Education News

Winners of the 2017 MTT-S Undergraduate/ Pregraduate Scholarships

■ Zlatica Marinković, Ping Jack Soh, and Ramesh Gupta

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Eight extraordinary students were awarded an IEEE Microwave Theory and Techniques Society (MTT-S) undergraduate/pregraduate scholarship for 2017. Scholarship winners were selected based on two calls for nominees: one in October 2016 to select the spring 2017 awardees and one in April 2017 to select the fall 2017 awardees.

Every application was evaluated by three reviewers, each an esteemed MTT-S member working in either academia or industry (or both). The MTT-S Education Committee highly appreciates the valuable assistance and feedback of these reviewers. At the same time, we thank university staff for encouraging students to participate in this program, taking their first steps toward generating research in the RF and microwaves field.

The awardees receive as part of the award

- a US$1,500 scholarship to be used either for realizing the proposed project or as a stipend
- a complimentary one-year MTT-S membership including a subscription to all MTT-S publications
- a travel supplement to attend the next MTT-S International Microwave Symposium or a regional MTT-S conference.

We congratulate all the awardees and wish them success in their future careers. Following are short biographies for each of them along with descriptions of their projects.

Spring 2017 Awardees

Tal Kasher

School: University of South Carolina, Columbia, United States.

Advisor: Prof. Guoan Wang.

Project topic: The design and implementation of an electrically tunable filter on thin-films-enabled engineered substrate.

Tal Kasher, who will receive his B.Sc. degree in electrical engineering from the University of South Carolina in

May 2018, worked as an undergraduate research assistant at the university's Smart Microwaves and RF Technology Laboratory under the supervision of Prof. Guoan Wang. His research interests include novel tunable passives and wireless power transfer.

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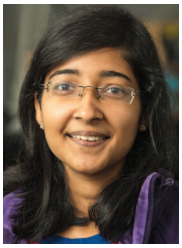
Project Description

To miniaturize communication systems, great effort has been put into developing tunable RF passives. Fully electrically miniaturized tunable RF passives have been implemented by integrating both ferromagnetic and ferroelectric thin films directly into the individual specific design. Already developed are a strategy to improve the ferromagnetic resonance frequency of permalloy to over 6 GHz and an electrical tuning method of equivalent permeability for permalloy with a dc magnetic field generated by applied dc current. A novel engineered substrate implemented with embedded multilayer permalloy and lead-zirconate-titonate thin-film patterns has recently been investigated and proposed. The substrate has high dc-current-tunable permeability and dc-voltage-tunable permittivity. Miniaturized frequency-agile arbitrary RF components could be developed with the proposed electrically tunable engineered substrate combined with state-of-the-art RF design techniques. This research combines the two previously described techniques to design, fabricate, and test an electrically tunable filter, with the goal of optimizing the resonator structure and the engineered substrate and so improve tuning range and performance.



Manuja Sharma
School: University of Washington, Seattle, United States.
Advisor: Prof. Hung Cao.
Project topic: The design and development of a Bluetooth-based continuous blood pressure (BP) monitoring device.

Manuja Sharma received her B.Sc. degree in electrical engineering from the University of Washington in August 2017. While there, she pursued bioelectronics research under the supervision of Dr. Hung Cao. Her research interests include patch antennas, sensor systems, and embedded-based circuit design.

Project Description

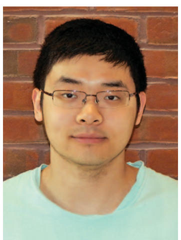
High BP, or hypertension, is a common condition that can lead to serious cardiovascular complications if left uncontrolled. Patients require continuous monitoring of BP and electrical activity of the heart, currently provided by electrocardiography (ECG). But the existing bulky ECG instruments hinder patients' daily activities. In this work, we propose a home-monitoring, cuffless, hassle-free BP wrist-based device that derives BP from photoplethysmography and ECG signals and uses Bluetooth for real-time wireless communication with a smartphone. A user can wear this device as a watch, wristband, or armband, and the signals are transmitted to a mobile device or computer, possibly connected to a cloud, for further analyses and computing. The development of a customized Bluetooth circuit with a printed 2.4-Ghz antenna is crucial for continuous monitoring. A quarter-wave patch antenna will be developed, characterized, and later incorporated on a flexible substrate.

Ramandeep Vilkhu
School: The Ohio State University, Columbus, United States.
Advisor: Prof. Asimina Kiourti.
Project topic: Wearable sensors for elbow flexion monitoring.

Ramandeep Vilkhu will receive his B.S. degree in electrical and computer engineering from The Ohio State University in May 2018. While there, he was an undergraduate research assistant at the ElectroScience Laboratory under the supervision of Prof. Asimina Kiourti. His research interests include wearable sensors, power harvesting and generation, electrochemistry, and signal processing. He plans to pursue graduate studies focused on these research interests.

Project Description

Monitoring elbow-joint kinematics after a medical procedure is critical for maximizing/accelerating rehabilitation and preventing future injuries. The most common technologies used to date for monitoring elbow-joint kinematics include two-dimensional/three-dimensional motion computing cameras and goniometers. However, these technologies are not portable, making it hard for them to capture valuable data in the average individual's daily environment. The proposed project seeks to resolve these issues through the development of a lightweight, flexible, and low-cost wearable joint sensor embroidered into a textile. These wearable sensors will leverage the principles of magnetic flux to measure the flexion of the elbow with high accuracy and reliability. Additionally, novel methods for powering these wearable sensors are being explored as a way to eliminate the need for bulky batteries.



Minwo Wang
School: University of Massachusetts (UMass), Amherst, United States.
Advisor: Prof. Joseph Bardin.
Project topic: A calibration procedure for cryogenic noise measurements.

Minwo Wang received his B.S. degree in electrical engineering from UMass in May 2017. While there, he worked in the UMass RF Nanoelectronics Group, led by Prof. Joseph Bardin. His research interests include cryogenic electronics, RF and analog integrated circuit design, and computational theory.

Project Description

Accurate calibration of cryogenic noise measurements has posed a long-standing challenge due to the uncertainties associated with thermal gradients along the path between the reference noise source and the device under test (DUT). One approach to address this problem is by performing the measurement using a tunnel junction noise source, which can be operated at the base temperature and whose noise spectrum is well described by basic physical expressions. However, for this technique to work, the insertion loss between the intrinsic tunnel junction and the amplifier's input must be known. The goal of this research is to develop a methodology for systematically determining this loss. A two-tiered vector network analyzer calibration procedure will be developed, allowing one to determine the gain of each component along the path from the DUT input to the spectrum analyzer input. Because the system is to be operated under vacuum and at cryogenic temperatures, a suite of microwave switches will be employed to make the connections required to perform this two-tiered calibration. Once the gain from the input of the amplifier to the input of the spectrum analyzer is known, it will be compared to the gain determined using the tunnel junction noise source to determine the unknown loss.

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Chun-Kit Wong
School: City University of Hong Kong (CityU), Kowloon, SAR.
Advisor: Prof. Chi Hou Chan.
Project topic: A terahertz near-field measurement system.

Chun-Kit Wong received his B.Eng. degree in electronic and communication engineering from CityU in 2014. Later, he was enrolled in a research program at the CityU partner laboratory of the State Key Laboratory of Millimeter Waves, under the supervision of Prof. Chi Hou Chan, a program from which he graduated in August 2017. His research interests include antennas, microwave and millimeter-wave components and systems, and terahertz components and systems.

Project Description

The project aims at building a near-field platform for antenna radiation pattern measurement at terahertz frequencies. The effect of the measuring probe will be delineated using probe compensation techniques. Due to the fine resolution of the stepper motors, the system can be used for other frequency ranges up to 1.1 THz. The system can also be used for terahertz imaging with high resolution and characterization of terahertz probes for a terahertz Mueller imaging system to detect cancer by exploiting polarimetry. Terahertz probes with ±45° linear and left- and right-handed circular polarizations, which are not commercially available, will also be designed, fabricated, and tested.

Fall 2017 Awardees

Pouyan Keshavarzian
School: University of Calgary, Canada.
Advisor: Prof. Michal Okoniewski.
Project topic: A retrodirective backscatter transponder for intelligent transportation systems.

Pouyan Keshavarzian completed his B.Sc. degree in electrical engineering at the University of Calgary in 2015. After working in industry, he returned to the University of Calgary to pursue his master's degree studies under the supervision of Dr. Michal Okoniewski and Dr. John Nielsen. His research interests include RF system design for microwave and millimeter-wave automotive applications.

Project Description

With the advent of autonomous systems in the automotive industry, a ubiquitous effort is underway to improve the reliability of sensor system measurement. Some areas of interest include retrodirective backscattering techniques for vehicle-to-vehicle communication and radar cross-section enhancement in adverse weather conditions. This project aims to create an active transponder capable of integratation in both these applications. The proposed system consists of active low-power reflection gain and a microwave lens design combined with a linear antenna array. This prototype is being designed for the licensed Intelligent Transportation System 5.85–5.925-GHz dedicated short-range communication radio band using Keysight ADS and Ansys HFSS simulation. When the performance of the transponder is evaluated, the feasibility of scaling it to millimeter-wave automotive frequency bands will be better understood.

Abraham Pérez Hernández
School: University of Seville, Spain.
Advisor: Prof. Carlos Crespo.
Project topic: Signal processing techniques for the linearization of concurrent multiband communications systems.

Abraham Pérez Hernández is a B.Sc. degree student in electrical engineering, majoring in communications systems, at the University of Seville. Recently, he has worked with the Department of Signal and Communication Theory there, under the supervision of Prof. Carlos Crespo. His research interests include nonlinearities in power amplifiers as well as digital predistortion (DPD) as a solution for this problem. Expected to graduate in June 2018, he plans to pursue a master's degree in electronics, signal processing, and communications.

Project Description

Currently, significant research effort is dedicated to standardizing the physical layer of future fifth-generation (5G) systems. Defining waveforms, frequencies, and bandwidths is a research challenge aiming to provide a deep transformation in data transfer, with capacities in the range of gigabytes per second, for which the efficiency versus linearity tradeoff will have an increased impact on 5G transceiver design.

The main objective of this proposal is the linearization of nonlinear impairments in modulators, power amplifiers, and transmitters through DPD. Special attention will be devoted to concurrent amplification and multiband communications. The complexity of the behavioral models applied to these cases demands merging classical and current signal processing techniques, such as nonlinear adaptive filtering, compressed sensing, principal component analysis, and pruning of regression matrices, among others. The project will balance the theoretical part of DPD algorithms, implemented in MATLAB, with the experimental evaluation of their performance using specialized measurement setups with vector signal generators and vector signal analyzers.

The MTT-S strongly encourages students in microwave and RF engineering to apply for the 2019 undergraduate and pregraduate scholarships.

Jie Zhou
School: University of Electronic Science and Technology of China, Chengdu, Sichuan.
Advisor: Prof. Xun Luo.
Project topic: A smart microwave phased-array transmitter for 5G applications.

Jie Zhou received his B.Sc. degree in microelectronics from the University of Electronic Science and Technology of China. He began studies for his master's degree there under the supervision of Prof. Xun Luo in September 2016. His research interests include reconfigurable passive and active microwave integrated circuits.

Project Description

Focusing on the application requirements of 5G communication systems with merits of low power consumption and high data rates, this project will investigate a smart microwave phased-array transmitter. The correction of modulation distortion within a wide band will be the main focus. A wide-band power amplifier with a DPD-based dynamic matching network is being used to achieve high power efficiency with good linearity. Meanwhile, microwave beamforming/beam-steering will be fulfilled using a reconfigurable multibit phase shifter with high phase precision and low power consumption. Based on this project, a solid theoretical and technical foundation will be built for 5G applications.

Next Call for Applications

The MTT-S strongly encourages students in microwave and RF engineering to apply for the 2019 undergraduate and pregraduate scholarships. The first call is 15 October 2018 for the spring 2019 scholarships.

Please consult the detailed instructions for the MTT-S Undergraduate/Pregraduate Scholarship Program at http://www.mtt.org/students.html.