



Department of Physics and Engineering

2018-2019 Alumni Newsletter

Featured Alumnus



Chris Kearns '98

Chris Kearns is Senior Vice President in the Operations and Technology organization at NBC Universal. Chris leads Client Services across the globe and his team supports key technology used by NBC Universal's multiple businesses including News, Sports, Film, Broadcast and Cable Productions and Universal Parks. Prior to this role, Chris

was the Global Head of Infrastructure for the Vanguard Group, where he oversaw engineering for data center services serving more than 20 million investors, advisors and institutions around the world. Chris has also had roles as Senior Vice President of Enterprise and Cyber Solutions at Lockheed Martin and Leidos. Chris's career has spanned over 20 years in various roles as program manager and engineering manager for government and company projects. Chris is also an Adjunct Professor at Temple's Fox School of Business and was co-founder of the National Cyber Analyst Competition (NCAC) hosting top students from around the country in an annual cyber competition. Chris graduated from the University of Scranton in 1998 with a B.S. in Electrical Engineering. While working at Lockheed Martin he completed an M.S. in Information Science at Penn State. While at the University, Chris was the president of the IEEE club and a resident assistant. A Scranton native, he moved to the Philadelphia area after college. He lives in Glenmoore, PA with his wife Maureen (class of '98) and their children Sarah and Patrick.

Chris's Scranton Perspective

"I tribute much of my career success to the foundation I built at the University of Scranton. When joining the engineering workforce at a top engineering firm, I not only had the math, science and engineering background but I could present, write, and work well on teams." Reflecting on the paper he presented at the IEEE competition on

Artificial Intelligence, he finds it serendipitous that today, more than 20 years later, his teams are exploring AI/ML to maintain and self-heal critical computer infrastructure and autonomous cars are sharing the roadways with us.



(From left) Dr. Spalletta, Chris Kearns, Mike McAndrew, Eric Suchecki, and Joe Templin. EE Class of '98

Mechanical Engineering Program Approved by University

New Academic Program (Degree Program, Major, Minor or Concentration)

Title of New Program Mechanical Engineering Undergraduate Graduate
 Required Credits: 131 Major Minor Concentration First Offering: Fall 2020
Semester Year
 Department(s) Physics/Electrical Engineering Contact Person: W. Andrew Berger, Chair, 4056
Name extension

In support of the University's Strategic Plan goal of developing new mission-driven and market sensitive programs, and with input from our students, our faculty, university Admissions, Alumni and our Industrial Advisory Board, we successfully proposed and developed curriculum for a new Bachelor of Science Program in Mechanical Engineering. The program is approved and the **first class of ME students will enter the university in the Fall of 2020.**

Our new BS degree in Mechanical Engineering will strengthen the reputation of the University of Scranton with regard to the breadth and quality of offerings in the engineering sciences and the degrees to which those majors address the needs of tomorrow's students. A significant investment by the university will include a facility in a renovated existing space on campus with state of the art equipment. With our growing number of engineering programs, our department name will transition from only identifying EE in our name to the:

Department of Physics and Engineering



Model H-6910-CDL
 Wind Tunnel shown with
Model H-6910-5 Manometer
 Package option
 and **Model H-6910-55**
 Lift and Drag option
 Dimensions: 69"H x 96"W x 30"D
 Weight: 1,000 lbs.



Shown **Model H-6920-CDL** with optional **H-6920-MR** Mobile Storage Cart (left) for storage of Sensing and Transmitting accessories. Also shown, optional **H-6920-22** Water Pump system (right).
 Dimensions: 78"H x 98"W x 30"D Weight: 1000 lbs.



Nathaniel Frissell - New Faculty



nathaniel.frissell@scranton.edu

Working and Pursuing a Degree

Jonathan Rizzo, EE '21 – A Testimonial

“After high school, I attended Lincoln Technical Institute in Allentown, PA for Electronic Engineering Technology from 2002-2003. Afterwards, I worked as an electronic equipment technician. I attended Luzerne County Community College from 2011-2015 for Electronics Engineering Technology while working full-time as an electronic equipment technician and transferred into the electrical engineering program at the University of Scranton. This fulfills a childhood dream of being an electrical engineer”!



Why Scranton?

“I knew that the University of Scranton is the most rigorous and academically challenging out of all of the colleges in Northeast Pennsylvania. I wanted to be challenged and pushed to my limits. I wanted to grow in my Catholic faith, and the University of Scranton has allowed me to do both. Electronics is my love and passion, and the University of Scranton has allowed it to develop even more! Classes are small and the instructors are extremely helpful and encouraging. I owe so much to the instructors that challenged me and allowed me to grow into who I am today. Ever since I was four years old, I was taking things apart to figure out how they worked. My passionate curiosity is just as strong today as it was then. Because of this, there was no better choice than the University of Scranton”.

Dr. Frissell is a Space Physicist and EE who comes to Scranton as an **Assistant Professor** from the New Jersey Institute of Technology Center for Solar-Terrestrial Research. Dr. Frissell has a passion for radio science and remote sensing of the ionosphere, the electrically charged layer of the upper atmosphere that extends from ~50 to 600 km above the Earth’s surface.

Prior to being a Research Professor and Postdoctoral Associate at NJIT, Dr. Frissell completed his masters (2011) and Ph.D. (2016) at Virginia Tech in the Space@VT Super Dual Auroral Radar Network (SuperDARN) laboratory. Using the SuperDARN radar measurements, Dr. Frissell studied magnetospheric Ultra Low Frequency pulsations measured by the radars and their connection to Earthward-moving plasma flows in space, as well as Traveling Ionospheric Disturbances associated with Atmospheric Gravity Waves and their connection with Polar Vortex.

Dr. Frissell was introduced to space physics and space weather in middle and high school through the hobby of amateur (ham) radio He was fascinated by long-distance radio propagation and the variability imposed on it by the geospace system. In addition to leading him to pursue a Ph.D. in this field, it enabled him to found and lead the Ham Radio Science Citizen Investigation (HamSCI, hamsci.org), a citizen science collective that aims to bring together the professional research and the amateur radio communities. The amateur radio community awarded him the prestigious 2017 Yasme Foundation Excellence Award and the 2019 Dayton Amateur Radio Association Amateur of the Year Award. We welcome Nathaniel to the department!



Physics Research Projects

Our Physics and Biophysics senior students attended the AAPT-CPS 67th Annual Conference at Wilkes University this past March. They successfully presented recent progress made in their respective research projects.

Title: *"Instrumentation and Implementation of Marginal Oscillator Circuits for a Continuous Wave Nuclear Magnetic Resonance Spectrometer."*

Author: Camille Mikolas '19

Advisor: Declan Mulhall

Since its discovery, nuclear magnetic resonance (NMR) has played an essential role in the development of new technologies and applications in different areas of science, medicine, and engineering. The construction and instrumentation of a continuous-wave NMR apparatus by students provide an invaluable teaching tool for educators as it encourages an in-depth understanding of nuclear physics and radio frequency electronics. In this project, we developed an easy-to-follow and educational experiment in NMR for the undergraduate physics major consisting in the design and construction of a bridge and marginal oscillator circuits to detect the absorption frequency (Larmor frequency) of a proton in a sample tube. We described two simple but successful marginal circuits that could detect this NMR signal.

Title: *"Modeling for high efficiency graphene/oxide/semiconductor-alloy Schottky barrier solar cell"*

Author: Jesse Kemmerling '19

Advisor: Argyrios Varonides

We propose an insertion of a GaAs/Alloy multi-quantum well (mqw) GaAs/AlGaAs thin layer between oxide and n-GaAs layers to improve solar cell performance by opening a wider reception window for incident solar photons through an AlGaAs/GaAs layer (1.80eV/1.42eV). Solar photons generate transport of mobile photo-excited carriers in all three major regions of the hetero-structured cell (graphene layer, depletion region and the bulk semiconductor). This transport includes (a) electrons thermionically escaping from the graphene side to the depletion region through the oxide layer (b) electron-hole pairs as photo-generated in individual quantum wells with subsequent thermionic escape for the wells and (c) holes generated in the bulk n-GaAs (1.42eV) and diffusing to the junction. The existence of lattice-matched AlGaAs/GaAs quantum wells (with wider optical gap 1.59eV) ensures electron hole separation due to the strong existence of junction electrostatic field. Photoelectrons can overcome the junction barrier and by tunneling through the oxide layer, they can reach the n-GaAs side. We predict higher total current due to thermionic emission from graphene, mqw regions, and photo-holes. We predict open circuit voltage more than 1.12V, short circuit current density near 18mA/cm², and fill factors about 75% leading to collection efficiency levels in excess of 15%.

Title: *"Construction and Operation of a Fizeau's Interferometer"*

Author: Griffin Mulvihill '19

Advisor: Juan D. Serna

Hippolyte Fizeau's aether-drag experiment changed nineteenth-century optics. Physicists widely debated the existence of the luminiferous aether and Fizeau's experiment laid the groundwork for not only disproving its existence but also Einstein's theory of relativity. Often, Fizeau's experiment is used in introductory physics to illustrate the concept of composite velocities. In this project, we built an affordable version of Fizeau's interferometer using clear PVC tubes; pipe couplers and caps to hold the water; a water pump and flowmeter to run the water, and stock optical and electrical equipment. During the construction and operation of this cyclic interferometer, we faced different challenges including optical misalignment losses, reduction of laser intensity and collimation, lensing effects, and water scale buildup. We described these difficult to deal with problems and discussed some measures we took to resolve these issues.



Dr. Serna with (from left) Camille Mikolas, Joseph Delmar, and Griffin Mulvihill at the 67th AAPT Conference

Title: *"Population Inversion Dynamics of a Two-Level System in Sine and Chirp-like Modulated Fields"*

Author: Joseph Delmar '19

Advisor: Juan D. Serna

The Jaynes-Cummings Model is a theoretical model in quantum optics that describes the interaction of a two-level atom in an optical cavity with an electromagnetic field. The solutions to this system typically exhibit Rabi oscillations of the occupation probability between the upper and lower states and the collapse and revival of the population inversion. In this study, we examined numerically the dynamics of a two-level atomic system interacting with a cavity field modulated by sine and chirp-like waveforms. By varying the amplitude and frequency, we compared the time-length between collapses and revivals of the population inversion for these two signals. We also discussed the feasibility of generating a chirp-like modulated field and the use of its amplitude and frequency as possible control parameters.



Internships, REUs, and Graduate Schools

Graduate School

Joseph Delmar PHYS - Temple University, Particle Physics
Camille Mikolas PHYS - Michigan State University, Physics
Jesse Kemmerling CE - Penn State University, CE
Andrew Charway CE - Lehigh University, E/CE

Research Experiences for Undergraduates

Francis Tholley '21 – Penn State University
Victoria K. Norman '19 – University of Arkansas-Fayetteville.

Internships

Brain Kroll '22 EE – SMART Program - Electrical Engineering Technician, Engineering Directorate Tobyhanna Army Depot
Ellie Rosentel '22 EE – Miller-Rosentel Assoc., Wilkes Barre, PA
Nicholas Voltaggio '20 EE - Johnson Controls, New Freedom, PA
Eileen McNulty '20 EE – TREC Group, Inc – Springfield, PA
Stephanie DeBarros '20 CE – IT Services, LLC, Stamford CT
Vincent Oliverio '20 CE – US Air Force, Wright Patterson AFB
Andrew Buttner '20 CE – Saab Sensis, Syracuse NY
Joseph Brancato '20 EM – Tishman Speyer, New York, NY
Mark Pawelski '20 EE – Toyhanna Army Depot, Tobyhanna, PA
Matthew Slezak '20 EE – Enersys, Reading PA
Quinn Killeen '20 CE – Syska Hennessey Group, New York, NY
John Radetich '20 EE – Pride Mobility, Duryea, PA

Aubrey Savage '21, CE – Internship Highlight

Sanofi Pasteur is the largest company in the world devoted to the production of vaccines, protecting against infectious diseases at all life stages. I worked with EE Alumnus Kerry Williams '14 in Maintenance and Reliability Engineering. I focused on a project for predictive maintenance through documenting errors that were caused by the machine and translating these errors into a predictability model that can predict when a station on the machine will fail. I worked with large amounts of data in Excel using Python and various complex Excel formulae. The purpose of this project was to organize data to detect and eliminate unused maintenance spare parts while also determining failure rates of those actively used.



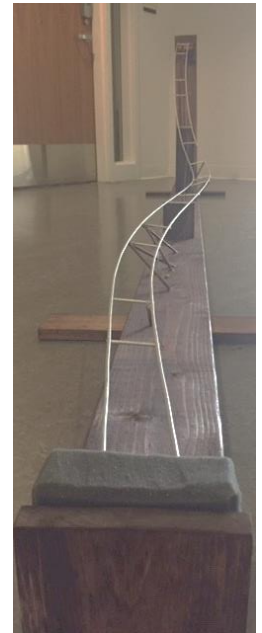
Project Management Competition

Based on last year's exposure and experience the department decided to incorporate the Project Management (PM) SimulTrain software into our engineering capstone course. Nine engineering juniors and seniors (three teams) participated in the competition. The University of Scranton team (**Justin White EM '19, Luke Cullen CE '19, and Aubrey Savage CE '21**) won the competition! To increase our students' awareness of PM in their future careers, one of the first IEEE seminars will be dedicated to PM with speakers from the industry.



The Hayes Family Science Competition

On April 16, 2019, the 17th Annual Hayes Family Science Competition was held at The University of Scranton. This was the largest Hayes Competition held to date. We hosted 242 students composing 30 teams from 16 high schools. Thanks to PASCO Scientific, the Hayes Competition Fund, and a Spitz Foundation Grant through the university's government and community relations office, we were able to give a PASCO Smart Cart back to every high school in attendance. This wireless data collecting dynamics cart collects and then transmits via Bluetooth position, velocity, and force data, among others, back to free software on an instructor's computer. This year's competition theme was Olympics. We hosted David Kurtz, a former Olympian and Captain of the 1994 US Bobsled team and most recently general counsel for the International Bobsled and Skeleton Federation, in attendance to help with our main event themed the "Skeleton", which utilized the PASCO smart cart. Mr. Kurtz also gave a presentation to students about his experience as an Olympian.





2019 IEEE Region 2



Students from Scranton competed in every competition, held at West Virginia University, ranging from robotics competitions to an ethics presentation competition. Scranton placed in 7 of 9 competitions including:

2nd Place in the Micromouse Competition

Peter Kulick '19, Aubrey Savage '21, Charles Kulick '22

2nd Place in the WIE Teach Competition

Eileen McNulty '20

3rd Place in the Sumo Robot Scratch Competition

Jesse Kemmerling '19, Andrew Charway '19, Dan D'Agostini '19

5th Place in the Sumo Robot Kit Competition

Ellie Rosentel '22, Gabby Hanstein '22, Alexa Baldon '22

6th Place in the Sumo Robot Kit Competition

Alexander Thoennes '19, James Orr '20, Kyle Hill '19

People's Choice in the Project Showcase

Matt Slezak '20, Mark Pawelski '20, Nick Voltaggio '20, Francis Tholley, '21

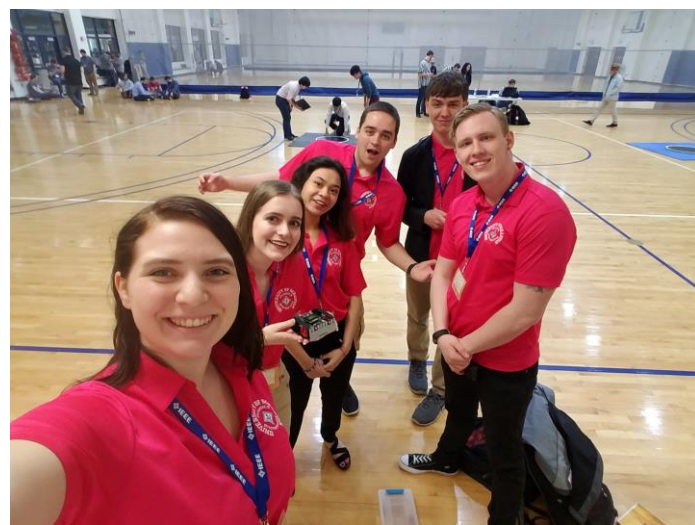
1st Place in the T-shirt Competition

Alexa Baldon '22

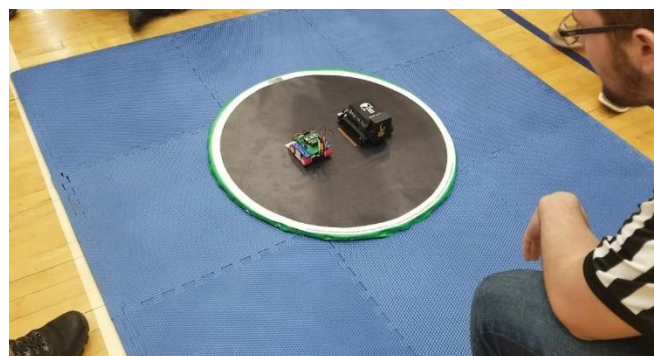
Student Activities Conference

The student branch of IEEE at the University of Scranton is a program providing students with the opportunity to participate in a campus wide event in the form of an IEEE seminar series (presentations by distinguished scientists, community business leaders, as well as our alumni and various employers and prospective job companies). The IEEE club also fosters

professional development and networking. **Dr. Andrew Berger** has been the IEEE club mentor since 1991.



Sumo Robot Competition Students (from left) **Ellie Rosentel '22, Gabby Hanstein '22, Alexa Baldon '22, James Orr '20, Alex Thoennes '19, and Kyle Hill '19** at the 2019 SAC Conference. Below: the U of S Scratch Sumo Bot (right) in the ready position for a match.





Paul Fahey '64 Retires

Dr. Fahey has been a faculty member at the University since 1968, when he joined the faculty of the Physics/EE Department. He has taught physics, biophysics, and electronics engineering courses. He was promoted to full professor in 1978 and served as chair of the Physics/Electronics Department from 1982 to 1988. In 1989, Dr. Fahey was appointed acting dean of the College of Arts and Sciences, and in 1990, was appointed Dean. In 1997, he returned to his teaching position in Physics/EE. His current research specialty is the biophysics of hearing. Dr. Fahey has been a visiting professor at Cornell University and a resident visitor at AT&T Bell Labs. He held fellowships from NASA and the National Science Foundation, and has received grant funding from the National Institutes of Health, the Department of Energy and the Ben Franklin Partnership. Dr. Fahey will continue to be an active member of the department on a part-time basis.

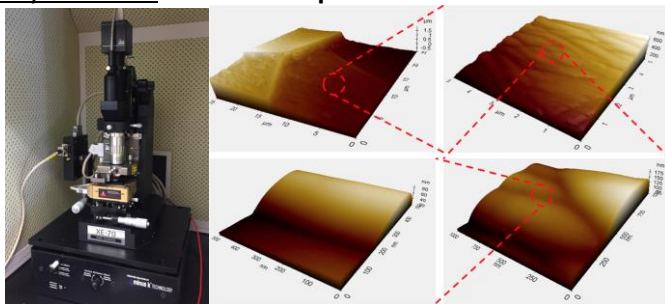


Atomic Force Microscopy (AFM) Inter-Disciplinary Projects

“Development of a Finite-Element Physical Model of Structural Properties of the Camponotus Floridanus (Florida Carpenter Ant) Cuticle as determined in part by Atomic Force Microscopy”

Student: Joshua Toth '20

Faculty Advisors: **Dr. Robert Spalletta** and **Dr. Marc Seid**



“Structural analysis of antibiotic treated Camponotus floridanus using atomic force microscopy”

Students: Dylan Valente

Faculty Advisors: **Dr. Robert Spalletta** and **Dr. Marc Seid**

NSF Collaboration Grant

Dr. Frissell brings with him a 3-year NSF grant entitled "Collaborative Proposal: DASI Track 1: Personal Space Weather Station." It is a collaborative proposal (now) between The University of Scranton, University of Alabama, Case Western Reserve University, and the TAPR Amateur Radio Electrical Engineering Organization. The goal is to create a small device that people can install in their backyards to measure local effects of space weather, and then send those observations back to a central server to allow analysis on global scales. We are interested in understanding short-term and small-scale variability in the ionosphere and magnetosphere.

IEEE HKN Activities

The university's Lambda Nu chapter of the IEEE-Eta Kappa Nu (HKN) engineering honor society held several events throughout the academic year with the guidance of faculty advisor **Dr. Christine Zakzewski**.

Induction Ceremony – *November 29, 2018*. Students who met entrance requirements and who submitted an essay were selected for induction to the honor society.

Resume Workshop – *November 20, 2018*. Career Services, department faculty, and senior engineering students worked with students to build or refine their resume and create cover letters.

Mock Interviews – *February 21, 2019*. The following alumni/engineers came on campus to give a "Mock Interview" to our students and then the engineer reviewed the student resume and gave feedback on their resume and interview skills. We thank them for giving their time!

Ryan Savage '10 – Electrical Engineer, Lockheed Martin, Archbald PA

Jeffrey Williams '06 – Physicist/Radiographer for the US Army ARDEC, Picatinny Arsenal, NJ.

Patrick "PJ" Wagner '10 – Senior Engineer, Systems Integration & Test Trident Fleet Ballistic Missile Program, Lockheed Martin, Mitchel Field, NY

Hardik Patel '14 – Senior Engineer, Susquehanna Nuclear Power Plant for Talen Energy, Berwick PA

Jon Troy '95, Senior Program Manager, Gentex Corporation, Carbondale, PA.



Engineering and Athletics

Dan D'Agostini '19 Electrical Engineering

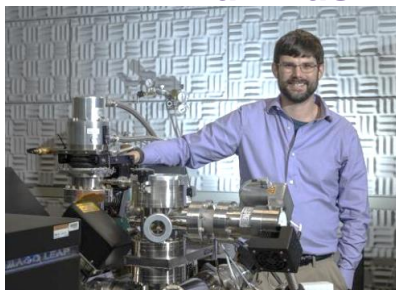
enjoyed a stellar four-year career on the wrestling mat and in the classroom for Scranton. During his career, he won 108 matches, the third most in program history.



In his senior season, D'Agostini broke a school record with his 39th win of the season at the NCAA National Championships after he became just the 12th Royal to reach the national tournament. He was the runner-up at NCAA Mideast Regional Championships, falling only to the top-ranked wrestler in the nation in overtime. He finished his historic senior season with a 39-5 overall record and was a perfect 19-0 in dual meet competitions.

He is the first Scranton competitor to earn National Wrestling Coaches Association Scholar All-American honors three years in a row. He is a member of the Sigma Pi Sigma physics honor society and is president of the Lambda Nu chapter of the HKN engineering honor society. (Borrowed from U of S news)

Alumnus in the News



Jon Poplawsky '07, a materials scientist at the Department of Energy's Oak Ridge National Laboratory, develops and links advanced characterization techniques

that improve our ability to see and understand atomic-scale features of diverse materials for energy and information technologies. One of the tools he uses is atom probe tomography (APT). Poplawsky describes the product of ATP:

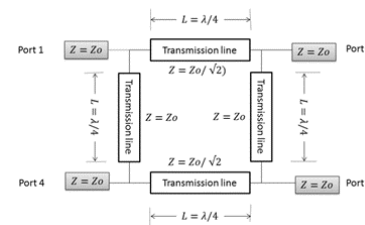
"The atom probe is like a movie that you can freeze to see one frame at a time. You can see each atom reconstructed in 3D and understand what happened to the atoms because of a given process." Read more about Jon and what he does by following the link below:

<https://www.ornl.gov/news/jon-poplawsky-probing-materials-improve-energy-and-information-technologies>

Engineering Research Projects

Miniaturized dual-band impedance matching branch-line coupler

The conventional branch-line coupler is a single-band coupler and is therefore not an optimal solution for multiband/multi-



standard technologies. In addition, due to the presence of Quarter wavelength transmission lines, the size of conventional BLC is relatively larger, especially at the lower frequencies. This project proposed using coupled lines in conjunction with port impedance matching techniques to realize a smaller dual-band coupler. A detailed theoretical analysis was carried out to find the design equations. Initial circuit simulations performed in Keysight ADS software shows the possibility of obtaining a solution. In the future, students will carry out a full electromagnetic simulation of their design, prototyping and subsequent measurements.

Students: **Eileen McNulty '20**

Mark Pawelski '20

Faculty Advisor: **Dr. M.D. Maktoomi**

Generalized Multi-section Wilkinson Power Divider

A Wilkinson power divider (WPD) is a highly useful component in the RF/Microwave industry. For example, it is frequently used in test and measurement setups, in RF power amplifiers and in balanced amplifiers. A WPD design by appending lossless passive two-port network at its three port gives opportunity to enhance its bandwidth, provides multiband capabilities, and helps in miniaturization. While such designs for single section WPD exist, but application of this approach in multi-section Wilkinson has not been investigated. Students were required to do a rigorous theoretical analysis of multisection WPD to obtain design equations for various parameters. A MATLAB analysis of the obtained design equation confirmed the correctness of the obtained equations. Students will be working on validation of this idea through electromagnetic simulation and by developing a working prototype.

Students: **James Orr '20**

Matt Burns '20

Faculty Advisor: **Dr. M.D. Maktoomi**

Modeling Euler-Bernoulli cantilevered beams under Tension

Nano-electromechanical systems (NEMS) have many applications in fundamental science and engineering such as the study of quantum-limited motion and force detection in atomic force microscopy (AFM) applications. Materials such as Si, GaAs, and SiC have been used in situations with prototypical resonators consisting of nanoscale beams clamped at one or both ends. Using standard methods, we model an AFM cantilever as a clamped-pinned Euler-Bernoulli oscillating beam under axial stress and derive (a) the general solution of vibration (b) the equation determining the fundamental frequency of oscillations under tension and (c) the effective spring constant of the cantilever/beam by using the relation $f = (1/2\pi) (k/m)^{1/2}$.

Students: **Jesse Kemmerling '19**

Faculty Advisor: **Dr. Argyrios Varonides**



Thank you for reading our 2018-2019 Physics/EE newsletter! Feel free to contact any of us at any time!



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**Dr. MD
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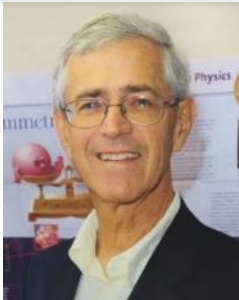
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**Prof. Paul
Pearson '13**

Prof. Paul Pearson '13, hired as a **faculty specialist** in the department, will teach introductory physics courses and laboratories for the Department of Physics and Engineering. He received a B.S. in Physics and M.S. in Secondary Education from the University of Scranton. He served as an instructor in Chemical, Biological, Radiological, and Nuclear Defense from the United States Marine Corps. He taught secondary AP physics and mathematics at Scranton Preparatory School, and acted in support of various high school science and mathematics events, including the PA Junior Academy of Science, the Hayes Family Physics Competition, and the Newton Mathematics Competition. We welcome him back to the department! Prof. Pearson resides in Wayne County, PA with his wife, Aimee, and his two children, Eli and Fiona.

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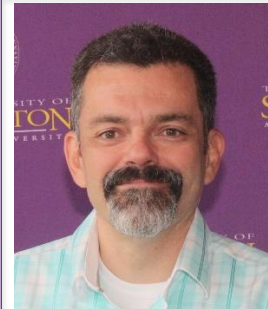
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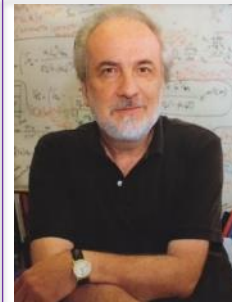
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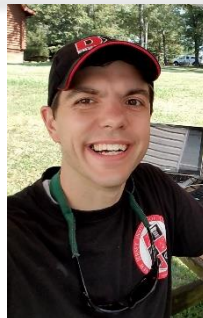
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