Maximize Your CERF Membership

There are many benefits to being a CERF Industrial Affiliate. Affiliates have access to state-of-the-art facilities, faculty and student researchers, and specialty training courses tailored to member needs. The funds collected through the membership fees are used to develop new short courses, organize short courses and technical meetings, and sponsor student training and research.

Take full advantage of your CERF membership when you participate in the upcoming 8th Annual Technical Meeting and Short Courses. Membership level dictates eligibility for the number of seats for both the meeting and short course participation without charge to the participants.

For more information on ESL-CERF contact Bob Burkholder (burkholder.1@osu.edu) or visit https://electroscience.osu.edu/cerf.

<table>
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<th>Member Level</th>
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<th>Short course Seats</th>
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ESL-CERF 8th Annual Technical Meeting

The annual meeting will be held at The Blackwell Inn and Pfahl Conference Center on Tuesday, August 1st. Please note a change for 2017: The CERF Affiliates dinner is scheduled for Tuesday immediately following the meeting and will be held at the Refectory, https://refectory.com/.

For additional information, please visit the event website, https://electroscience.osu.edu/CERF/annual-meeting.

Letter from the P.I.

It’s that time of year again! Time to start making travel plans for the Annual CERF Meeting and Short Courses August 1-4 at the Blackwell Pfahl Conference Center on the main campus of The Ohio State University.

Lots of new things are going on at ESL this year as we transition to a College Center and continue our search for a new Director. You’ll see some changes at CERF as well. The CERF Advisory Board has recommended that the ESL Director should serve as the CERF Principal Investigator (PI). That’s me, and this will serve the purposes of both CERF and ESL for promoting the consortium to new companies and sponsors that come to the lab. Alissa Comella, our Senior Associate Director, is serving as Co-PI on CERF.

Speaking of sponsors, we are inviting our government sponsors to be more involved in CERF this year so that they can interact with our Affiliates and see what we are doing together. This is another way we are increasing value to your membership.

You will also notice some changes in the meeting format. There will be a greater student involvement in the CERF meeting to give Affiliates a chance to put names and research topics with faces. For the future, we are working on a plan for our Affiliates to be able to support ESL students through CERF fellowships and internships if they wish. More on this at the meeting. Your input will be greatly appreciated.

I’m looking forward to seeing you all at the meeting this year, and hope you will stick around for the ESL Short Courses and meet with our researchers. We have excellent new courses in addition to the best of our previous courses. Lastly, don’t forget to mark your calendars for the ESL 75th Anniversary on October 6, 2017!

At your service,
Bob Burkholder
P.I., ESL-CERF
Interim Director, ESL
Attend Remotely

Did you know we offer the opportunity to attend our short courses online via live streaming video? Just select the online attendance option during the registration process. You will receive a confirmation email along with information on the remote connection process.

For a smooth video streaming experience, IT requirements are available at https://electroscience.osu.edu/short-courses-online-streaming-requirements. If you have questions about the IT requirements for online streaming, please contact our IT department by sending an email to ETShelp@osu.edu with a subject line “Assistance with ESL Short Course IT Requirements”.

Poster Awards

During last year’s CERF Annual meeting 41 presenters competed for the Best Poster Award. For the third year in a row we will be awarding the top five poster presenters based on academic content, appeal to the audience and overall quality of layout. First and second place awardees receive a monetary award along with a certificate. Certificates will be presented to third through fifth place awardees.

2017 CERF Funded Projects

Remote Sensing of Scintillation/Fading Due to Tropospheric Turbulence Using a Drone
Personnel: Caglar Yardim and Swagato Mukherjee (graduate student)
This will be a unique experiment for measuring signal fading due to tropospheric turbulence. It will provide a dataset which can be used to validate and improve our present theoretical and numerical models for calculating the fading depths. Once perfected, the system can also be used in future signal measurements at various elevation angles in different environments. Currently, there is interest in non-standard atmospheric conditions and scintillation/fading in lower atmosphere at high frequencies. Dr. Yardim has grants from AFRL, MIT LL, and ONR to study these in detail. Having real data to compare with the developed theory using drones is very promising.

Purchase of an Environmental Test Chamber to Enhance the Testing Capabilities at ESL
Personnel: Shane Smith (PI) and Andrew J. O’Brien
There are a significant number of activities pursued by multiple PIs which would benefit from having a thermal testing capability at ESL. We propose to use ESL-CERF funds to purchase either a bench-top or upright environmental test chamber for thermal testing of electronics and antennas at ESL. Once the environmental chamber has been commissioned, it will provide the only facility at ESL which affiliates, staff, graduate, and undergraduate students will be able to perform temperature studies on their antennas and electronics. The proposed chamber will provide new test and measurement capabilities for the OSU community at ESL and will also be leveraged to enhance future project proposals.

A New Method of Power Harvesting Using Electroceutical Dressings
Personnel: Asimina Kioruti
The vision of this research is a new class of fabrics, namely electroceutical dressings, that generate DC power when moistened by a conducting liquid (sweat, wound fluid, etc.). Example applications include pads that turn “on” an LED when the underlying wound opens up, or T-shirts that power up sensors (accelerometers, heart rate sensors, etc.) while the subject is exercising and sweating. Generation of DC power is achieved via an electrochemical process that enables transfer of electrons from silver dots (brown-colored in Fig. 1) to zinc dots (grey-colored in Fig. 1) when the fabric is moistened. Thus, this research brings forward a novel method of harvesting DC power out of thin air, which, contrary to existing methods of RF or solar power harvesting, does not require bulky circuits or any sort of rigid components. As such, the proposed technology is expected to be of utmost significance for military, healthcare, sports, and emergency applications, among others.

Millimeter wave Phased Array with Integrated MEMS Phase Shifters
Personnel: Niru K. Nahar
We propose a low profile, wideband beam-steering antenna for continuous coverage of the K- and Ka-bands. The array is based on the tightly coupled dipole principle and micro-electro mechanical systems (MEMS) phase shifters will be integrated into each element for real-time beam forming. This topology leads to significant reduction in the size, weight, complexity, and cost of the phased array. A proof-of-concept 8x8 array is simulated. Under this effort we propose the hardware realization and measurement of the finite array. Give there will be enough funding, we would also like to integrate the MEMS shifter to demonstrate the real-time beamforming by the array.

Automated wafer scale test and measurement of silicon photonic integrated circuits
Personnel: Ronald M. Reano
We propose a year of CERF funding to support our research towards creating automated wafer scale test and measurement of silicon photonic integrated circuits. The research is important because of the technological challenges for developing next generation high-speed signal processing systems based on the convergence of electronics and photonics. Although wafer scale test and measurement is commonplace for chip-scale microelectronics, it is a new area of investigation for chip-scale integrated photonics. The need is driven by the rapidly growing interest in silicon integrated photonics where optical waveguides are employed to harness the processing power of fiber optics on the scale of a microelectronic circuit. In this project, we will create methods to automatically align an optical fiber to a micrometer scale cantilever coupler, enabling automated wafer scale test and measurement of silicon photonic devices with cantilever couplers for the first time.
The Short Courses will be held at The Blackwell Inn and Pfahl Conference Center, 2110 Tuttle Park Place, Columbus, OH 43210. This year we are offering 12 half-day courses and are excited to present a selection of courses covering revolutionary topics such as body area sensing, spectroscopy, and trusted microelectronics.

- Antenna Induced Biases in GNSS Receiver Measurements (Inder (Jiti) Gupta)
- Ultra-Wideband Phased Arrays and Transceivers (John L. Volakis)
- Fundamentals and Applications of Integrated Photonics (Ronald M. Reano)
- Textile Electronics and Body Area Sensing (Asimina Kiourti)
- Cognitive Processing for Radar Systems: From Theory to Practice (Graeme E. Smith)
- Analysis and Design of mm-Wave VCOs in CMOS and Bipolar Technologies (Waleed Khalil)
- Propagation over the Sea: Mechanisms & Models (Caglar Yardim)
- High Performance Digital to Analog Converters: Challenges and Solutions (Waleed Khalil)
- Introduction to Hardware Security: Trojans, Counterfeits, and Security in an Interconnected World (Brian Dupaix)
- Recent Developments in Computational Electromagnetics (Jin-Fa Lee)
- Recent Developments in Spectroscopic Sensor Technology (Christopher Ball)
- A Private Collection of Novel UWB Antenna Design and Measurement Technologies (Chi-Chih Chen)
- Recent Developments in Computational Electromagnetics (Jin-Fa Lee)

Instructor Spotlight: Asimina Kiourti

Prof. Kiourti began her appointment with The Ohio State University Department of Electrical and Computer Engineering in the Fall of 2016. Prior to her appointment, between 2013—2016, she served as a Post-Doctoral Researcher and a Senior Research Associate at the OSU ElectroScience Laboratory. Prof. Kiourti received her Ph.D. in Electrical and Computer Engineering from the National Technical University of Athens, Greece (2013) and her M.Sc. from the University College London, UK (2009). Her research interests include: wearable and implantable sensors, antennas and electromagnetics for body area applications, and flexible textile-based electronics.

Her course, Textile Electronics and Body Area Sensing, will discuss transformational wearable and implantable technologies, addressing their potential and challenges raised. Rapid advances in antenna design, sensing technologies, and materials are opening new and hitherto unexplored opportunities in body area sensing, promising to address the unsustainability of existing healthcare provision models. Particular focus will be on a new class of functionalized garments with excellent electrical and mechanical properties that are based on automated embroidery of conductive E-threads. Very recently, the fabrication process was refined to enable resolutions as high as 0.1 mm, attracting the attention of media across the world (ALN Magazine, TechCrunch, Australia Network News, Innovation Toronto, The Times of India, etc.). Further, emphasis will be given on game-changing implants for deep brain signal monitoring. The approach entails a fully-passive (no battery, no energy harvester) and wireless biotelemetry to demonstrate the first-ever unobtrusive acquisition of deep brain signals as low as 20 μVpp. Other technologies required to make these on-/in-body devices a reality will also be discussed, including antennas, in-vitro/in-vivo testing, powering, and conformance to international safety guidelines.

Student Spotlight: Markus Novak

Markus Novak, advised by Prof. John L. Volakis, was selected as an IEEE Antennas and Propagation Society (AP-S) Doctoral Research Grant recipient. IEEE AP-S awards up to ten $2,500 doctoral grants each year to encourage students to pursue careers in the area of electromagnetics. Markus will use this research grant to study “Ultra-Wideband RF Architecture for 5G Systems.”

His paper, “Ultra-Wideband Array in PCB for Millimeter-Wave 5G and ISM”, won 3rd place for best paper award at the International Workshop on Antenna Technologies (iWAT) held in Athens, Greece. He was one of 13 student finalists for the competition which received hundreds of paper submissions. Markus is expected to complete his Ph.D. program this summer.
Volakis Presented with George Sinclair Award

After reinstating the award in 2016, Prof. John L. Volakis was announced as the newest recipient of the George Sinclair Award (established in 1980). The Sinclair Award recognizes an individual for distinguished technical contributions and/or service to the ElectroScience Laboratory (ESL). The award honors the memory of Dr. Sinclair, who exhibited exemplary standards in his own technical research and administrative leadership at the Antenna Laboratory (later renamed “ESL”) which he formally founded in 1942.

Volakis was selected based on his excellence in research and his exemplary leadership of ESL including establishing new research areas in electromagnetic sensor technology and securing a new ESL building. Faculty, staff, students and friends gathered on March 20, 2017 for the official presentation of the award. Volakis was presented with a desk plaque and an identical one is displayed in the ESL atrium along with the other Sinclair award recipients.

In March it was announced that Volakis had been appointed dean of Florida International University’s College of Engineering & Computing. His new appointment starts August 1, 2017 and we will certainly miss his presence here at ESL. Volakis has agreed to conduct a short course before leaving. His course, Ultra-Wideband Phased Arrays and Transceivers, is scheduled for Wednesday, August 2nd, 8:30 am to 12:00 pm. Additional short course information can be found at https://electroscience.osu.edu/esl-short-courses/2017.

ESL-CERF

The faculty and researchers at ESL have formed a Consortium on Electromagnetics and Radio Frequencies (CERF) to share their expertise in training of undergraduate and graduate students as well as employees of the US-based RF industry. One of the main goals of ESL-CERF is to support industry professionals at the leading edge of their fields and to provide them with access to world-class research and knowledge in EM and RF areas. Under this consortium, members have access to state-of-the-art facilities, faculty and student researchers. Specialty training courses are tailored to member needs.

CERF Affiliates

We are pleased to welcome our newest affiliate Lockheed Martin to the group. We look forward to their representatives attending the CERF meeting on Tuesday, August 1st.

BerrieHill Corp. BAE Systems  Lockheed Martin
MIT Lincoln Laboratory Northrop Grumman Raytheon

Consortium Advisory Board Members

Robert Burkholder Chi-Chih Chen Alissa Comella Inder J. Gupta Ronald Reano Fernando Teixeira Waleed Khalil

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Celebrating 75 Years
The year 2017 marks the 75th Anniversary of ESL. We are excited to announce that we will be hosting a celebration on Friday, October 6th. Please save-the-date and plan to join us as we celebrate. A full schedule of activities will follow shortly.

ESL-CERF
ElectroScience Laboratory Consortium on Electromagnetics and Radio Frequencies