ESL SHORT COURSES

August 2 - 4, 2017

Small group learning experience with renowned experts

The Ohio State University ElectroScience Laboratory (ESL) is offering 12 half-day short courses on key topics in EM and RF. Instructors for the short courses are world renowned faculty and researchers from The Ohio State University Department of Electrical and Computer Engineering. The courses are designed for engineers, technicians, graduate students and others interested in learning about these specialized topics.

Select special topics of interest to you

ESL short courses cover state-of-the art antenna design and measurement, photonics, computational electromagnetics, body area sensing, mixed signal and RFIC circuits, remote sensing, spectroscopy, imaging, optics, trusted microelectronics, and fully adaptive radar. Courses are conducted in a small group environment. Moreover, you can attend multiple courses in the same location during this three-day event.

Can't come to Columbus? Attend and interact remotely

Attend in Columbus, Ohio, or avoid the cost of traveling and attend remotely via an interactive online meeting with streaming video.

Registration Fees

Attend in-person or remotely via streaming video.

	Regular	Student
Half-day Course	$550	$275
Full-day Course	$1,100	$550

Registration deadline: July 19, 2017

Information and online registration:

https://electroscience.osu.edu/esl-short-courses

General Information

Professional Development/CPD

ESL Short Courses qualify for State of Ohio Professional Engineers Continuing Professional Development (CPD) Program hours. For more information please visit: http://www.peps.ohio.gov/IndividualLicensing/ContinuingEd.aspx

Location

The Blackwell Pfahl Conference Center
2110 Tuttle Park Place
Columbus, OH 43210
614-247-4000

Each in-person short course registration fee includes the cost of tuition, breaks and lunches. Cancelations prior to July 19, 2017 will be refunded minus a $50 administration fee. No refunds will be made after July 19th.

Accommodation Recommendations

The Blackwell Inn

2110 Tuttle Park Place, Columbus, OH 43210
614-297-4000 or 866-247-4003

Springhill Suites Marriott OSU
1421 Olentangy River Rd, Columbus, OH 43212
614-297-9912

Hampton Inn and Suites Columbus OSU
3160 Olentangy River Rd, Columbus, OH 43212
614-268-8700

Further Information

Visit the event website or contact:

Prof. Robert Burkholder
614-292-4597, burkholder.1@osu.edu

Michelle Diefenbach
614-292-6191, diefenbach.8@osu.edu

Schedule & Course Descriptions

Wednesday August 2, 2017

Antenna Induced Biases in GNSS Receiver Measurements **8:30am—12:00pm**

Inder "Jiti" Gupta, Professor Emeritus. Radar imaging, EM scattering, compact range technology, and adaptive antennas

Antennas can cause biases in code phase and carrier phase measurements in GNSS receivers. The biases are aspect dependent in that they vary from one satellite to the next in view of a GNSS receiver. This results in errors in the position and time solutions. Fixed reception pattern GNSS antennas can be calibrated for these biases in GNSS measurements. The same is not true for controlled reception pattern (adaptive) antennas which are needed for electronics protection in GNSS receivers. This short course will describe the latest methods to estimate and mitigate adaptive antenna induced biases in GNSS receivers. The methods will include optimum filtering in GNSS antenna electronics as well as modification of GNSS receivers.

Ultra-Wideband Phased Arrays and Transceivers **8:30am—12:00pm**

John L. Volakis, Professor. UWB antenna arrays, wearable electronics, millimeter waves, neurosensing, RFID, and EMI/EMC

Wide band antennas and arrays are essential for high resolution imaging, cognitive sensing, high data rate communication links, multi waveform, and multi-function frontends for holistic spectrum utilization and secure communications. There is a longstanding difficulty in realizing small and conformal aperture versions of these arrays. But recent miniaturization techniques, bandwidth enhancements and establishment of theoretical limits, feed technology, digital beam forming transceivers and post-processing algorithms have led to a new class of conformal antennas and tight-coupled arrays that can operate from UHF to millimeter wave frequencies. This short course will cover RF front-ends from the array aperture to transceivers and digital processors to realize ultra-wide band communications with channel coding for spread spectrum communications.

Fundamentals and Applications of Integrated Photonics **1:30pm—5:00pm**

Ronald M. Reano, Associate Professor. Integrated optics, electro-optics, and hybrid RF/optical devices

Integrated photonics encompasses the science and engineering of optical guided waves in highly integrated devices, components, circuits, and systems in a manner that is analogous to integrated circuits in electronics. This short course introduces the fundamentals of integrated photonics with an emphasis on silicon photonics. Fundamental building blocks will be discussed including waveguides, modulators, filters, couplers, resonators, switches, multiplexers, and detectors. Efficient fiber-to-chip couplers will also be covered. Applications in telecommunications, interconnects, sensors, and radio-frequency (RF) photonics will be discussed throughout the course within a theoretical and experimental context.

Textile Electronics and Body Area Sensing **1:30pm—5:00pm**

Asimina Kiourti, Assistant Professor. Antennas and RF circuits for body area applications, medical sensing, flexible textile-based electronics, and bioelectromagnetics

Rapid advances in wireless communications, sensing technologies, and materials are opening new and unexplored opportunities in body area sensing. Next-generation wireless on-/in-body devices are envisioned that can unobtrusively provide round-the-clock health status information. Example applications include: healthcare, sports, military, consumer electronics, emergency, space, etc. In this short course, we will discuss transformational wireless technologies for body area sensing (wearables, implantables, and ingestibles), addressing their potential and challenges raised. Particular focus will be on a novel class of flexible electronics based on embroidery of conductive textile threads. Other technologies required to make these on-/in-body devices a reality will also be discussed, including antennas, power harvesting, sensor-antenna interfaces, and human safety against electromagnetic fields.

Thursday August 3, 2017

Cognitive Processing for Radar Systems: From Theory to Practice **8:30am—12:00pm**

Graeme E. Smith, Research Assistant Professor. Radar systems, cognition for sensing, bioinspired signal processing, passive radar, radar target recognition, and micro-Doppler

The tutorial provides an introduction to cognitive processing for radar systems**.** The course is attempting to answer the question: *How does one build a cognitive radar?* The meaning of cognition, from an engineering perspective, is discussed and a case is made as to why future radar systems need to be cognitive. From this base position, techniques by which cognitive-like algorithms can be developed are discussed and the role of bioinspired signal processing considered. A mathematically rigorous, generalized cognitive framework will be introduced and examples of its use in experimental tests given. Examples will be provided of how cognition can be, and in some cases already is, used in radar processing.

Analysis and Design of mm-Wave VCOs in CMOS and Bipolar Technologies **8:30am—12:00pm**

Waleed Khalil, Associate Professor. RF and mm-wave circuits and systems, sub-THz circuits, front-end actives and passives, and high performance clocking circuits

Over the past two decades, great strides have been made in the theory and design process of low frequency silicon LVCOs while also presenting numerous architecture choices to optimize their performance. Unfortunately, this thought process does not scale well as we shift to mm-wave. To this end, there is a clear gap in understanding the challenges in optimizing the VCO tuning range and phase noise while maintaining high yield as operation pushes close to the device's fT/fmax. This course will present key analysis and techniques to "robustly" design VCOs at mm-wave. Intended participants are design, application and test engineers interested to learn about key and fundamental aspects in mm-wave VCO design and operation.

Thursday August 3, 2017 (cont.)

Propagation over the Sea: Mechanisms & Models — 1:30pm—5:00pm

Caglar Yardim, Research Scientist. Electromagnetic theory, lower atmospheric propagation, sea clutter

Non-standard propagation in Earth's atmosphere can play an important role in radar and communication system design, particularly for systems operating near the coast or at sea. Ducting propagation mechanisms can cause changes in radar system performance, including the presence of coverage holes, extended detection ranges, and increased clutter. The ducting mechanism depends on meteorological properties, so that understanding and forecasting ducting effects involves coupling electromagnetic and geophysical information. This short course will introduce the basic physical mechanisms of ducting propagation, and describe the standard techniques used to describe the related atmospheric properties and forecast the impact on radio frequency propagation.

High Performance Digital to Analog Converters: Challenges and Solutions — 1:30pm—5:00pm

Waleed Khalil, Associate Professor. RF and mm-wave circuits and systems, sub-THz circuits, front-end actives and passives, and high performance clocking circuits

The growing demand for high performance digital-to-analog converters (DACs) in wireless and wireline systems have spurred a plethora of research covering architectural, circuit, and calibration aspects. However, the challenges in achieving stringent dynamic linearity requirements over gigahertz of bandwidth remains a formidable barrier to designers and high-yield manufacturers. In light of these challenges, this course provides a broad perspective on design and calibration of the ubiquitously used current-steering DAC architecture. Intended participants are design, application and test engineers as well as technicians interested to learn about DAC behavior as well as key and fundamental aspects at both architecture and circuit levels.

Friday August 4, 2017

Introduction to Hardware Security: Trojans, Counterfeits, and Security in an Interconnected World — 8:30am-12:00pm

Brian Dupaix, Research Scientist, AFRL. Integrated digital/RF systems, multichannel mixed-signal receivers, and mm-wave Circuits

This course will provide an overview of Hardware Security and its emergence from the vulnerabilities identified with cryptographic processing. In the class, recent academic literature related to side-channel attacks, hardware Trojans, and logic obfuscation techniques will be presented.

Recent Developments in Spectroscopic Sensor Technology — 8:30am-12:00pm

Christopher Ball, Research Scientist. Spectroscopy, sensor technology development, millimeter wave, terahertz, infrared, optical, spectral libraries, detection algorithms

Researchers have investigated the science of spectroscopy in the laboratory for over a century. In recent years, the development of enabling technologies, such as smaller, more powerful sources, highly sensitive detectors, novel analysis algorithms, and high-speed processors, has enabled the development of a broad range of sensor technologies based on spectroscopy techniques. This course will provide an overview of spectroscopy phenomenology from microwave through ultraviolet, summarize recent developments of components and systems, and discuss several applications in pollution monitoring, agriculture, and defense applications.

A Private Collection of Novel UWB Antenna Design and Measurement Technologies — 1:30pm-5:00pm

Chi-Chih Chen, Research Associate Professor. Ground penetrating radar technology, novel radar systems, buried target detection/classification, and UWB antenna design

During this course, participants will be taken through the journey of designing six novel ultra-wave bandwidth antennas developed by the lecturer's research group. We will wrap up the course with a cableless antenna gain and return loss characterization method. The six antenna designs to be discussed are: 1) Extremely Low-Profile Wide-Scanning Dual-Polarization UWB Array; 2) UWB Dielectric Rod Antenna with Constant Gain, Pattern, and Phase Center; 3) Miniature Spiral Antenna; 4) UWB Inverted-Hat Monopole Antenna; 5) Antenna for High-Precision GNSS Signal Reception; 6) Backscattering Method for Antenna Gain and Return Loss Characterization.

Recent Developments in Computational Electromagnetics — 1:30pm-5:00pm

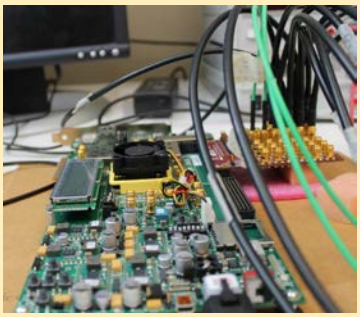
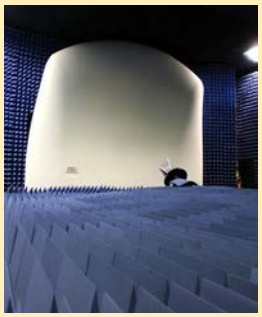
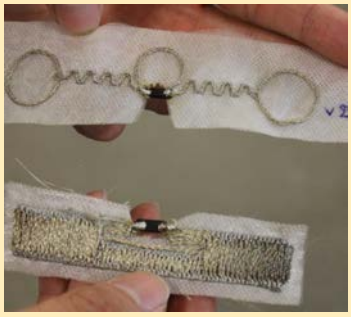
Jin-Fa Lee, Professor. Computational methods and computational geometry, 3D Finite Element Methods for electromagnetics, pioneer of the H(curl) conforming vector finite element methods, developer of HFSS (High Frequency Structure Simulator) a commercial FEM package

This course covers recent developments in computational Electromagnetics, particularly on non-conformal numerical methods. Both integral equation discontinuous Galerkin methods and non-conformal domain decomposition methods will be introduced.

For more information or to register, visit: https://electroscience.osu.edu/esl-short-courses

THE OHIO STATE UNIVERSITY

ElectroScience Laboratory
The Ohio State University
1330 Kinnear Road
Columbus, Ohio 43212
614-292-6191

The Ohio State University's ElectroScience Laboratory Presents

August 2-4, 2017

A three-day event featuring 12 short courses from renowned experts on electromagnetics, RF, antennas, radar, photonics and more.

THE OHIO STATE UNIVERSITY
COLLEGE OF ENGINEERING

Attend live in Columbus, Ohio, or remotely online.
Get details and register online at: https://electroscience.osu.edu/esl-short-courses