Representative
17. College of Engineering Representative, Naval Architecture and Marine Engineering Faculty Candidate Irena Lucifreddi