



Department of Physics and Engineering

2019-2020 Alumni Newsletter

Featured Alumnus Carol (Walker) Strauch '01



Carol Strauch is Director, Marine Corps Systems' Business Capture and Affordability at Sikorsky, a Lockheed Martin Company. Carol manages bid & proposal activities for Marine Corps System pursuits including the CH-53 and VH-92 platforms as well as developing strategies for long-term improvements in the process. In addition to business capture, Carol is responsible to develop and execute an

integrated affordability strategy with customers and provide leadership to a large cross functional team to successfully capture these savings across the full lifecycle of the CH-53K platform. Prior to this role, Carol was Director, Maritime Sustainment Programs within Sikorsky where she led program team in execution of a portfolio of sustainment programs supporting the US Navy, US Coast Guard and international MH-60 fleets as well as responsibility over the wholly owned Sikorsky Australia Aircraft Limited entity. Carol has been with Lockheed Martin since graduating the University of Scranton and has held roles of increasing responsibility in engineering, technical management, research and development management, business development, strategy, program management and business capture Carol graduated from the University of Scranton in 2001 with a B.S. in Electrical engineering. She lives in Clarks Summit, PA with her husband Ken and their children Jackson and Anthony.

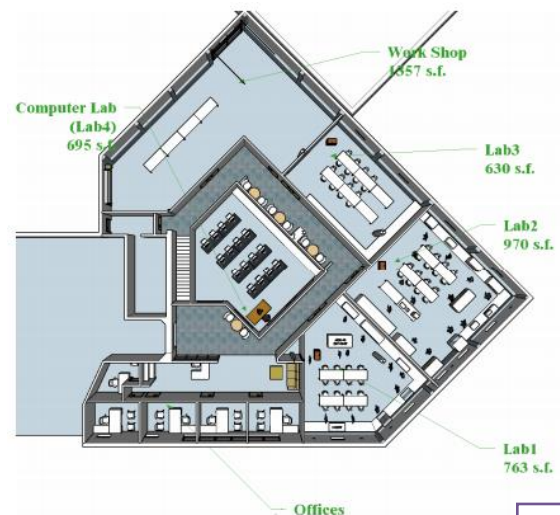
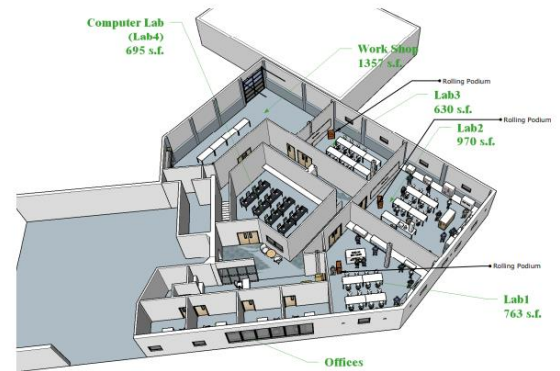
Carol's Scranton Perspective

"The University of Scranton provided me with a well-rounded foundation to which I attribute much of my career success. When joining Lockheed Martin, I was quickly able to contribute to teams in expanded capacities that my colleagues coming out of technology schools struggled to achieve. In addition to a strong technical foundation, I was able to write papers and prepare presentations to communicate key messages to leaders at various levels and with various backgrounds. Fitting into cross-functional teams to address the needs of our nation's defense also came easily coming from a smaller program with students and professors that worked side by side to grow together. I am forever grateful for this incredible foundation that my Jesuit education has provided." Reflecting on the incredible mentor leadership the professors in the EE department always provided, Carol also shared how that has helped to shape her own style of leadership. Her professors always helped her to learn while also challenging her to grow and she works hard to do the same for individuals she has led and mentored throughout her career. "My career, starting with my university experience, has afforded me so many opportunities and allowed me to grow so much that I want to pass that on to future engineers wherever I can."

Mechanical Engineering Program Development

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 in Hyland Hall with state of the art equipment.





Amir Zamanian - New Faculty



Dr. Amir Hosein Zamanian is Assistant Professor in the Physics and Engineering Department. He has joined the University of Scranton from Southern Methodist University in Dallas, Texas. He received his MS at the Amirkabir University of Technology in Tehran, Iran.

His Ph.D. research was the development of Hydraulically amplified dielectric elastomer actuators (artificial muscles) and investigation of stability analysis, dynamic modeling, and kinematic analysis of soft robot manipulators using these actuators.

Amir was involved in the development of an expert application for vehicle gearbox health monitoring combining artificial intelligence techniques and vibration signal processing at the Amirkabir University of Technology, design and the development of a prosthetic arm for rehabilitation using the electromyographic signals, and suppression of the pathological tremor in hand using with an adaptive notch filter with a linear motor at Southern Methodist University are some other of his research.

Amir received the best paper award in the 4th Condition Monitoring and Fault Diagnosis Conference at the Sharif University of Technology in 2010. His current research interests include Vibration, Modal Analysis, Dynamics, Control, Soft Robotics, Condition Monitoring, Artificial Intelligence, and Numerical Computing. He is the author of a textbook and 18 journals and conference papers.

Amir is a member of the American Society of Mechanical Engineers (ASME) and the American Institute of Aeronautics and Astronautics (AIAA). He is the editorial board member of Insight-Automatic Control Journal. He has served as a peer reviewer for journals including IEEE/ASME Transactions of Mechatronics, Mechanism and Machine Theory, Advances in Systems Science and Applications, Frontiers of Computer Science, Journal of Optimization, and more.

He received his Ph.D. from SMU, Dallas, Texas; his MS from the Amirkabir University of Technology in Tehran, Iran; and his BS from Bu-Ali Sina University in Hamedan, Iran, all in Mechanical Engineering.

Micromouse Simulator

Matt Burns, '20 and Cuong Nyugen participated in the IEEE SAC Micromouse Competition in 2020, developing many simple Python programs to test multiple implementations of the path finding algorithm. However, those programs lacked a graphical interface; all outputs could only be viewed through the console. Furthermore, every implementation required a whole new script. Without a logical interface through which they could execute the desired algorithm, they developed a stand-alone application.

Without access to the robot and maze on campus due to COVID-19, the students were further motivation to develop the app. The app is based on the Python Tkinter library. It possesses a minimalistic interface with a minimal number of buttons and displays. It does not require a separate Python installation on the computer. All instructions for the app are packaged together with the app itself. Users can write a one-file script using the given template, which significantly reduces the time needed for a new algorithm's development, visualization, and testing. Users can use the same template to write another short script for a different algorithm. Moreover, they would be able to interactively select which algorithm to test from within the app. There is a built-in random maze generator which, as its name suggests, randomly generates a maze so that the users can test the algorithm against all possible maze configurations. When a user presses the "Start Navigation" button, a diamond shape, which represents the micromouse will start to move according to the user's algorithm, as if it is the real micromouse.

After the Spring 2020 semester, Cuong and Matt continued the app's development in support of future ENGR 150 students. Currently the app's Custom Mode allows the user to design, save, and retrieve their own maze designs. Anyone can test their algorithm against a specific maze configuration to determine whether the algorithm is adequate for every possible situation. In addition, faculty now have a means to digitally design the maze for the ENGR 150 competition.

Beyond the scope of the Micromouse project, the development of the app encouraged Cuong to learn more about the programming language Python, algorithms, and data structures. The students further honed their skills in app development, and much of the new knowledge gained was particularly useful in Cuong's current Data Structures and Algorithms course, in which he is currently enrolled.

Physics Research Projects

The superlattice (SL) effect on current increase in Graphene/Oxide/n-GaAs Schottky Barrier Solar Cells

Presentation at the 37th European Photovoltaic Solar Energy Conference and Exhibition (PVSEC) International Conference, Sept 7 – 1, 2020 by Dr. Argyrios Varonides

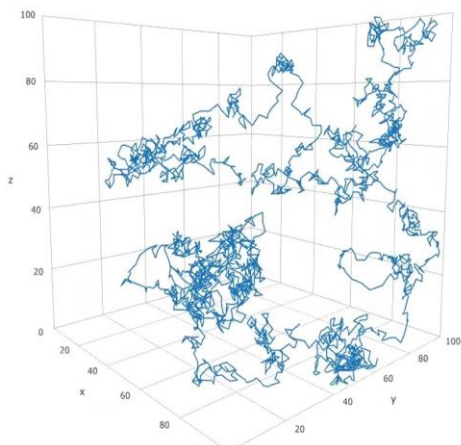
We demonstrate the advantage of current density increase in graphene/Oxide/n-GaAs solar cells by means of a short AlAs/GaAs superlattice (SL) embedded in the GaAs layer. Such a layer attracts photo-excited carriers of both kinds leading to optical gap increase from 1.42eV to 2.129eV due to ground state energy difference, leading to strong absorption at 582nm of incident solar wavelength. We study carrier escape in the thermionic emission model and find that excess carriers thermally escaping from quantum wells of the SL region contribute additional current depending on temperature and solar concentration. Specifically, a twenty-period SL region under one sun absorbs within 582nm <math>1 < 873\text{nm}</math> range, contributing 1.391mA/cm² and 9.83mA/cm² and near 20mA/cm² at one, 50 and 200 suns, respectively.

Photon Diffusion

Dr. Declan Mulhall, Shaaf Sarwar, James Lanning, Thomas Elias, John Nelson

The intensity of light from the side of a candle decreases with distance. A model for this is photon diffusion, where the light is treated like a gas of particles that do a random walk through the medium. There is a mean free path, and a probability of an absorption. The material has scattering sites.

We are modelling this phenomenon as a diffusion of photons, treating light as a gas. We are constructing an apparatus that will measure the intensity of the light along a wax cylinder that is illuminated by our LED. It involves nontrivial data measurement and analysis, and mathematical modeling.



Quantum Chaos

Dr. Declan Mulhall, Cuong Nguyen, Peter Bouraphael

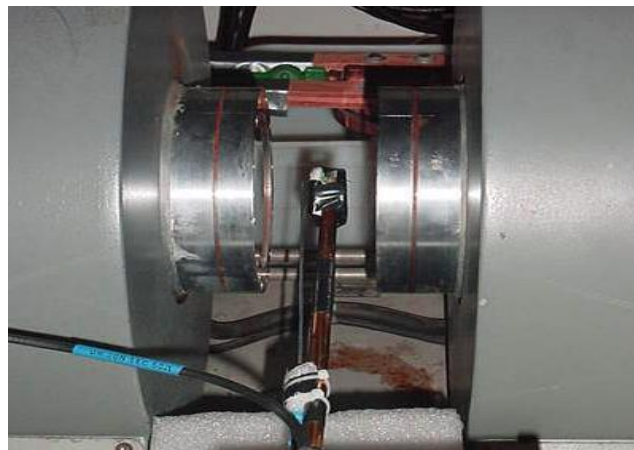
Random matrices can model chaotic quantum systems, like the atomic nucleus, or very excited atoms. Random matrix theory is the center of quantum chaos. The results of RMT can be used for the immensely practical and important job of analyzing data from certain nuclear experiments. In this project, we would use python to make random matrices, look at their properties, and then analyze data from Brookhaven National Laboratory.



Nuclear Magnetic Resonance

Dr. Declan Mulhall, James Lanning, Aidan Szabo

We are designing a continuous wave nuclear magnetic resonance apparatus to measure the tiny absorption of RF energy by the protons in a sample. The sample is a tiny bottle of oil or water, in a small coil put in the poles of a magnet. E challenges here are making an oscillator circuit, simulating it on LTspice, and then designing the PCB.





Internships, REUs, and Graduate Schools

Graduate School

Luke Cullen 2020 – MS Computer and Electrical Engineering, State University of New York Binghamton
Mark Pawelski 2020 – MS Electrical Engineering, Pennsylvania State University
Joshua Toth 2020 – PhD Materials Science, University of Pennsylvania

Internships

Ellie Rosentel 2022 – PPL Susquehanna Nuclear Power Plant
John Mecca 2021 – Lockheed Martin, Archbald, PA
John Patwell 2021 – General Electric, Schenectady, NY
Aubrey Savage 2021 – Lockheed Martin, Archbald, PA
Stephanie DeBarros 2020 – IT Services LLC, Stamford, CT
Madison Ashby 2020 – C&S Companies, Syracuse, NY

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

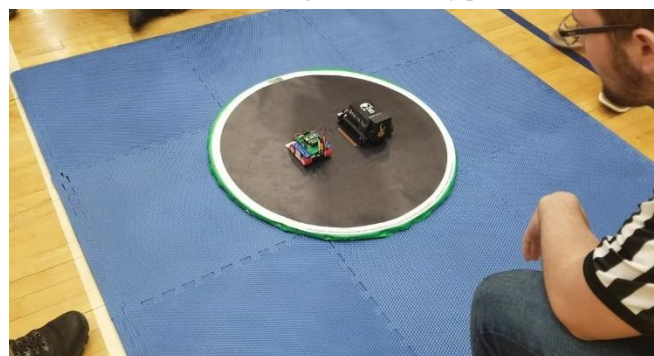
Student Activities Conference

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.





The University of Scranton Hosts Virtual HamSCI Workshop

This past March 20-21, 2020, almost 300 people from 6 continents gathered on Zoom to participate in HamSCI 2020: The Auroral Connection, a workshop dedicated to studying space physics, space weather, and radio propagation through a collaborative effort of both the professional geospace and the amateur radio communities.

This NSF-sponsored workshop, led by Scranton Assistant Professor Dr. Nathaniel Frissell, featured invited talks by Dr. Elizabeth MacDonald (Aurorasaurus/NASA) on optical auroral signatures, Dr. Jim LaBelle (Dartmouth College) on natural radio auroral emissions, and David Hallidy K2DH on amateur radio auroral communications. In addition, this workshop served as a biannual team meeting the HamSCI Personal Space Weather Station project, a \$1.3 million collaborative NSF project led by Dr. Frissell to develop new ground-based instrumentation for citizen space science. As part of this effort, University of Scranton Senior Electrical Engineering student Jonathan Rizzo presented a paper on the development of a receiver for detection and study of Very Low Frequency radio emissions.

Although this HamSCI workshop was originally supposed to be held in-person on Scranton's campus, it became one of the first science workshops to effectively transition to a virtual format as a result of the COVID-19 pandemic. A complete video recording of HamSCI 2020 is available from hamsci.org/hamsci2020. The HamSCI 2021 workshop will again be hosted virtually by the University of Scranton in March 2021. Please join us! For more information, please visit hamsci.org or e-mail nathaniel.frissell@scranton.edu

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.

Scranton's Newest Club: W3USR Amateur Radio Club

One of The University of Scranton's newest student organizations, the W3USR University of Scranton Amateur Radio Club, was voted to become an official club by the University of Scranton Student Senate on September 4, 2020. Amateur (ham) radio is a hobby that is officially recognized by the U.S. Federal Communications Commission (FCC) as having the fundamental purpose of providing volunteer public service and emergency communications, advancing the state-of-the-art of radio technologies, expanding the pool of trained radio operators, radio technicians, and electronics experts, and enhancing international goodwill. W3USR is the official radio callsign issued to the club by the FCC.

Even in the midst of the COVID-19 pandemic, W3USR has been highly active with regular meetings on Zoom. Thanks to online radio platforms such as kiwisdr.com and Echolink, club members have been able to remotely access shortwave listening facilities and VHF/UHF communications systems around the globe. Collaborations with other university clubs such as New Jersey Institute of Technology K2MFF, Massachusetts Institute of Technology W1MX, and the Case Western Reserve University W8EDU have allowed for Scranton students to earn new and upgraded amateur radio licenses remotely. Zoom has also enabled the W3USR Scranton club to regularly host world leaders in amateur radio and ionospheric science as guests at club meetings. Planned activities for the Fall 2020 semester include guided building of the Elenco AM-780k radio kit, talks on the history of Heinrich Hertz by Dr. Ted Simpson and Amateur Radios by Mr. Bill Liles NQ6Z, an intercollegiate Short Wave Listening Contest.

The W3USR Amateur Radio Club is led by President Veronica Romanek KD2UHN ('23, Physics), Vice President Jonathan Rizzo KC3EEY ('21, Electrical Engineering), Secretary Tommy Baran KD2SNG ('23, Neuroscience), Treasurer Steve Holguin ('22, Computer Engineering), and Faculty Advisor Dr. Nathaniel Frissell W2NAF. Zoom club meetings are held Thursday at 8 PM and open to all interested. Please contact the club secretary at thomas.baran@scranton.edu for more information.

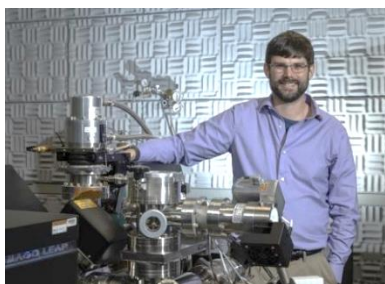


The New Director of Student Retention and Completion



Nicholas Truncale '06, G'07 was appointed to the inaugural position of director of Student Retention and Completion this summer. Previously, he served as a faculty specialist in the University's Department of Physics and Engineering. In addition to the time he spent in the classroom, he also served as the Coordinator of General Education Assessment and OEA Fellow in the Office of Educational Assessment and as the Coordinator of Elections for the Faculty Senate while serving on the Faculty Senate Executive Committee. As a faculty representative on the University's Governance Council, Strategic Enrollment Planning and Student Retention committees, he has been an engaged contributor to student success initiatives for many years.

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>

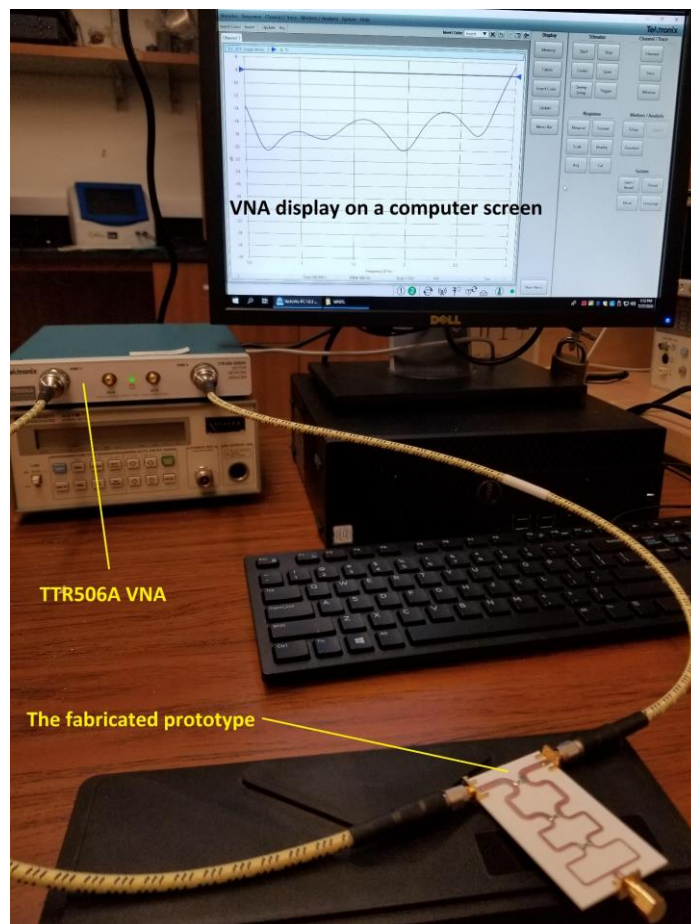
Engineering Research Projects

A New Analytical Design Methodology for A Three-Section Wideband Wilkinson Power Divider

Mohammad A. Maktoomi, Zeba N. Zafar, Hussain Al-Shakhori, Christine Zakzewski, and Aubrey N. Savage

A new analytical design technique for a three-section wideband Wilkinson power divider is presented. The proposed design technique utilizes the dual-frequency behavior of commensurate transmission lines for the even-mode analysis and contributes a set of completely new and rigorous design equations for the odd-mode analysis. Measurement of an in-house fabricated prototype utilizing the proposed technique shows an excellent return-loss (> 20 dB), insertion loss ($< 3:25$ dB), and decent isolation (minimum: 14 dB) with bandwidth extending beyond the minimum requirements.

A research paper based on this work is currently under review in the Progress in Electromagnetics journal.



TTR506A VNA

The fabricated prototype

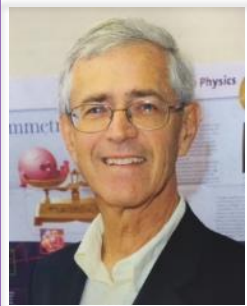


Thank you for reading our 2019-2020 Physics/Engineering newsletter! Feel free to contact any of us at any time!



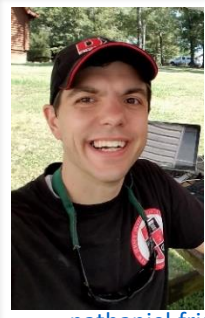
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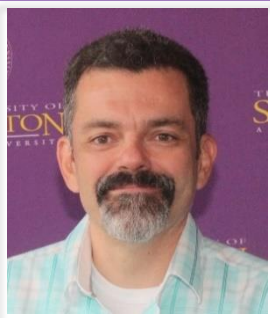
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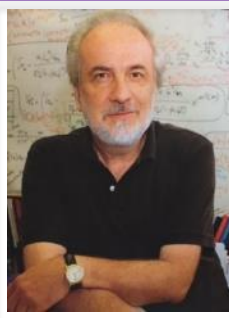
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