



Interdisciplinary Microsystems Group

Annual Report 2019



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<i>Book/Book chapters (1)</i>	<i>37</i>
<i>Patents (7)</i>	<i>37</i>
<i>Patent Applications (12)</i>	<i>38</i>

2019 Year End Highlights

~90
Members

11
Faculty

5
PhD Graduates

45
Journal Publications

7
Issued Patents

67
Conference
Publications

12
Patent Applications

41
Active
Research Projects

28
Different Sponsors

\$2.5M
Research Expenditures



Introduction

The Interdisciplinary Microsystems Group (IMG) is a college-wide multi-departmental education and research program within the Herbert Wertheim College of Engineering at the University of Florida. IMG operates under the direction of Mark Sheplak, Hugh Fan, and Saeed Moghaddam of the Department of Mechanical and Aerospace Engineering; Toshikazu Nishida, Huikai Xie, David Arnold, Y.K. Yoon, Jack Judy, Roozbeh Tabrizian, and Philip Feng of the Department of Electrical and Computer Engineering; and Jennifer Andrew of the Department of Materials Science and Engineering.

IMG research focuses on micro- and nanosystems for healthcare, energy, security, aerospace, transportation, consumer electronics, and other industries. Efforts include design, fabrication, characterization, and ultimately deployment of micro and nanotechnologies for a wide variety of applications. Founded in 1998, IMG has steadily grown in size, scope, and impact. Since its inception, IMG has graduated 125 PhD students and published 610 journal articles and 612 conference papers. IMG faculty have participated in 304 sponsored research projects valued at \$102M (IMG portion was \$57M). Of these, 243 projects (80%) were led by an IMG faculty member as PI, and 74 (24%) included more than one IMG investigator. IMG's student training and research impact have been fueled by true interdisciplinary research and strong internal and external collaborations.



Faculty Spotlight

Jennifer Andrew

Associate Professor

Jennifer Andrew is currently the Margaret A. Ross Associate Professor in the Department of Materials Science & Engineering at the University of Florida. She received her B.S. in Materials Science from Northwestern University in 2002, and her Ph.D. in Materials Engineering in 2008 from the University of California, Santa Barbara. Before coming to UF she was a UC President's Postdoctoral Fellow in Michael J. Sailor's lab in the Department of Chemistry and Biochemistry at the University of California, San Diego.



She was awarded the NSF CAREER Award titled "Structure-property Relationships Arising From Interfacial Coupling in Bi-phasic Ceramic Nanocomposites." Her research interests include the development of nanocomposite materials with novel multifunctional electronic and biomedical applications.

Education

Graduation Year	Degree	University	Program of study
2008	Doctorate	University of California, Santa Barbara	Materials Science and Engineering
2002	Bachelor of Science	Northwestern University	Materials Science and Engineering

David P. Arnold

Professor

David P. Arnold is the George Kirkland Engineering Leadership professor in the Dept. of Electrical and Computer Engineering at the University of Florida. He also holds an affiliate appointment in the Dept. of Materials Science and Engineering. He is currently Deputy Director of the NSF Multi-functional Integrated System Technology (MIST) Center. He served as Director of the Interdisciplinary Microsystems Group (IMG) from 2016-2019.



He received dual B.S. degrees in electrical and computer engineering in 1999, followed by the M.S. degree in electrical engineering in 2001, from the University of Florida, Gainesville. He received the Ph.D. degree in electrical engineering at the Georgia Institute of Technology, Atlanta in 2004. His research focuses on magnetic thin/thick films and magnetic micro/nanostructures; magnetic microsystems and electromechanical transducers; and compact (<100 W) power/energy systems.

Dr. Arnold is an active participant in the magnetics and MEMS communities, serving on conference committees for the MEMS, PowerMEMS, Hilton Head, Transducers, Sensors, MMM, and Intermag meetings. He was the technical program co-chair of the 2009 PowerMEMS and is currently on the editorial board of J. Micromechanics and Microengineering and Energy Harvesting and Systems. His work has been recognized with several prestigious awards, including the 2008 Presidential Early Career Award in Science and Engineering (PECASE) and the 2009 DARPA Young Faculty Award. Dr. Arnold is the current UF chapter faculty advisor and member of the Eta Kappa Nu ECE engineering honor society. He is also a Senior Member of IEEE and a member of Tau Beta Pi.

Beyond his passion for research and teaching, he most enjoys spending time with his wife and three children.

Education

Graduation Year	Degree	University	Program of study
2004	Doctorate	Georgia Institute of Technology	Electrical Engineering
2001	Master of Science	University of Florida	Electrical and Computer Engineering
1999	Bachelor of Science	University of Florida	Electrical Engineering
1999	Bachelor of Science	University of Florida	Computer Engineering

Z. Hugh Fan

Professor

Dr. Hugh Fan is a professor of the Department of Mechanical and Aerospace Engineering, J Crayton Pruitt Family Department of Biomedical Engineering, and Department of Chemistry at the University of Florida (UF). He currently holds UF Term Professorship and is a member of UF Health Cancer Center. Dr. Fan was an E.T.S. Walton visiting professor in Biomedical Diagnostics Institute at Dublin City University, Ireland in 2009. Prior to joining UF in 2003, Dr. Fan was a Principal Scientist at ACLARA BioSciences Inc. (Mountain View, CA) and was previously a Member of the Technical Staff at Sarnoff Corp. (Princeton, NJ).



Dr. Fan's research interests include microfluidics, BioMEMS (Biomedical Microelectromechanical Systems), sensors, and bioengineering. His research focus is to develop microfluidics and BioMEMS technologies and apply them to biological applications. Microfluidics is promising to reach the holy grail of "lab-on-a-chip". In analogy to shrinking a computer from the size of a room in the 1950s to a laptop today, instruments for chemical and biological analyses may be miniaturized using modern microfabrication technology. Potential applications of the portable, miniaturized devices may include point-of-care testing (e.g., in emergency rooms), environmental monitoring, and detection of biowarfare agents in the field.

Dr. Fan is a recipient of Fraunhofer-Bessel Research Award from Alexander von Humboldt Foundation. He is a Fellow of the American Association for the Advancement of Science (AAAS) and the American Society of Mechanical Engineers (ASME), an editor of *Microsystems and Nanoengineering* (Nature Publishing Group), and an editorial board member of *Scientific Report* (Nature Publishing Group). He received his B. Sc. from Yangzhou Teachers' College (now a part of Yangzhou University) in China and his Ph.D. from the University of Alberta in Canada. Dr. Fan worked as a postdoctoral fellow at Ames Laboratory of US Department of Energy at Iowa State University. He joined UF in 2003 after more than eight years of industrial experience.

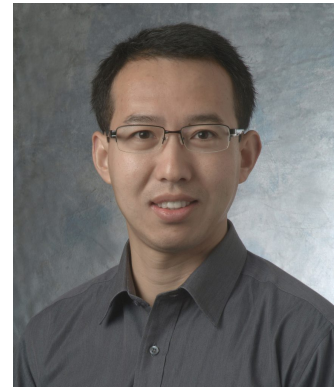
Education

Graduation Year	Degree	University	Program of study
1994	Doctorate	University of Alberta	Chemistry
1985	Bachelor	Yangzhou Teachers' College	Chemistry

Philip Feng

Professor

Dr. Philip Feng is a Professor in the Department of Electrical and Computer Engineering, at the University of Florida. He received his Ph.D. degree in Electrical Engineering from the California Institute of Technology (Caltech), Pasadena, CA, in 2007. Previously he was the Theodore L. & Dana J. Schroeder Associate Professor with the Department of Electrical Engineering and Computer Science (EECS), Case School of Engineering, Case Western Reserve University (CWRU), Ohio.



His research is primarily focused on emerging solid-state devices and systems, particularly nano/microelectromechanical systems (NEMS/MEMS), atomic layer semiconductors and 2D devices, silicon carbide (SiC) and other advanced semiconductors, quantum devices based on SiC and 2D materials, as well as their integration with state-of-the-art ICs and optical/photonic technologies.

Dr. Feng was an invited participant to the National Academy of Engineering (NAE) 2013 U.S. Frontier of Engineering (USFOE) Symposium. Subsequently, he received the NAE Grainger Foundation Frontiers of Engineering (FOE) Award in 2014.

His recent awards include the Presidential Early Career Award for Scientists and Engineers (PECASE, 2019), the National Science Foundation CAREER Award (2015), the Case School of Engineering Research Award (2015), and the Case School of Engineering Graduate Teaching Award (2014). He and his students have won four Best Paper/Presentation Awards at IEEE and other international conferences. He has mentored over 10 Ph.D. students to successful dissertation defense and supervised 8 M.S. students with thesis research. He is a senior member of IEEE.

Education

Graduation Year	Degree	University	Program of study
2007	Doctorate	California Institute of Technology	Electrical Engineering
2002	Master of Science	California Institute of Technology	Electrical Engineering
2001	Master of Engineering	Tsinghua University	Engineering
1996	Bachelor of Science	Tsinghua University	Engineering

Jack Judy

Professor

Dr. Jack Judy is the Director of the Nanoscience Institute for Medical and Engineering Technology (NIMET) at the University of Florida, holds the Intel Nanotechnology Chair, and is a professor of Electrical and Computer Engineering, Biomedical Engineering, and has a courtesy appointment in Neurology.



The mission of NIMET is to bridge engineering, scientific, and medical communities by revealing, enabling, focusing, and coordinating related research and educational activities. NIMET also supports access to world-class centralized research facilities, technical support, and equipment for the design, fabrication, and characterization of innovative micro/nanotechnologies, as well as a dedicated hands-on instructional laboratory for training students in the use of micro/nanoscale fabrication tools and techniques.

Dr. Judy's research involves the development of novel microscale and nanoscale sensors, actuators, and systems, and their use in impactful engineering, scientific, biological, and medical, applications. A particular focus of his recent research is in the development of advanced and robust neural-interface technology components and systems for bi-directional prosthetic control and other neurotechnology applications.

Previously, Dr. Judy was a Program Manager in the Microsystems Technology Office (MTO) of the Defense Advanced Research Projects Agency (DARPA), where he created and managed the Reliable Neural-Interface Technology Program (RE-NET) to address fundamental, and yet at the time largely overlooked, critical reliability problems of chronic neural-recording interfaces. Without successfully developing robust clinical-grade high-performance neural-recording interfaces that function for the life of the patient, some widely envisioned advanced clinical applications for brain-machine interfaces and other neural-electronic technologies will not be translated effectively.

Dr. Judy served at DARPA while on leave from his faculty position at the time in the Electrical and Biomedical Engineering Departments at UCLA, where he also served as Director of the NeuroEngineering Program, the Nanoelectronics Research Facility, and the Instructional Microfabrication Laboratory. He has received the National Science Foundation Career Award, the Okawa Foundation Award, and the Office of the Secretary of Defense Medal for Exceptional Public Service.

Education

Graduation Year	Degree	University	Program of study
1996	Doctorate	University of California, Berkeley	Electrical Engineering
1994	Master of Engineering	University of California, Berkeley	Electrical Engineering
1989	Bachelor of Science	University of Minnesota	Electrical Engineering

Saeed Moghaddam

Professor

Dr. Saeed Moghaddam is the Knox T. Millsaps Professor of Mechanical and Aerospace Engineering at the University of Florida. Before joining the University of Florida in 2010, he was a postdoc (2007-2010) in the Chemical and Biomolecular Engineering Department at University of Illinois, Urbana-Champaign. His academic background is in micro-/ nanoscale transport, interfacial science, micro-/ nanoengineering, and ionic liquid membrane-based absorption process.

Dr. Moghaddam has made significant contributions in the field of phase-change heat transfer through invention of a new measurement technique that has enabled resolving the thermal field at the interface of a heated wall and a boiling liquid with unprecedented spatial and temporal resolutions. This work has led to addressing decades old fundamental questions regarding the underlying physics of the process at microscales.

Dr. Moghaddam is also the inventor of semi-open absorption cycle that has been successfully tested in ORNL in 2017. He has developed the world's first membrane-based IL hybrid absorption cycle for energy efficient exchange of latent and sensible heats. Dr. Moghaddam's work on nanoengineered membranes and their transport characteristics has been highlighted in Nano Science and Technology Institute (NIST) Innovation Spotlight, Nature Nanotechnology, New Scientist magazine, Heat Pumping Technologies Magazine and 2010 Guinness World Records. His research is published in nearly 100 peer-reviewed papers, 14 patents, and one book chapter. Dr. Moghaddam's research has been supported by ARPA-A, DARPA, DOE, NSF, ONR, NIH, SRC, ORNL, and private companies.



Education

Graduation Year	Degree	University	Program of study
2006	Doctorate	University of Maryland at College Park	Mechanical Engineering

Toshikazu (Toshi) Nishida

Professor and Associate Dean

Dr. Nishida is a professor in the Department of Electrical and Computer Engineering and affiliate professor in the Department of Mechanical and Aerospace Engineering. He serves as Associate Dean of Academic Affairs in the Herbert Wertheim College of Engineering. He is a Term Professor and an Alan Hastings Faculty Fellow. Dr. Nishida received his Ph.D. (1988) and M.S. degrees in Electrical and Computer engineering and B.S. degree in Engineering physics at the University of Illinois at Urbana-Champaign. With colleagues and students, he has published over 170 refereed journal and conference papers and received three best paper awards. He also received the 2003 College of Engineering Teacher of the Year award. He holds 13 U.S. patents. He is a senior member of IEEE.



Dr. Nishida's research interests include the development of reliable, high performance, multi-functional semiconductor devices, sensors, and actuators for microsystems employing strained Si, SiGe, GaN, ferroelectrics, and polymers and enabling multi-functional integrated system technology for smart systems.

Dr. Nishida is the Director of the NSF Industry/University Cooperative Research Center on Multi-functional Integrated System Technology (MIST).

Education

Graduation Year	Degree	University	Program of study
1988	Doctorate	University of Illinois at Urbana-Champaign	Electrical and Computer Engineering
1985	Master of Science	University of Illinois at Urbana-Champaign	Electrical and Computer Engineering
1983	Bachelor of Science	University of Illinois at Urbana-Champaign	Engineering Physics

Mark Sheplak

Professor

Mark Sheplak is currently a Professor holding joint appointments in the Department of Mechanical and Aerospace Engineering and the Department of Electrical and Computer Engineering at the University of Florida. Since 2019, he has served as Director of the Interdisciplinary Microsystems Group (IMG).

He received a BS degree in 1989, a MS degree in 1992, and a Ph.D. degree in 1995 in Mechanical Engineering from Syracuse University, Syracuse, NY. During his Ph.D. studies he was a GSRP Fellow at NASA-LaRC in Hampton, VA from 1992-1995. Prior to joining UF in 1998, he was a postdoctoral associate at the Massachusetts Institute of Technology's Microsystems Technology Laboratories, Cambridge, MA from 1995-1998.



His current research focuses on the design, fabrication, and characterization of high-performance, instrumentation-grade, MEMS-based sensors and actuators that enable the measurement, modeling, and control of various physical properties. Specific applications include technology development to enable large-channel count micromachined directional microphone arrays for aeroacoustic noise source localization and miniature skin-friction sensors for aerodynamic drag characterization and flow control.

He is a member of the Multi-functional Integrated System Technology Center (MIST) and the Florida Center for Advanced Aero-Propulsion (FCAAP). He is member and past chair of the AIAA Aerodynamic Measurement Technology Technical Committee. He is also an associate editor for JASA Express Letters. He is an associate fellow of AIAA and a fellow of the Acoustical Society of America.

Education

Graduation Year	Degree	University	Program of study
1995	Doctorate	Syracuse University	Mechanical Engineering
1992	Master of Science	Syracuse University	Mechanical Engineering
1989	Bachelor of Science	Syracuse University	Mechanical Engineering

Roozbeh Tabrizian

Assistant Professor

Roozbeh Tabrizian received his B.S. in Electrical Engineering from Sharif University of Technology, Tehran, Iran, in 2007, and Ph.D. in Electrical and Computer Engineering from Georgia Institute of Technology, 2013. In 2014, he joined the Department of Electrical Engineering, University of Michigan as a Postdoctoral research fellow. In August 2015, he joined the Department of Electrical and Computer Engineering, University of Florida as an Assistant Professor.



His research at the University of Florida involves linear, nonlinear, and nonreciprocal nano-acoustic devices, RF M/NEMS, mixed-domain nanosystems for time-keeping / transfer, frequency reference, and spectroscopy applications, and micro- / nano-fabrication technologies. Dr. Tabrizian is the recipient of DARPA Young Faculty Award (2019) and NSF CAREER award (2018). His research has resulted in more than 50 journal and conference papers, 2 book chapters, 3 published patents and 10 patent applications. He and his students are the recipients of outstanding paper awards at the IEEE International Conference on Micro Electro Mechanical Systems (MEMS) and International Conference on Solid-State Sensors, Actuators, and Microsystems (Transducers).

Education

Graduation Year	Degree	University	Program of study
2013	Doctorate	Georgia Institute of Technology	Electrical and Computer Engineering
2007	Bachelor of Science	Sharif University of Technology	Electrical Engineering

Huikai Xie

Professor

Huikai Xie is currently a professor at the Department of Electrical and Computer Engineering at the University of Florida. He received his master's degree in electro-optics from Tufts University in 1998 and his Ph.D. degree in electrical and computer engineering from Carnegie Mellon University in 2002. He also holds BS and MS degrees both in electronic engineering from Beijing Institute of Technology. He was a research faculty at the Institute of Microelectronics at Tsinghua University, Beijing, China.



His research is mainly focused on development of innovative optical and acoustic MEMS devices and their applications in various beam steering microsystems and endoscopic imaging modalities. The goal is to develop enabling micro/nanofabrication technology and build innovative integrated microsystems with improved performance, functionality and affordability for medical, industrial, space and consumer electronics applications. His current research activities include optical MEMS, micro-mirrors, microactuators, piezoelectric MEMS microspeakers and ultrasonic transducers, biophotonics, optical endomicroscopy, optical coherence tomography (OCT), photoacoustic microscopy, two-photon microscopy for in vivo brain imaging, micro-LiDAR, and microspectrometers.

Education

Graduation Year	Degree	University	Program of study
2002	Doctorate	Carnegie Mellon University	Electrical and Computer Engineering
1998	Master of Science	Tufts University	Electro-Optics
1992	Master of Science	Beijing Institute of Technology	Microelectronics
1989	Bachelor of Science	Beijing Institute of Technology	Electronic Engineering

Y.K. Yoon

Professor

YK Yoon is currently a Professor in the Department of Electrical and Computer Engineering at the University of Florida, Gainesville, FL. His current research interests include three-dimensional (3-D) micromachining and nano fabrication; design and implementation of metamaterial for radio frequency (RF) and microwave applications; micromachined millimeter wave and terahertz antennas and waveguides; bio/microfluidic systems for the lab-on-a-chip applications; wireless telemetry systems for biomedical applications; and ferroelectric material development for high density memory devices and/or tunable RF devices.



He received his BS and MS degrees in electrical engineering from Seoul National University in Korea. He also earned an MSEE degree from the New Jersey Institute of Technology, Newark, NJ in 1999 and the Ph.D. degree in electrical and computer engineering from the Georgia Institute of Technology, Atlanta, GA in 2004. He held a postdoctoral position in the Microelectronics Research Center of Georgia Institute of Technology from 2004 to 2006. In 2006, he joined the faculty of the University at Buffalo, the State University of New York as an Assistant Professor in the Department of Electrical Engineering, where he directed the Multidisciplinary nano and Microsystems (MnM) laboratory until 2010. He received the NSF Early Career Development Award (CAREER) in 2008 and the Young Investigator Award from the University at Buffalo in 2009. He has more than 200 peer reviewed publications. He is a member of IEEE society. He actively participates in multiple technical conferences including Microelectromechanical systems (MEMS), Transducers, Hilton Head, micro total analysis systems (μ TAS), American Vacuum Society (AVS), International Microwave Symposium (IMS), Electronic Components and Technology Conference (ETC), and Antenna Propagation Symposium (APS).

Education

Graduation Year	Degree	University	Program of study
2004	Doctorate	Georgia Institute of Technology	Electrical and Computer Engineering
1999	Master of Science	New Jersey Institute of Technology	Electrical and Computer Engineering
1994	Master of Science	Seoul National University	Electrical Engineering
1992	Bachelor of Science	Seoul National University	Electrical Engineering

Honors & Awards

Student Awards

- **Mayur Ghatge**, Glen Walters, Toshikazu Nishida, and Roozbeh Tabrizian, Outstanding Paper Award Finalist, Transducers 2019
- **Austin Vera**, NDSEG Fellowship
- **Connor Watkins**, NSF SFS CyberCorps Fellowship
- **Carlos Manzananas**, ASME Fluids Engineering Division Scholarship
- **MinhChau Le**, Women In Defense Space Coast Chapter Scholarship
- **Kartik Sondhi**, IDTechEx Best Poster
- **Mayur Ghatge, Glen Walters**, Toshikazu Nishida, and Roozbeh Tabrizian, cover page of *Nature Electronics* (IF=27)
- **Renuka Bowrothu**, MIST Center Best Project and Best Poster Award (2019)
- **Renuka Bowrothu**, IEEE Antennas and Propagation Society (AP-S) Doctoral Research Award (2019)
- **Shayla Breedlove**, NSF Graduate Research Fellowship Program Award for 2019 – 2022 (Shayla is co-supervised with Dr. Henry Zmuda) (2019)
- **Garrett Pittman** and **Steven Rosenthal**, University Scholar Program Award (2019)
- **Kartik Sondhi, Renuka Bowrothu, Kangfu Chen**, IMG Excellence for Research Award (2019)
- **Timothy Clingenpeel, Paritosh Rustogi, Glen Walters**, IMG Excellence for Service Award (2019)

Faculty Honors and Intellectual Leadership

Prof. Jennifer Andrew

- *Honors*
 - Awarded Senior Member, IEEE 2019
- *Conference Leadership*
 - Co-Organizer, *Frontiers in Biomagnetic Particles* 2019
 - Symposium Organizer, *Electronic Materials and Applications* 2020

Prof. David Arnold

- *Honors*
 - George Kirkland Engineering Leadership Professorship 2016-present
 - UF Research Foundation Professorship 2016-2019
- *Conference Leadership*
 - Local Arrangements Chair, Transducers 2021 2019-2021
- *Conference Technical Program Committee*
 - Transducers 2019
 - PowerMEMS 2019

Prof. Z. Hugh Fan

- *Honors*
 - University of Florida Term Professorship 2017-2023
 - ASME Fellow 2018-present
 - AAAS Fellow 2016-present
- *Technical Program Committee*

- Executive TPC, μ TAS 2018-2020
- Prof. Philip Feng*
 - *Conference Leadership*
 - Chair, MEMS 2021 2021
 - *Conference Technical Track/Group Chair*
 - IEEE IFCS-EFTF, Group 4 Chair 2019
 - *Conference Technical Program Committee*
 - Transducers 2019
- Prof. Jack Judy*
 - *Conference Leadership*
 - Co-Chairman: Gordon Research Conference on Neuroelectronic Interfaces 2022
 - General Chairman: Transducers 2021 2021
- Prof. Toshikazu Nishida*
 - *Honors*
 - Associate Dean of Academic Affairs 2017-present
 - UF Term professorship 2017-2020
 - Alan Hastings Faculty Fellow Award 2017-present
- Prof. Mark Sheplak*
 - *Honors*
 - ASA Fellow 2009-present
- Prof. Roozbeh Tabrizian*
 - *Honors*
 - DARPA Young Faculty Award (YFA) Class of 2019 2019-2022
 - 2018 National Science Foundation (NSF) CAREER Award 2018-2023
 - UF Research Foundation Professorship 2019-2022
 - Professor of the Year Award, ECE Department 2019
 - *Conference Technical Program Committee*
 - Transducers 2019
 - IEEE IFCS 2019
 - Hilton Head Workshop on Microsystems 2020
- Prof. Huikai Xie*
 - *Honors*
 - SPIE Fellow 2018-present
 - IEEE Fellow 2017-present
- Prof. Yong-Kyu Yoon*
 - *Honors*
 - UF Term Professorship 2017-2020
 - *Conference Technical Program Committee*
 - RWCS Committee, ECTC 2019-2021
 - Review Committee, MEMS 2019-2020

Educational Activities

Ph.D. Graduates (5)

Graduate student	Advisor	Title
Matthew Bauer	Andrew	Low Power Magnetic Field Sensors Utilizing Janus Magnetoelectric Nanowires: Fabrication and Characterization
Mayur Ghatge	Tabrizian	Linear and Nonlinear Micro-Acoustic Waveguides for Frequency Control Applications
Todd Schumann	Yoon	Electronic and Optical Applications of Perovskite and Ferroelectric Materials
Amanda Uhl	Andrew	Magnetoelectric Composite Nanomaterials for the Stimulation of Neuronal Proliferation and Differentiation
Jose Varillas	Fan	Evaluation of Pre-enrichment Methods and Enumeration of Circulating Tumor Cells for Pancreatic Cancer Treatment Monitoring

New Alumni

Alumnus	Degree	Advisor	Company
Yunkai Bai	Master of Science	Xie	
Matthew Bauer	Doctorate	Andrew	L3 Harris
Yizhou Chao	Master of Science	Xie	
Nicolas Garraud	Doctorate	Arnold	CEA (France)
Seahee Hwangbo	Doctorate	Yoon	Intel Corporation
Todd Schumann	Doctorate	Yoon	National Telecommunications and Information Administration
Amanda Uhl	Doctorate	Andrew	Intel Corporation
Jose Varillas	Doctorate	Fan	Food and Drug Administration
Zhi Li	Master of Science	Xie	

Classroom Instruction

Spring 2019

Instructor	Course Number	Course Name	Enrolled
Andrew	EMA3011	Fundamental Principles of Materials	55
Fan	EGN 3353C	Fluid Mechanics	82
Moghaddam	EML 4140	Heat Transfer	23
Sheplak	EEL 3111C	Circuits 1	44
Sheplak	EGN 6933	Engineering Faculty Development	13
Tabrizian	EEE 4222 EEE 5225	Resonant MEMS	34 11
Yoon	EEE 3308	Electronic Circuits 1	59
Yoon	EEE 5354L	Semiconductor Device Fabrication Lab	25

Fall 2019

Instructor	Course Number	Course Name	Enrolled
Andrew	EMA3050	Intro Inorganic Materials	65
Arnold	EEL 3008	Physics of Electrical Engineering	96
Fan	EGN3353C	Fluid Mechanics	130
Judy	EEL 5225	Principles of MEMS Transducers	14
Moghaddam	EML 6154	Conduction Heat Transfer	30
Sheplak	EGM 5121	Data Measurement and Analysis	17
Tabrizian	EEL 3112	Circuits 2	69
Xie	EEE 4930	Spec Topic: Optical Engineering	7
Xie	EEE 5354L	Semiconductor Device Fabrication	22



Yoon	EEL 3111C	Circuits 1	48
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Microsystem Technology Certificate

In 2016, IMG launched a graduate certificate program in "Microsystem Technology."

Certificate Description: The Microsystem Technology certificate prepares students for the complex, interdisciplinary development of microsystem technologies such as microactuators, microsenors, microfluidic devices, micropower systems, microoptical devices, and other microelectromechanical systems (MEMS).

Requirements for Admission: A bachelor's degree or equivalent from a regionally accredited institution. Students must be registered in a graduate degree program in the College of Engineering and maintain a 3.0 GPA.

Requirements for Completion: Students must complete the following courses (9 credits total) with a grade of B or higher:

1. Required: EEE 5405 Microelectronic Fabrication Technologies
2. Any two of the following: EEE 5354L Semiconductor Device Fabrication Laboratory
 EEL 5225 Principles of Micro-Electro-Mechanical Transducers
 EEE 6465 Design of MEMS Transducers
 EEE 6460 Advanced Microsystem Technology
 BME 5580 Microfluidics and BioMEMS

Awarded Certificates in 2019:

Semester	Certificates Awarded
Spring 2019	2
Fall 2019	1
Total	3

IMG Seminars Series

Supported by the IMG Alumni fund

Date	First speaker	Second speaker
January 18	Dr. Jiangeng Xue – Nanostructured Organic and Inorganic Electronic Materials for Optoelectronics	Dr. Walter Lee Murfee – A Systems Biology View for Discovering Cell Dynamics During Microvascular Growth
February 1	Dr. Jon Dobson – Biomedical Applications of Magnetic Micro and Nanoparticles	Dr. Jennifer Nichols - Predictive Biomechanical Simulations: Applications to the Musculoskeletal System
February 15	Three Minute Thesis Presentations	
March 1	Dr. Ant Ural - Low dimensional nanoscale materials and devices	
March 15	Dr. Hitomi Greenslet - Ultra-precision Finishing using Magnetic Field-Assisted Finishing	Pablo Dopico (Dr. Fan) - Combination of Ganglioside 2 and 3 as an Immunoaffinity Target for Circulating Osteosarcoma Cell Detection
March 29	Dr. Claudio Spiguel - Engineering ethics and leadership	Dr. Benjamin G. Keselowsky – Bio-material Cell Interactions
April 12	Dr. Damon Woodard - Cybersecurity	Dr. Edward Phelps – Bio-synthetic Cellular Microenvironments
April 26	Dr. Karim Oweiss- Sensorimotor integration	Dr. Jonathan R. Scheffe - Solar Thermochemical and Electrochemical Energy Conversion
August 30	Dr. Steve Miller - Research Overview & Thermo-Acoustic Combustion Instability	
September 13	James Fleetwood - Safety Simplified for IMG Researchers	Dr. Chuck Hages - Developing next-generation semiconductors for energy research
September 27	Dr. Philip Feng - Multimode Resonant MEMS in Liquid: from Microscale Chladni Patterns to Cancer Cell Cluster Analysis	
October 11	Dr. Myoseon Jang - Emerging issues on Atmospheric Aerosol: Modelling, characterization, and its Implications to Health and Climate	Dr. Xin Tang - new tools for the application in the systematic investigation of uni- and multi-cellular systems
November 22	Dr. G. Bahar Basim (Invited speaker - UF) - A Review on Controlling Nano-Scale Chemically Modified Thin Films for Microelectronics Processes Development	
December 6	Dr. Yong Huang (Invited speaker - UF) - Additive Manufacturing and its Applications to Three-Dimensional Bioprinting	

Research Activities

In the year 2019, IMG had active research projects funded through the federal, state, industry, and UF-internal sponsors.

Federal Sponsorship

Title of Grant	Faculty Member	Funding Agency	Award Value (Faculty's Portion)	Expenditures (Reporting Period)
The Emergence of Ferroic Phenomena and Size-Effects in Fluorite-Based Nanoparticles.	Andrew	NSF	\$360,282	\$117,972
SNM: Batch Manufacturing of Integrated Magnetic Devices	Andrew	NSF	\$587,693	\$124,588
Collaborative Research: Magnetic Field Processing, Assembly, and Actuation of Multiferroic Fiber Devices	Andrew	NSF	\$272,724	\$37,859
CAREER: Structure-property relationships arising from interfacial coupling in bi-phasic ceramic nanocomposites	Andrew	NSF	\$488,223	\$795
Collaborative: Controlling Large Microrobot Teams	Arnold	NSF	\$295,191	\$82,026
Magnetic Thick Films for Integrated Microwave Devices	Arnold	ARO (DARPA)	\$808,959	\$101,914
Support for MIST Center Coordinator	Arnold	UVa (NSF)	\$32,935	\$11,883
Electromagnetic and Magnetic Penetration for High-Resolution	Arnold	DARPA	\$153,140	\$93,387
SNM: Batch Manufacturing of Integrated Magnetic Devices	Arnold	NSF	\$396,013	\$48,876
I/UCRC for Multi-functional Integrated System Technology	Arnold	NSF	\$401,646	\$77,867
Federal MIPR Membership	Arnold	NSF	\$50,000	\$35
Radiation Effects in Nanoscale Electromechanical Logic Devices: Pathways Toward Robust Computing in Extreme Environment	Feng	DTRA	\$350,000	\$38,122

Collaborative Research: Harnessing Crystalline Phase Transition in 2D Materials for Ultra-Low-Power and Flexible Electronics	Feng	NSF	\$137,121	\$0
CAREER: Dynamically Tuning 2D Semiconducting Crystals and Heterostructures for Atomically-Thin Signal Processing Devices and Systems	Feng	NSF	\$224,526	\$0
EFRI ACQUIRE: A Scalable Integrated Quantum Photonic Interconnect	Feng	NSF	\$136,716	\$0
Tissue-Engineered Electronic Nerve Interface (TEENI)	Judy	DARPA	\$884,906	\$43,029
Planning Grant: Engineering Research Center for Neural Engineered Systems with Societal Impact	Judy	NSF	\$100,000	\$12,559
Reliable Miniature Implantable Connectors with High Channel	Judy	NIH	\$407,206	\$110,042
NIH 1 R01 NS111518-01 – Tissue Engineered Electronic Neural Interface (TEENI)	Judy	NIH	\$1,205,956	\$182,961
Membrane-Based Ionic Liquid Absorption System for Ultra-Efficient Dehumidification and Heating	Moghaddam	DOE	\$1,707,780	\$12,065
Critical Flow Regimes in Compact Naval Energy System	Moghaddam	ONR	\$408,377	\$136,415
Critical Heat Flux	Moghaddam	NSF	\$349,996	\$11,782
Ferroelectric HfO₂ on Germanium Tunnel Junctions Towards	Moghaddam	NSF	\$128,779	\$32,571
Ionic Liquid Membrane-Based Polymer Absorber	Moghaddam	UT Battelle-DOE	\$95,446	\$8,442
R21 - NIBIB	Moghaddam	NIH	\$413,129	\$56,585
MIST REU Supplement	Nishida	NSF	\$40,000	\$12,444
INTERN Supplement	Nishida	NSF	\$31,882	\$578
REU Supplement	Nishida	NSF	\$8,000	\$8,000

Ferroelectric HfO₂ on Germanium Tunnel Junctions Towards Sub-Femto Joule Switching	Nishida	NSF	\$167,424	\$50,142
I/UCRC for Multi-functional Integrated System Technology (MIST)	Nishida	NSF	\$401,646	\$77,867
NSF-Radiated Noise in a Jet	Sheplak	NSF	\$164,963	\$31,723
Ferroelectrically Transduced Nano-Fin Germanium Resonator	Tabrizian	DARPA	\$1,000,000	\$88,056
Thermo-Acoustic Engineering of GaN Micromechanical	Tabrizian	Cal Tech (NASA)	\$55,000	\$17,057
CAREER: Active Nano-Acoustic Waveguide Matrix to Tackle	Tabrizian	NSF	\$500,000	\$69,293
Subcontract for a Multimodal Imaging System and Targeted	Xie	USF/NIH	\$461,546	\$101,973
Directional Controlled Time-of-Flight Sensors	Xie	ONR	\$164,313	\$94,006
RI: Medium: Collaborative Research: Novel Depth Sensor	Xie	NSF	\$205,703	\$17,882
Hardware-in-the-Loop Simulator Development T.O. 013	Yoon	Eglin AFB	\$109,340	\$0
Energy Dense and High Rate Electrochemical Capacitors	Yoon	AFOSR	\$107,477	\$44,326
IRES Track I: Collaborative Research: Interdisciplinary	Yoon	NSF	\$29,284	\$15,690
Magnetic Thick Films for Integrated Microwave Devices	Yoon	DARPA	\$145,458	\$84,282
		Total	\$13,988,780	\$2,055,094

State Sponsorship

Title of Grant	Faculty Member	Funding Agency	Award Value (Faculty's Portion)	Expenditures (Reporting Period)
Multiplexed Detection Platform for Point-of-Service Testing of Virus	Fan	FL Department of Health	\$449,886	\$58,360
University of Florida (UF) Testbed Initiative – Transit Components	Yoon	FL Dept. of Transportation	\$63,789	\$1,020
		Total	\$513,675	\$59,380

Industry Sponsorship (including NSF I/UCRC MIST Center Sponsorship)

Title of Grant	Faculty Member	Funding Agency	Award Value (Faculty's Portion)	Expenditures (Reporting Period)
MIST Center Projects	Andrew	Multiple Sponsors	\$104,757	\$13,040
MIST Center Projects	Arnold	Multiple Sponsors	\$189,607	\$23,818
MIST Center Projects	Fan	Multiple Sponsors	\$138,691	\$23,249
MIST Center Projects	Nishida	Multiple Sponsors	\$285,360	\$59,680
MIST Center Projects	Nishida	Multiple Sponsors	\$50,000	\$610
MIST Center Projects	Sheplak	Multiple Sponsors	\$561,500	\$140,900
MIST Center Projects	Xie	Multiple Sponsors	\$50,000	\$12,880
MIST Center Projects	Yoon	Multiple Sponsors	\$243,016	\$83,156
IEEE Student Travel Grant 2019	Andrew	IEEE	\$5,000	\$5,000
Cell free protein synthesis (CFPS) device development	Fan	DASFANH Bioscience	\$69,999	\$19,336

New Generation Ultra-Efficient Air-Conditioning Systems	Moghaddam	MNT-NYSERDA	\$123,970	\$93,875
SBIR - Capacitive Vector Skin Friction Measurement System	Sheplak	IC2	\$99,999	\$0
Capacitive Vector Skin Friction Measurement Systems for	Sheplak	IC2	\$24,981	\$21,773
SBIR - High Channel Count, High-Density Microphone Array	Sheplak	IC2	\$99,995	\$68,574
High-Frequency Calibration System for Sensors Used in Hi	Sheplak	IC2	\$51,000	\$22,797
Nano-Dot Labels for Product Identification and Authentic	Tabrizian	Discover Financial Services	\$69,867	\$62,561
RF Bulk Acoustic Wave Fin Resonators and Filters with Si	Tabrizian	OEM	\$140,000	\$105,126
Active-FinBAR Resonator Building Block for Configurable	Tabrizian	Intel	\$152,220	\$79,275
Directional Antennas for Glass	Yoon	Corning	\$39,038	\$6,906
Energy Dense and High Rate Electrochemical Capacitors: A	Yoon	Mainstream	\$93,475	\$0
		Total	\$1,017,384	\$251,488

Internal Sponsorship

Title of Grant	Faculty Member	Funding Agency	Award Value (Faculty's Portion)	Expenditures (Reporting Period)
Development of Wirelessly Rechargeable Battery Technology	Arnold	UF OTL	\$24,850	\$22,876
Colorectal Cancer Screening Project	Fan	UF Foundation	\$299,285	\$54,507
Moonshot	Fan	UF Foundation	\$69,993	\$0

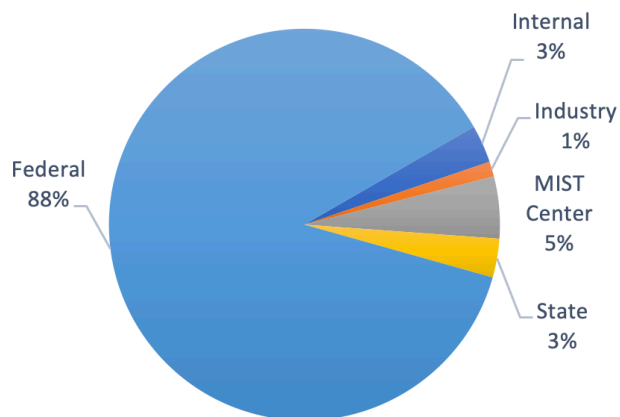
DSR Matching Funds	Fan	UF Office of Research	\$2,000	\$0
icoast	Fan	UF Foundation	\$35,007	\$0
The Next Generation of Treatments for Parkinson's Disease	Yoon	UF Foundation	\$20,000	\$20,000
		Total	\$501,135	\$97,383

Research Financial Summary

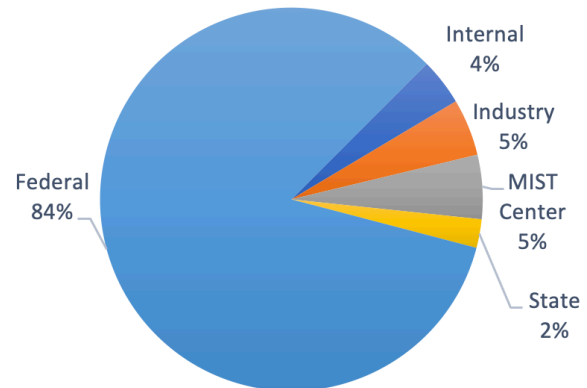
Total Funding

	Award Value (Faculty's Portion)	Expenditures (Reporting Period)
Total	\$16,020,974	\$2,463,244

Research Awards



Research Expenditures



Publications

Editorial Advisory Boards

- Jennifer Andrew: Associate Editor, *IEEE Trans. Nanobioscience* 2015-present
- David Arnold: Editorial Board, *Micromachines* 2019-present
- David Arnold: Editorial Board, *J. Micromachines and Microengineering* 2013-present
- David Arnold: Associate Editor, *Energy Harvesting and Systems* 2013-2019
- Z. Hugh Fan: Editorial Board, *Scientific Reports* 2013-present
- Z. Hugh Fan: Associate Editor, *Microsystems and Nanoengineering* 2017-present
- Philip Feng: Associate Editor, *IEEE Trans. Ultrasonics, Ferroelectrics, and Frequency Control* 2018-present
- Philip Feng: Associate Editor, *Frontiers in Mechanical Engineering – Micro- and Nanoelectromechanical Systems* 2016-present
- Jack Judy: Associate Editor, *IEEE Trans. Biomedical Engineering* 2006-present
- Toshi Nishida: Editorial Board, MDPI Sensors 2015-present
- Mark Sheplak: Associate Editor, *Journal of Acoustical Society of America* 2011-present
- Mark Sheplak: Associate Editor: *JASA Express Letters* 2011-2019
- Huikai Xie, Editor, *Sensors and Actuators: A* 2018-present
- Huikai Xie, Editor, *IEEE Sensors Letters* 2016-present
- Huikai Xie, Editor, *Micromachines* 2017-present
- Huikai Xie, Associate Editor, *the International Journal of Optomechatronics* 2011-present
- Y.K. Yoon, Editor, *Micro and Nano Systems Letters* 2017-present
- Y.K. Yoon, Associate Editor, *IEEE Trans. Components, Packaging and Manufacturing Technology* 2018-present

Reviewers for Scholarly Journals

- ACS Nano
- ACS Photonics
- ACS Sensors
- ACS Applied Nano Material
- Advanced Materials
- Advanced Functional Materials
- Advanced Optical Materials
- Advanced Electronic Materials
- Advanced Biosystems
- Advanced Materials Technology
- AIAA Journal
- Analytical Chemistry
- Angewandte Chemie International Edition
- Applied Energy
- Applied Optics
- Applied Physics Letter
- Biomedical Optics Express
- Chemical Engineering Communications
- Energy
- Experimental Thermal Fluid Science
- IEEE Access
- IEEE Electron Device Letters
- IEEE J. Selected Topics in Quantum Electronics
- IEEE Photonics Journal
- IEEE Photonic Technology Letters
- IEEE Sensors Journal
- IEEE Sensors Letters
- IEEE Magnetic Letters
- IEEE Trans. on Biomedical Engineering
- IEEE Trans. on Electron Devices
- IEEE Trans. Microwave Theory & Techniques
- IEEE Trans. Ultrasonics, Ferroelectrics, and Frequency Control
- International Journal of Refrigeration
- International Journal of Thermal Sciences
- J. Acoustical Society of America

- J. Applied Physics
- J. Biomedical Optics
- J. Biophotonics
- J. Energy Resources Technologies
- J. Intelligent Material Systems and Structures
- J. Magnetism and Magnetic Materials
- J. Microelectromechanical Systems
- J. Micromechanics and Microengineering
- J. Vacuum Science & Technology
- J. Nanoparticle Research
- Lab on a Chip
- Microfluidics and Nanofluidics
- Microsystem Technologies
- Microsystems and Nanoengineering
- Nano Letters
- Nanoscale
- Nature Materials
- Nature Scientific Reports
- Optics Express
- Optics Letters
- PLOS ONE
- Proc. National Academy of Sciences
- SCIENCE CHINA Chemistry
- Science and Technology for the Built Environment
- Scientific Reports
- Sensors and Actuators A: Physical
- Soft Robotics
- Theranostics
- Translational Research

Peer-reviewed journals (45)

- K. Castillo-Torres, D. P. Arnold, and E. S. McLamore, "Rapid isolation of Escherichia coli from water samples using magnetic microdiscs," Sensors & Actuators B: Chemical, vol. 291, pp. 58-66, July 2019.
- K. Castillo-Torres, E. S. McLamore, and D. P. Arnold, "A high-throughput microfluidic magnetic separation (μ FMS) platform for water quality monitoring," Micromachines, vol. 11, no. 16, 13 pages, Dec. 2019.
- Chen H, Jia H, Liao W, Pashaei V, Arutt CN, McCurdy MW, Zorman CA, Reed RA, Schrimpf RD, Alles ML, Feng PXL, "Probing Heavy Ion Radiation Effects in SiC via 3D Integrated Multimode Vibrating Diaphragms", Applied Physics Letters 114, 101901 (2019). ["Editor's Pick" Article]
- K. Chen, P. Dopico, J. Varillas J. Zhang, F T. J. George, Z. H. Fan, "Integration of Lateral Filter Arrays with Immunoaffinity for Circulating-Tumor-Cell Isolation", Angewandte Chemie International Edition, 58, 2019, 7606–7610. (inside cover page)
- Q. Chen, H. Xie, and L. Xi, "Wearable optical resolution photoacoustic microscopy," Journal of Biophotonics, 12:e201900066 (2019).
- D. Chugh, K. Gluesenkamp, A. Abu-Heiba, M. Alipanah, A. Fazeli, R. Rode, M. Schmid, V. Patel, and S. Moghaddam, "Experimental Evaluation of a Semi-open Membrane-based Absorption Heat Pump System using Ionic Liquids," Applied Energy, vol. 239, pp. 919-927, 2019.
- S. Chyczewski, S. Hwangbo, Y.-K. Yoon, and D. P. Arnold, "Experimental demonstration of multi-watt wireless power transmission to ferrite core receivers at 6.78 MHz," Wireless Power Transfer, vol. 6, no. 1, Mar. 2019.
- N. Garraud, A. Garraud, D. Munzer, M. Althar, and D. P. Arnold, "Modeling and experimental analysis of rotating magnet receivers for electrodynamic wireless power transmission," J. Phys. D: Appl. Phys., vol. 52, no. 18, 185501, 12 pages, Feb. 2019.
- M. Ghatge, G. Walters, T. Nishida, and R. Tabrizian, "A Non-Reciprocal Filter using Asymmetrically Transduced Micro-Acoustic Resonators," IEEE Electron Device Letters, Vol 40, Issue 5, March 2019, pp. 800-803.

- Mayur Ghatge, Glen Walters, Toshikazu Nishida, Roozbeh Tabrizian, "Atomically Engineered $\text{Hf}_{0.5}\text{Zr}_{0.5}\text{O}_2$ Integrated Nano-Electromechanical Transducers," eprint arXiv:1904.05648, 04/2019, <http://adsabs.harvard.edu/abs/2019arXiv190405648G>
- M. Ghatge and R. Tabrizian, "Dispersion-Engineered Guided-Wave Resonators in Anisotropic Single-Crystal Substrates – Part I: Concept and Analytical Design," IEEE Transactions on Ultrasonics, Ferroelectrics, and Frequency Control, Vol. 66, Issue 6, June 2019, pp. 1140-1148.
- M. Ghatge, M. Ramezani, and R. Tabrizian, "Dispersion-Engineered Guided-Wave Resonators in Anisotropic Single-Crystal Substrates – Part II: Numerical and Experimental Characterization," IEEE Transactions on Ultrasonics, Ferroelectrics, and Frequency Control, Vol. 66, Issue 6, June 2019, pp. 1149-1154.
- M. Ghatge, G. Walters, T. Nishida, and R. Tabrizian, "An ultrathin nanoelectromechanical transducer based on hafnium zirconium oxide," Nature Electronics, 2 (8), pp. 506-512. [Cover for Nature Electronics, November 2019 Issue]
- L. Guan, S. Liu, J. Chu, R. Zhang, Y. Chen, S. Li, L. Zhai, Y. Li, H. Xie, "A novel algorithm for estimating the relative rotation angle of solar azimuth through single-pixel rings from polar coordinate transformation for imaging polarization navigation sensors," Optik, vol. 178, pp. 868-878 (2019).
- Islam A, van den Akker A, Feng PXL, "Polarization Sensitive Black Phosphorus Nanomechanical Resonators", Optical Materials Express 9, 956-535 (2019).
- Jia H, Feng PXL, "Very High Frequency Silicon Carbide Microdisk Resonators with Robust Multimode Responses in Water", Journal of Microelectromechanical Systems 28, 941-953 (2019).
- M. Matin, A. Fazeli, and S. Moghaddam, "Thermographic Characterization of Thin Liquid Films Formation and Evaporation in Microchannels," Lab on a Chip, issue 15, pp. 2610-2618, 2019.
- R. Khnouf, D. Karasneh, E. Abdulhay, A. Abdelhay, W. Sheng Z. H. Fan, Microfluidics-based device for the measurement of blood viscosity and its modeling based on shear rate, temperature, and heparin concentration, Biomedical Microdevices, 21, 2019, 80 (10 pages).
- M. Pan, L. Carol, J. A. Lednicky, A. Eiguren-Fernandez, S. Hering, Z. H. Fan, C.Y. Wu, "Determination of the Distribution of Infectious Viruses in Aerosol Particles using Water-Based Condensational Growth Technology and a Bacteriophage MS2 Model", Aerosol Science & Technology, 53, 2019, <https://doi.org/10.1080/02786826.2019.1581917>.
- H-C Park, X. Zhang, W. Yuan, L. Zhou, H. Xie, and X. Li, "Ultralow-voltage electrothermal MEMS based fiber-optic scanning probe for forward-viewing endoscopic OCT," Optics Letters, 44, 2232-2235 (2019).
- V.K. Patel, F.K. Reed, R. Kisner, C. Peng, S. Moghaddam, and A. Momen, "Novel Experimental Study of Fabric Drying Using Direct-Contact Ultrasonic Vibration," Journal of Thermal Science and Engineering Applications, vol. 11, 2019.
- C. Peng and S. Moghaddam, "Energy Efficient Piezoelectrically Actuated Transducer for Direct-Contact Ultrasonic Drying of Fabrics," Drying Technology, 15 April 2019.
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- Rukmani, S. J. G, Lin, P.F, Andrew, J. S., Colina, C., Molecular modeling of complex cross-linked networks of PEGDA nanogels, J. Phys. Chem. B, 123, 4129, 2019.

- G. Walters, A. Shekhawat, S. Moghaddam, J. Jones, and T. Nishida, "Effect of In Situ Hydrogen Plasma On The Ferroelectricity of Hafnium Zirconium Oxide Films," Applied Physics Letters, accepted, 2019.
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- A. Shekhawat, G. Walters, C. Chung, R. Garcia, Y. Liu, J. Jones, T. Nishida, and S. Moghaddam, "Effect of Furnace Annealing on the Ferroelectricity of $\text{Hf}_{0.5}\text{Zr}_{0.5}\text{O}_2$ Thin Films," Thin Solid Films, vol. 677, pp. 142-149, 2019.
- C. S. Smith, S. Savliwala, C. Rinaldi, and D. P. Arnold, "Electro-infiltrated nickel/iron-oxide and permalloy/iron-oxide nanocomposites for integrated power inductors," J. Magn. Magn. Mat., 8 pages, published online, Aug. 24, 2019
- C. S. Smith, S. C. Mills, S. Savliwala, C. Rinaldi, J. Andrew, and D. P. Arnold, "Nanoscale structural evaluation of 0-3 magnetic nanocomposites fabricated by electro-infiltration," AIP Adv., vol. 9, no 12, 4 pages, Dec. 2019.
- K. Sondhi, N. Garraud, D. J. Alabi, D. P. Arnold, A. Garraud, S. Avuthu, Z. H. Fan, T. Nishida, "Flexible screen-printed coils for wireless power transfer using low-frequency magnetic fields," J. Micromech. Microeng., vol. 29, no. 8, 084006, 10 pages, June 2019.
- P. Taylor, C. V. Cuervo, D. P. Arnold, and L. F. Velásquez-García, "Fully 3D-printed, monolithic mini magnetic actuators for low-cost, compact systems," J. Microelectromech. Syst., vol. 28, no. 3, pp. 481-493, June 2019
- J. I. Varillas, J. Zhang, K. Chen, I. I. Barnes, C. Liu, T. J. George, Z. H. Fan, "Microfluidic Isolation of Circulating Tumor Cells and Cancer Stem-like Cells from Patients with Pancreatic Ductal Adenocarcinoma", Theranostics, 9, 2019, 1417-1425.
- C. Velez, S. Hwangbo, S. Chyczewski, J. Ewing, R. Bowrothu, C. Smith, Y.-K. Yoon, and D. P. Arnold, "Screen-printed barium ferrite/samarium cobalt composites with tailorable ferromagnetic resonance," IEEE Trans. Microw. Theory Techn., vol. 67, no. 8, pp. 3230-3236, Aug. 2019.
- D. Wang, C. Watkins, S. Koppal, H. Xie, "A silicon optical bench with vertically-oriented micromirrors for active beam steering," Sensors and Actuators A: Physical, vol. 298, 111586 (2019).
- D. Wang, P. Wang, H. Liu, H. Liu, J. Zhang, W. Liu, and H. Xie, "Nondestructive On-Site Detection of Soybean Contents Based on An Electrothermal MEMS Fourier Transform Spectrometer," IEEE Photonics Journal, vol. 11, no. 3, pp. 1-10 (2019).
- H. Wang, M. Godara, Z.F. Chen, H. Xie, "A one-step residue-free wet etching process of ceramic PZT for piezoelectric transducers," Sensors and Actuators A: Physical, Vol. 290, pp. 130-136 (2019).
- Wang, P.F.; Liu, Y.F.; Wang, D.F.; Liu, H.F.; Liu, W.; Xie, H. "Stability Study of an Electrothermally-Actuated MEMS Mirror with Al/SiO₂ Bimorphs," Micromachines, 10, 693 (2019).
- Y. Wang, R. Bowrothu, Y.-K. Yoon, and D. P. Arnold, "Patterning of thick electroplated CoPt magnets using SU-8 micromolds," Micro Nano Lett., vol. 14, no. 14, pp. 1393-1396, Dec. 2019.
- Y. Wang, J. Ewing, and D. P. Arnold, "Ultra-thick electroplated CoPt magnets for MEMS" J. Microelectromech. Syst., vol. 28, no. 2, pp. 311-320, Apr. 2019.
- Wang Y, Lee J, Zheng XQ, Xie Y, Feng PXL, "Hexagonal Boron Nitride Phononic Crystal Waveguides", ACS Photonics 6, 3225-3232 (2019).

- Wang Y, Zhou V, Xie Y, Zheng XQ, Feng PXL, “Optical Contrast Signatures of Hexagonal Boron Nitride (h-BN) on Device Platform”, *Optical Materials Express* 9, 1223-1232 (2019).
- H. Yang, D. Wang, T. Shan, X. Dai, H. Xie, L. Yang, and H. Jiang, “Miniature fluorescence molecular tomography (FMT) endoscope based on a MEMS scanning mirror and an optical fiberscope,” *Physics in Medicine & Biology*, Vol. 64, 125015 (2019).
- Zheng XQ, Xie Y, Lee JS, Jia ZT, Tao XT, Feng PXL, “Beta Gallium Oxide (β -Ga₂O₃) Nano-electromechanical Transducers for Dual-Modality Solar-Blind Ultraviolet Light Detection”, *APL Materials* 7, 022523 (2019). [“Editor’s Pick” Article]
- L. Zhou, X. Zhang, H. Xie, “An Electrothermal Cu/W Bimorph Tip-Tilt-Piston MEMS Mirror with High Reliability,” *Micromachines*, 10, 323 (2019).
- Z. Zhao, N. Garraud, D. P. Arnold, and C. Rinaldi, “Effects of particle diameter and magneto-crystalline anisotropy on magnetic relaxation and magnetic particle imaging performance of spherical nanoparticles,” *Phys. Med. Biol.*, 16 pages, published online Nov. 25, 2019: <https://doi.org/10.1088/1361-6560/ab5b83>.

Peer-Reviewed Conference Publications (67)

- Eric W. Atkinson, Elizabeth A. Nunamaker, Anne Gormaley, Alexis Brake, Minhal Yusufali, Benjamin S. Spearman, Cary A. Kuliasha, Abbas Furniturewala, Paritosh Rustogi, Sabha Mobini, Christine E. Schmidt, Jack W. Judy, Kevin J. Otto, “Evaluation of chronically implanted tissue-engineered-electronic-neural-interface (TEENI) for next-generation prosthetics”, 49th Annual Meeting of the Society for Neuroscience, October 19-23, 2019, Chicago, CA, USA.
- O. Azie, K. Castillo-Torres, Z. Greenberg, D. P. Arnold, and J. Dobson, “Magnetically triggered release of bioactive TGF- β from spin vortex micro-discs,” presented at *2019 Biomedical Engineering Society Meeting Annual Meeting*, Philadelphia, PA, Oct. 2019.
- O. Azie, K. Castillo-Torres, Z. Greenberg, D. P. Arnold, and J. Dobson, “Magnetically triggered release of active TGF- β from spin vortex micro-discs,” presented at *Frontiers in Biomagnetic Particles*, Telluride, CO, Aug. 2019.
- M. J. Bauer, A. Faria, D. P. Arnold, and J. S. Andrew, “Ultra-low-power current sensing with magnetoelectric nanowires” presented at 2019 Annual Research Strategy Meeting (ARSM) of the NSF Nanosystems Engineering Research Center (NERC) for Translational Applications of Nanoscale Multiferroic Systems (TANMS). Los Angeles, CA, Jan. 2019.
- Renuka Bowroth, Seahee Hwangbo, Todd Schumann, Yong-Kyu Yoon, Anthony Ng’Oma, and Cheolbok Kim, “28 GHz Through Glass Via (TGV) Based Band Pass Filter Using Through Fused Silica Via (TFV) Technology,” *IEEE 69th Electronic Components and Technology Conference (ECTC)*, Las Vegas, NV, May 28 – 31, 2019 (5 pages)
- Renuka Bowrothu, Seahee Hwangbo, Haein Kim, and Yong-Kyu Yoon, “Quintuple Band Lambda/4 Stub by using Unbalanced Bridged CRLH Transmission Lines,” *IEEE 69th Electronic Components and Technology Conference (ECTC)*, Las Vegas, NV, May 28 – 31, 2019, pp. 2337 - 2342
- K. Y. Castillo-Torres, D. P. Arnold, and E. S. McLamore, “Magnetic isolation of spin-vortex microdiscs for *E. coli* detection in water samples,” presented at *Frontiers in Biomagnetic Particles*, Telluride, CO, Aug. 2019.
- Chen H, Jia H, Shuvra PD, Lin JT, Alphenaar BW, Feng PXL, “GaN/AlN Heterostructure Micromechanical Self-Sustained Oscillator for Middle Ultraviolet (MUV) Light Detection”, *Proc. 32nd IEEE Int. Conf. on Micro Electro Mechanical Systems (MEMS 2019)*, 644-647, Seoul, Korea, January 27-31 (2019).

- Chen H, Jia H, McCurdy MW, Reed RA, Schrimpf RD, Alles ML, Hung P, Feng PXL, “Probing Ion Radiation Effects in Si Crystal by 3D Integrated Resonating Thin Diaphragms”, Proc. of the Government Microcircuit Applications & Critical Technology (GOMACTech’19), 628-629, Albuquerque, NM, March 25-28 (2019).
- P. J. Dopico, K. Chen, J. Varillas, V. Pedrosa, T. J. George, Z. H. Fan, “Circulating Tumor Cell Isolation from Clinical Samples Utilizing a Lateral Filter Array Microfluidic Device”, in Proceedings of the 23rd International Conference on Miniaturized Systems for Chemistry and Life Sciences (μ TAS’2019), Oct. 27-31, 2019, Basel, Switzerland, p1514-1515.
- Faizan M, Parmar MM, Feng PXL, Villanueva LG, “Acoustic Actuation of Suspended Graphene for Linear Excitation of 2D NEMS”, Tech. Digest of the 20th Int. Conf. on Solid-State Sensors, Actuators and Microsystems (Transducers 2019 / EuroSensors XXXIII), 2380-2383, Berlin, Germany, June 23-27 (2019).
- V. Felmetsger, M. Mikhov, M. Ramezani, and R. Tabrizian, “Sputter Process Optimization for Al_{0.7}Sc_{0.3}N Piezoelectric Films,” Int. Ultrasonic Symposium, pp. 2600 – 2603, Oct. 2019.
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