Education News

The 2022 and 2023 MTT-S Undergraduate/Pre-Graduate Scholarship Awards

■ Zlatica Marinković, Ping Jack Soh, Raafat Mansour, Wenquan (Cherry) Che, and Xun Gong

We would like to take this opportunity to introduce the IEEE Microwave Theory and Technology Society (MTT-S) Undergraduate/Pre-Graduate Scholarship awardees for the years 2022 and 2023. Each year, the MTT-S awards up to 12 scholarships to help undergraduate/pre-graduate students (enrolled in B.S., M.S., or combined B.S./M.S. programs) pursue their current research interests and a future career in the field of microwaves. There are two competition cycles organized in April and October. Each awardee receives a scholarship of US$1,500, which can be used either for the proposed scholarship research or as a stipend. In addition, a travel supplement is provided to awardees to attend the IEEE MTT-S International Microwave Symposium (IMS) or a regional MTT-S conference following the award.

Each applicant's project proposal and curriculum vitae are reviewed by experts from academia and industry, with the award going to the top-scoring applicants. It is important to note that no more than one award is given per institution in one competition cycle to strengthen geographical diversity. We would like to thank all of the reviewers for their valuable assistance in selecting the winners as well as the supervisors of all applicants for encouraging their students to apply.

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Biographies of the winners for 2022 and 2023 (as provided at the time of the announcement of the awards) and the project descriptions are provided as follows. We wish all applicants a successful further career!

2022 Cycle 1 Awardees (October 2021 Competition)

Kapil Gangwar

School: University of Alberta, Canada.

Advisor: Prof. Rambabu Karumudi.

Project topic: Ultrawideband radar system to study child obesity via adipose tissue characterization.

Kapil Gangwar received his B.Tech. degree in electronics and communication engineering from the Indian Institute of Technology (IIT) Dhanbad in 2019. Currently, he is working toward his M.Sc. degree in the Electrical and Computer Engineering Department, University of Alberta, Edmonton, Canada, under the supervision of Prof. Rambabu Karumudi. His research interests include microwave antennas, biomedical imaging, tomography techniques, ultrawide band radar, and energy-harvesting circuits.

Project Description

Leptin and resistin levels show a good correlation with anthropometric parameters of childhood obesity and its comorbidities. Hence, adipocytokines can be considered as a biomarker of childhood obesity. This work proposes a free-space, ex vivo method for estimating the dielectric properties as well as the thickness of brown and white fat tissue in the human body. The technique is based on data acquisition by an ultrawideband time-domain radar and genetic algorithm minimization of the goal function, which is the absolute difference between the measured frequency-dependent reflection coefficient and its corresponding theoretical value. The specific absorption rate value averaged more than 1 g of human tissue analysis is also investigated. To mimic the abdomen surface, three layers of the tissue are exploited: a pork skin layer, followed by pork fat (lard) and muscle. A metal plate with a circular aperture of radius 2 cm is placed on the skin surface to determine the accuracy of the result on a small area of interest on the animal tissue. The proposed technique can be a safe, cost-effective, and portable ex vivo, noncontact, free-space clinical solution for practitioners to determine the level of obesity.

Yuki Gao

School: New York Institute of Technology, USA.

Advisor: Prof. Reza K. Amineh.

Project topic: Microwave imaging and sensing for nondestructive testing and biomedical imaging applications.

Yuki Gao received her B.S. degree in electrical and computer engineering from New York Institute of Technology (New York Tech) in 2021 in New York, USA, where she graduated summa cum laude. She is currently pursuing an M.Sc. degree in electrical and computer engineering at New York Tech under the accelerated B.S. and M.S. program. During her undergraduate studies, she joined the Applied Electromagnetics Research Lab at New York Tech as a research assistant. Her research interests include microwave holographic imaging, microwave sensing, image reconstruction, biomedical imaging, and nondestructive testing.

Project Description

This project is focused on the microwave imaging and sensing of dielectric materials. An array of microwave sensors designed based on complementary split-ring resonators, with each element of the array resonating at a different frequency, is utilized. The array of microwave sensors operates within the range of 1–10 GHz. This frequency band allows for data acquisition with cost-effective microwave circuitry that can replace costly vector network analyzers (VNAs) for measurements. Although the frequency is relatively low for high-resolution imaging, the acquisition of the evanescent waves in extreme proximity to the imaged object and processing of these waves using near-field holographic imaging allows for the obtaining of high resolution in the cross-range direction. This new imaging and scanning system can be utilized for nondestructive testing of multilayer composite materials, printed circuit board (PCB) testing, and cancer diagnosis.

Jacqueline Schellberg

School: University of South Carolina, USA.

Advisor: Prof. Sanjib Sur.

Project topic: Vision-aided through-obstruction handheld imaging on 5G smart devices.

Jacqueline Schellberg is currently a B.Sc. student studying computer engineering at the University of South Carolina. She is working as a research assistant under the guidance of Prof. Sanjib Sur. She was invited to participate in the 2021 Grace Hopper Celebration Conference from the University of South Carolina Computer Science and Engineering Department. She also published and presented a poster at the 2021 Association for Computing Machinery UbiComp. Her research interests include millimeter-wave (mm-wave) imaging and RF motion tracking.

Project Description

The arrival of 5G smart devices with peripheral sensors, such as inertial measurement units, cameras, and microphones, is poised to enable mobile, infrastructure-free synthetic aperture radar (SAR) imaging. However, existing smart devices are not capable of producing the sufficiently accurate position estimates necessary for focused mm-wave imaging. In this project, we will design an algorithm to the correct position drift produced by the mobile device by exploiting hidden relationships between the motion tracking error and the correlations among multiple antennas. We will also explore SAR autofocus algorithms to further improve image quality. This design could enable handheld imaging in a wide range of applications, such as nonintrusive package inspection and efficient construction site surveying.

Sidharth Thomas

School: University of California, Los Angeles (UCLA), USA.

Advisor: Prof. Aydin Babakhani.

Project topic: A high-power, 910-GHz, 24-element radiator array based on a novel CMOS oscillator and coupling network.

Sidharth Thomas received his B.Tech. degree in electronics and communication engineering from IIT Roorkee, in 2020. He is currently working toward an M.S. degree in the Electrical and Computer Engineering Department at the UCLA, under the supervision of Prof. Aydin Babakhani. His research interests include mm-wave/terahertz (THz) silicon integrated circuits (ICs) for sensing, imaging, and communication applications.

Project Description

This project aims to design a high-power radiator capable of radiating more than –15 dBm total power with an EARP isotropic radiated power of 0 dBm at 910 GHz in CMOS. Power oscillator unit cells are designed with fundamental oscillation at 227.5 GHz, and the fourth harmonic at 910 GHz is extracted. A novel antenna coupling scheme is adopted to enable lossless passive synchronization among unit cells. The proposed radiator will comprise 24 elements that are phase and frequency locked to boost the total radiated power. On-chip monopole antennas enable radiation, and a high-resistivity silicon lens is used to improve radiation efficiency. The circuit is designed in a GlobalFoundries 45-nm silicon on insulator CMOS process.

Vishrutha Dinakaran

School: NIT Tiruchirappalli, Tamil Nadu, India.

Advisor: Dr. Hemant Kumar.

Project topic: MATLAB-based 3D Smith chart for plotting Rieke diagrams of microwave oscillators.

Vishrutha Dinakaran is a B.Tech. student in electronics and communication engineering at the NIT Tiruchirappalli in India. Her research interests include radars, 3D Smith charts, metamaterials, fractal antennas, electromagnetics, and the Internet of Things. She is currently a research scholar under the supervision of Dr. Hemant Kumar. She is grateful to Dr. Hemant Kumar and Dr. S. Raghavan for their able guidance and immense support.

Project Description

Rieke diagrams are an important load characteristic of microwave oscillators plotted on a Smith chart. They consist of two families of curves, one representing the contours of constant power and the other the contours of constant frequency. A Rieke diagram may be used to find the load impedance that provides the optimal balance of power output and frequency stability. An externally adjusted source determines the reflected power, so the magnitude of the reflection coefficient may be increased and become greater than unity. Since the reflection coefficient becomes greater than unity, it can no longer be plotted using the conventional Smith chart. A 3D Smith chart is a Reimann sphere-based Smith chart that allows plotting circuit parameters whose reflection coefficient magnitudes are greater than unity, hence overcoming the limitations of the conventional Smith chart. The method of plotting Rieke diagrams of microwave oscillators on a 3D Smith chart using MATLAB is discussed in this project.

2022 Cycle 2 Awardees (April 2022 Competition)

Zong-Jun Cheng

School: National Taiwan University, Taipei, Taiwan.

Advisor: Prof. Jun-Chau Chien.

Project topic: Near-field dielectric imager using field-modulated standing-wave oscillators for intraoperative tissue imaging.

Zong-Jun Cheng received his B.Sc. degree in electrical engineering from the National University of Kaohsiung in Taiwan. Currently, he is pursuing his master's degree at the Graduate Institute of Electrical Engineering at National Taiwan University in Taiwan. His research interests include portable medical sensor technology and mm-wave imaging.

Project Description

Tumor margin assessment is a critical step in breast tumor surgery to ensure complete removal. Such a procedure is routinely performed by postsurgical pathological examinations on the excised specimen. A re-excision surgery is often needed if a positive margin is identified, bringing significant discomfort to patients. Thus, intraoperative imaging that can perform rapid margin assessment (fewer than 5 min) with real-time feedback is highly desirable. This project aims to implement a large-size array sensor for imaging on clinical samples, and, specifically, current work has accomplished 22 pixelated standing-wave oscillators distributing a 22 × 22-pixel imager array over an area of 5 mm^2. Multiple chips will be encapsulated together to extend the field of view toward 44 × 44 pixels of a 5 × 5-mm imaging area.

Francesco Romano

School: University of Pavia, Italy.

Advisor: Prof. Maurizio Bozzi.

Project topic: Realization of a filter-like 3D-printed resonant structure with the aim to develop a cost-effective yet high-performance wireless sensor.

Francesco Romano received his bachelor's degree in electronics and computer engineering in 2018. He is currently attaining a master's degree in microelectronics at the University of Pavia. He is coauthor of the IMS paper "3D-Printed Compact Waveguide Filters Based on Slanted Ridge Resonators," which was presented at IMS2022. His research interests include microwave engineering, 3D-printed resonant structures, and wireless sensors.

Project Description
This research activity is focused on the implementation of a filter-like 3D-printed resonant structure, with a frequency response having several poles and transmission zeros, to be used for the assessment of the complex permittivity of a solid dielectric material, located in the ideal position, with the purpose of creating a high-performance yet affordable wireless sensor. To reduce the vulnerability to fabrication errors and potentially achieve new features in the frequency response of the filters, novel compact resonator designs (such as ridges with changed shapes) will be examined (for instance, a higher number of poles and transmission zeros or better control of them). The proposed structure will be used for sensing as a result of this research project. In fact, the suggested filter presents some areas where the electric field is rather intense (for example, underneath the ridges), and this effect can be exploited to accurately sense dielectric materials to determine their complex electric permittivity. Based on the fluctuation of the resonance frequency and the quality factor of a cavity resonator, the variation of the frequency response of the filter can be used to determine the electrical characteristics of the material under test more effectively than the conventional method. When perfected, these prototypes can open up new possibilities in the field of wireless sensor networks, thanks to the implementation of tunable filters and reduced manufacturing costs.

Jiacheng Xie

School: University of Electronic Science and Technology of China, China.

Advisor: Prof. Xun Luo.

Project topic: RF/mm-wave passive components based on substrate-integrated defected ground structure (SIDGS).

Jiacheng Xie received his B.S. degree from North China Electric Power University, Beijing, China, in 2020, where he is currently pursuing his M.S. degree in electronic science and technology at the University of Electronic Science and Technology of China, Chengdu, China. He is involved in a research program at the Big-Data Electronics & Advanced Micro-Systems Lab under the supervision of Prof. Xun Luo. His research interests include RF/mm-wave multifunction passive components.

Project Description
Aiming at microwave/mm-wave applications of 5G with low cost and wide frequency coverage, research on passive components with high integration and a low loss rate in the multifunction communication system is proposed in this project. The SIDGS is developed and implemented to allocate the intrinsic fundamental resonance with wideband harmonic suppression and low radiation loss. Furthermore, passive components (i.e., the filter and power divider) with interference suppression are fulfilled based on SIDGS resonant cells. With the investigation of this project, the physical theory and technical foundation will be built, and the tunable SIDGS resonator is fulfilled using the theory for its application.

2023 Cycle 1 Awardees (October 2022 Competition)

Anja Kovačević

School: School of Electrical Engineering, University of Belgrade, Serbia.

Advisor: Dr. Nikola Basta.

Project topic: Design of a low-cost compact microwave sensing system for organic tissue analysis.

Anja Kovačević received her B.Sc. degree in electrical engineering and computing, with a major in telecommunications and microwave engineering, from the School of Electrical Engineering, University of Belgrade, in 2022. She is currently earning her M.Sc. degree in microwave engineering at the same university. Her research interests include microwave sensors for biomedical applications, microwave imaging, and THz metamaterials.

Project Description
The proposed low-cost microwave sensing system is intended to estimate dielectric properties and create a spatially resolved dielectric image of tissue under test (TUT), which can then be used for the detection and localization of possible abnormalities, e.g., malignancies. The designed system consists of a sensing component, a simple affordable, off-the-shelf VNA, a portable computer, and components for system assembly. The sensing component will be realized as a planar microwave sensor array with split-ring resonators as sensitive elements. The operating frequency range of the sensor is expected to be from 0.1 to 6 GHz to ensure compatibility with the measuring instrument. Experimental testing will be conducted ex vivo by using animal and/or artificial tissues, with both low-cost and professional VNAs. Different techniques will be tested and employed for the extraction of the dielectric properties of the TUT. Experimental results will be compared with relevant data to test the validity of the built system.

Roshan P. Mathews

School: UCLA, USA.

Advisor: Prof. Aydin Babakhani.

Project topic: Miniaturized, batteryless, and wireless medical implants and wearables for stimulation and sensing.

Roshan P. Mathews received his B.Tech. (Hons.) degree with the gold medal in electrical engineering from the IIT Palakkad in 2021. He is currently working toward his M.S. degree in the Electrical and Computer Engineering Department, UCLA, under the supervision of Prof. Aydin Babakhani. He is passionate about developing energy-efficient, low-power circuits for biomedical implants and applications using wireless power transfer (WPT).

Project Description

The project aims at developing, optimizing, and refining fully wireless and batteryless implantable and wearable devices for medical stimulation and sensing. The device operation is realized through RF WPT for its various benefits in miniaturization due to its independence from a physical power source like a battery/cell. While the benefits of miniaturization are enabled through WPT, it also poses serious challenges to the ultimate form factor of the device due to depreciating WPT efficiency with miniaturization. This opens the challenging field in microwave theory and circuit design of making highly miniaturized yet efficient methods of WPT using multiresonant-coil frequency tuning of loops to obtain highly efficient power transfer with small form factors and the co-design of circuits to work with low harvested powers.

Kaustubh Pabba

School: IIT Kanpur, India.

Advisor: Prof. Imon Mondal.

Project topic: Design of an impedance transforming circulator.

Kaustubh Pabba is a B.T.–M.T. dual degree student in the Department of Electrical Engineering at IIT Kanpur. He intends to pursue a Ph.D. degree in the domain of RF/mm-wave IC design after graduation. His research interests lie in the fields of RF/mm-wave circuits, mixed-signal design, and quantum computing.

Project Description

Conceiving fully duplex (FD) communication systems—that operate the transmitter (TX) and receiver (RX) at the same time and frequency—requires antenna interfaces that are compact, lossless, and compatible with CMOS technologies. Nonmagnetic CMOS circulators exploiting time variance while breaking reciprocity have shown immense promise for enabling FD communication compared to their magnetic counterparts. The architectures presented thus far in the literature operate with their TX and RX functioning in a 50-Ω interface. In synthesizing highly efficient, stand-alone power amplifiers (PAs), the associated output impedance has to be as low as possible for optimal operation. Moreover, for achieving an optimal noise figure, the input impedance of a low-noise amplifier (LNA) also differs from 50 Ω. Hence, this project intends to leverage the impedance-transforming ability of quarter-wave transmission lines to facilitate the efficient co-design of circulator–PA–LNA transceivers. The proposed circulator will operate at a frequency of 1 GHz using Taiwan Semiconductor Manufacturing Company Limited (TSMC) 130-nm technology.

Aryan Rastogi

School: IIT Indore, India.

Advisor: Dr. Saptarshi Ghosh.

Project topic: Reconfigurable intelligent surfaces (RISs) for beam-steering applications.

Aryan Rastogi is a final-year B.Tech. student in electrical engineering at IIT Indore in India. His research interests lie in RISs and machine learning. He has published four journal articles and two conference papers. He aims to pursue a future career in a cross-field involving intelligent communication systems using RISs, empowered by machine learning.

Project Description

RISs are expected to form an integral part of the overall architecture of future networks (6G and beyond) owing to their dynamic controllability, which helps them adapt the propagation characteristics of the transmitted signal as per the end requirements. Beam steering is one of the important aspects of such networks for which RISs are highly suited. Owing to the fact that 6G and future ecosystems operate in a higher frequency band compared to the current standard, the signals are constrained by their low penetrative power, higher path loss, and the phenomenon of shadowing. However, by the use of an RIS, an effective means can be provided to change the reflection angle of the transmitted signal to ensure that the signal is received without obstruction and with the desired signal-to-noise ratio. Another implication of such control is that it ensures that the incoming signal is received only by the intended RX, thereby imparting a secure communication pathway between it and the TX. The objective of this project is, thus, to develop a beam-steering device using multiple RIS-based phase shifters and to test the setup in a custom testbed.

Arjun Sadasivan

School: Institute of Space Science and Technology (IIST).

Advisor: Prof. Chinmoy Saha.

Project topic: Harmonic, configurable, time-modulated, array-based WPT system with concurrent beam steering and sidelobe-level control.

Arjun Sadasivan is currently pursuing his B.Tech. degree in avionics from IIST, mentored by Dr. Chinmoy Saha along with his research scholar, Gopika R. His research interests include WPT.

Project Description

WPT is a rapidly growing topic, and its applications range from remotely powering an implant within the body to charging a drone for defense applications. Phased-array antennas are commonly used for beam shaping and steering despite being costly and massive. The phased-array antenna's commercialization is not a viable possibility, and its use in applications requiring stringent scanning is constrained by quantization error. In this proposal, a new time-modulated array (TMA)-based system that can, in principle, replace the phased-array antenna is presented. TMA arrays may simultaneously perform beam shaping and steering at all harmonics. The proposed system is significantly less expensive than its equivalents since its realization employs inexpensive RF switches. The possibility to employ any power level of the user-defined number of harmonics allows us to build a multiuser WPT scenario.

Jack Tomkiewicz

School: Rice University, USA.

Advisor: Prof. Taiyun Chi.

Project topic: An efficient multifeed antenna for RF energy harvesting.

Jack Tomkiewicz is a B.S. student in electrical and computer engineering at Rice University in Houston, TX, USA. His research interests include antennas, optics, imaging, and communications. Upon graduation, he plans to get his Ph.D. degree in electrical engineering.

Project Description

We developed a multifeed rectenna for high-efficiency RF energy harvesting. By using a multifeed slot loop antenna and co-designing the antenna and rectifier circuit, we were able to eliminate the conventional lossy impedance-matching network between the antenna and rectifier, thereby boosting the RF-to-dc conversion efficiency. In addition, using multiple antenna feeds extends the high-efficiency working region of the rectifier to realize high dc output power and high efficiency simultaneously.

2023 Cycle 2 Awardees (April 2022 Competition)

Alessandro Chillico

School: University of Bologna (UNIBO), Italy.

Advisor: Prof. Alberto Santarelli.

Project topic: Design of a reconfigurable PA for radar applications.

Alessandro Chillico is pursuing his M.Sc. degree in electronics engineering at UNIBO, Italy. He is currently working on his master's thesis project in Berlin thanks to a collaboration between the UNIBO Electronic and Measurement Laboratory and the Ferdinand Braun Institut's RF Power Lab (FBH), supervised by Prof. Alberto Santarelli (from UNIBO) and Prof. Olof Bengtsson (from FBH). His research includes the study of innovative reconfigurable devices working in the mm-wave spectrum.

Project Description

Reconfigurable RF systems are an increasingly important research field, especially for radar systems, where multiple frequency bands, even if not active at the same time (operated, for example, through time duplexing), would lead to a major increase in radar capabilities. To this end, reconfigurable matching networks (RMNs) can be used to completely change the frequency response of a device with just a few electric signals. For this project, different RMN topologies will be created using gallium nitride–high-electron mobility transistors (as switches) and passive components and then analyzed to see which one is the most advantageous and flexible. Afterward, a whole PA will be designed, which must work in at least two different frequency ranges between the C and Ku bands (4 ÷ 18 GHz). The final system will incorporate the PA and the most suitable RMNs to maximize performance and efficiency.

Sankhadeep Das

School: NIT Rourkela, India.

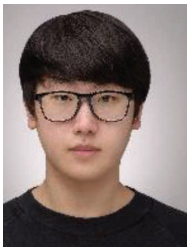
Advisor: Prof. Rakesh Sinha.

Project topic: A CAD tool for design and analysis of nonuniform transmission lines (NTLs).

Sankhadeep Das is pursuing a B.Tech. degree in electrical engineering from NIT Rourkela, India. He is performing undergraduate research under the supervision of Dr. Rakesh Sinha. His research interests include the design of the impedance-matching network and NTL and the development of CAD applications.

Project Description

The impedance taper, or NTL, is a critical component in microwave engineering, used for matching and transforming the impedance of transmission lines and other passive and active components. Because of wideband impedance-matching performance, the NTL finds application in power divider, branch-line coupler and rat-race coupler designs. The design and analysis of various kinds of NTLs are crucial for microwave engineers. However, there needs to be a tool/software available to ease the problem. This motivates the authors to develop a software tool to facilitate the design and analysis of NTLs. The software will comprehensively review past and recent developments in impedance taper design, analysis, and optimization, including different types of tapers and techniques. This CAD tool will be a valuable resource for researchers, engineers, and students working in microwave engineering.



Seungjun Lee

School: Korea University, South Korea.

Advisor: Prof. Juseop Lee.

Project topic: General similarity transformation method for coupling matrix topology and value adjustment.

Seungjun Lee is a B.Eng. student in computer science and engineering at Korea University in South Korea. Currently, he is working in the microwave/mm-wave lab at Korea University as an undergraduate research student under the supervision of Prof. Juseop Lee. His research interests include analytic filter synthesis.

Project Description

Some filter topologies have multiple coupling matrices that yield the same frequency response. However, currently, there does not exist a systematic method to find these coupling matrices and, furthermore, to identify such topologies. This lack of a method limits the design flexibility of physical filters. The proposed project aims to find two analytic synthesis processes, 1) for synthesizing arbitrary topology coupling matrices and 2) for synthesizing multiple coupling matrices with the same topology and frequency response. Specifically, the work intends to generalize the conventional similarity transformation method for coupling matrix reconfiguration. The result of this project will enable the systematic design of many microwave filters with diverse architectures, expanding the variety of practically designable filters. It will also enable identifying topologies that support multiple (possibly infinite) coupling matrices yielding the same frequency response. Having multiple coupling matrices allows a filter designer more flexibility in selecting physical dimensions.

Chenoa Nila Michel Limachi

School: Universidad Privada Boliviana (UPB), Bolivia.

Advisor: Prof. Hugo Condori Quispe.

Project topic: Optimization of the local oscillator (LO) chain of the phase-locked loop (PLL) synthesizer with planar filters to improve signal integrity.

Chenoa Nila Michel Limachi is a student of electronic systems and telecommunications engineering at UPB. She was born in April 2002. During her university career, she was on the honor roll in the second semester. She is currently working on the project "Optimization of the LO Chain of the PLL Synthesizer With Planar Filters to Improve Signal Integrity" under the supervision of Prof. Hugo Condori Quispe. Her research interests include PLL synthesizers, mobile communications, and microwave engineering.

Project Description

The demands of multiband links in 5G/6G wireless communication necessitate a frequency synthesizer possessing an extensive tuning span and minimal phase noise as well as spectral purity. Our project aims to design and integrate planar filters into an LO chain following a synthesizer to improve the spectral purity of the chain. By strategically designing these compact planar filters, it is possible to mitigate issues, such as interference and frequency harmonics, which can impact the quality of the generated frequency signal. This optimization effort entails refining the performance and quality of the LO chain in communication systems, effectively enhancing overall system performance. Through this integration, we anticipate improvements in signal quality, a reduction in interference and noise, and a consequential enhancement in RF signal reliability, contributing to the robust functionality of the communication infrastructure.

Sofia Rustioni

School: University of Pavia, Italy.

Advisor: Prof. Maurizio Bozzi.

Project topic: A dielectric permittivity sensor based on inverted microstrip/3D printing hybrid technology.

Sofia Rustioni is a B.Sc. student in electrical and computer engineering at the University of Pavia, Italy. Currently, she is working in a research group to prepare the final project for her bachelor's degree, which is based on the design of a microwave sensor, under the supervision of Prof. Bozzi. Her research interests include hybrid technology, inverted microstrips, and microwave sensors.

Project Description

The proposed research topic consists of the development of an innovative sensor for the dielectric characterization of liquid materials. The sensor is based on a section of inverted microstrip line combined with a channel where the liquid material flows. The structure is fabricated by using a hybrid technology that integrates the standard PCB technique (to implement the inverted microstrip) with additive manufacturing (to realize the channel). The dielectric characteristics of the liquid material are retrieved from the variation of the frequency response of the structure (with respect to the case of no liquid). Different materials will be adopted for validating the performance of the sensor, and the retrieved dielectric properties of the materials will be compared with data obtained from commercial devices.

Niklas Takanen

School: University of Oulu, Finland.

Advisor: Prof. Ping Jack Soh.

Project topic: Design of reconfigurable antennas for compact wearable health monitoring devices.

Niklas Takanen was born in 1998 and is an M.Sc. student in radio engineering at the University of Oulu, Finland. Currently, he is working on his master's thesis on wearable antennas under the guidance of Associate Prof. Ping Jack Soh. His research interests include reconfigurable, compact, and wearable antennas.

Project Description

This project aims to design, prototype, and measure a reconfigurable wearable antenna for multiple LTE bands, with strict requirements for the physical size of the device. The goal is to investigate the effect of a body phantom, antenna casing, and aperture tuning circuit on the scattering parameters and efficiency of the antenna as well as to maintain an acceptable specific absorption rate. With such an antenna design, the end-user experience would be hugely simplified, as the health monitoring device can directly utilize cloud computing resources.

Next Deadline for the MTT-S Undergraduate/Pre-Graduate Scholarship Awards

The next application deadline for the MTT-S Undergraduate/Pre-Graduate Scholarship Awards is 15 April 2024. For more information, please visit https://mtt.org/students/.

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