ESL Short Courses

August 6 - August 8, 2014

Small group learning experience with renowned experts

The ElectroScience Laboratory is offering 10 short courses, including half-day and full-day courses on key topics of interest. Instruction for the courses is provided by renowned faculty and researchers from The Ohio State University's Department of Electrical and Computer Engineering and the ElectroScience Laboratory.

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

Choose from 10 courses that cover the state-of-the-art in antenna design and measurement, computational electromagnetics, radar, remote sensing, imaging, optics, and photonics. Learn from world-class instructors in a small group environment and attend multiple courses in the same location during this three-day event.

Can't come to Columbus? Attend and interact remotely

Attend a course live in Columbus, Ohio, or avoid the cost and hassle of traveling, and attend and interact remotely via an online meeting with streaming video.

Registration Fees

Course Fees:
Attend in-person or remotely via streaming video

	Regular	Student
Half-day course	$525	$265
Full-day course	$1,045	$525

Registration deadline: July 21, 2014

Information & online registration: ***go.osu.edu/eslshortcourses***

General Information

Location

The Fawcett Center
The Ohio State University
2400 Olentangy River Road
Columbus, OH 43210

Each in-person short course registration fee includes the cost of tuition, breaks and lunches. Should you cancel before July 21, 2014, the registration fee will be refunded minus a $50 administration fee. No refunds will be made after July 21, the registration deadline.

Accommodations

The Blackwell (located on campus)
614-247-4000 or 866-247-4003
Rate: $135/night (ask for the OSU rate)

Springhill Suites Marriott OSU
614-297-9912
Rate: $124/night (group code: ESL Short Courses Conference)

Holiday Inn Express & Suites OSU
614-447-1212
Rate: $105/night (group code: ESL Short Courses)

Extracurriculars

There are numerous restaurants, shops and entertainment options located nearby on campus and just a few minutes away in the short north and downtown Columbus.

Further information

Visit the event website or contact:

Dr. Greg Creech
614-292-0609, creech.41@osu.edu

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

Schedule & Descriptions

Wednesday, August 6, 2014

Adaptive Antenna for GNSS Receivers

Inder "Jiti" Gupta — *8:30 am – 12:00 pm*

GNSS receivers are vulnerable to radio frequency interference. One can use signal processing techniques, e.g. FIR filters, frequency domain excision, etc. to suppress the interfering signals. Spatial processing using adaptive antenna, however, has become the universal choice for suppression of radio frequency interference in GNSS receivers. An adaptive antenna consists of multiple antenna elements. The signals received by various antenna elements are weighted and summed to produce a common output signal (for a given satellite signal frequency band) for all GNSS satellites in view or individual signal for each satellite in view. The element weights are calculated in real time and depend on the radio frequency environment. There are many approaches to calculate the antenna element weights. Thus, the performance of an adaptive antenna not only depends on the physical characteristic (size, number of elements and distribution of elements, etc.) of the antenna array but also depend on the weighting algorithm. In this short course, we will discuss the various parameters that affect the performance of GNSS adaptive antennas. The performance metrics will include C/N as well as antenna induced biases in GNSS receiver measurements.

Design and Operation of UWB Antennas

Chi-Chih Chen — *8:30 am – 12:00 pm*

Ultra-wideband (UWB) antennas are desirable for supporting modern software-defined radios and software-defined radars, as well as advanced coding and waveforms. These advanced technologies have been developed for achieving higher data rates, more secured channels, and better accuracy via spectrum agility, spectrum diversity, and wide bandwidth. Using a single UWB antenna in place of multiple co-located narrowband antennas also avoids performance degradations related to absorption and scattering from adjacent antennas, as well as reduces cost, maintenance, inventory, and visibility. Designing an UWB antenna requires careful consideration of radiation mechanisms and performance tradeoffs in order to obtain desired gain, pattern, and impedance performance at all frequencies. This half-day course will cover: definition of UWB antennas, classification of UWB antennas, UWB antenna design guidelines, and design examples of UWB antennas

A Tutorial on Designing Wideband Tightly-Coupled Phased Arrays

Chi-Chih Chen — *1:30 pm – 5:00 pm*

Tightly coupled phased array (TCPA) antenna designs differ from conventional phased array antenna design in that strong inter-element coupling is utilized to achieve multiple octaves of bandwidth with and without the presence of ground plane backing. This tutorial will cover: step-by-step instructions of designing a generic TCPA design, insightful discussions about the causes of performance issues associated with low-angle beam steering in phase arrays, and design examples of generic wideband & wide beam steering TCPA antennas.

Integrated Photonics

Ronald M. Reano — *1:30 pm – 5:00 pm*

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. The chip-scale control of light in planar optical waveguides enables processing and routing of data in the optical domain, offering size, weight, and power consumption advantages, compared to electronic solutions, especially at increasingly high data rates. 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.

Complete course details: ***go.osu.edu/eslshortcourses***

Lecturers

Courses will be taught by faculty and researchers from the Ohio State Department of Electrical and Computer Engineering and the ElectroScience Laboratory.

Chris Baker
Ohio Research Scholar and Professor
Coherent radar techniques, radar signal processing, radar signal interpretation and radar imaging

Robert J. Burkholder
Research Professor
Electromagnetic modeling, radar scattering and imaging

Chi-Chih Chen
Research Associate Professor
Ground penetrating radar technology, compact/low-profile UWB antenna designs, phase array, GPS/GNSS antennas

Brian Dupaix
Research Scientist
Integrated digital/RF systems, multi-channel mixed-signal receivers, and mm-wave circuits

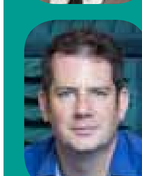
Inder "Jiti" Gupta
Research Professor
Radar imaging, EM scattering, compact range technology, adaptive antennas

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

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

Prabhakar H. Pathak
Professor Emeritus
Asymptotic High Frequency, Beam and Hybrid Methods for solving Large Antenna and Scattering Problems

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



Graeme Smith
Research Scientist
Radar systems, cognition for sensing & passive radar

Fernando L. Teixeira
Professor
Analytical and numerical techniques for wave propagation and scattering

Thursday, August 7, 2014

Cognition and Radar Sensing - Graeme Smith *8:30 am – 12:00 pm*

The application of cognitive signal processing to radar sensing has enormous potential to improve the performance of current systems, as well as opening up new applications, particularly those requiring autonomy. In this short course, the need for cognition in radar sensing is established along with the ingredients necessary for true cognition. Human cognition is used as an accessible and pertinent example from which artificial forms may be derived and applied to radar sensors. The lessons learned are applied to the design of new forms of radar processing architecture and processing methodologies. A new processing concept for radar exploiting echoic flow fields is introduced as an example of a cognitive processing concept that links perception and action through decision making. This concept offers a power basis for autonomous applications such as navigation, automatic landing, docking and vehicle collision management.

Antenna-to-Antenna Coupling on Aircraft Robert Burkholder & Prabhakar Pathak *8:30 am – 12:00 pm*

Predicting the coupling between multiple antennas mounted on realistic aircraft platforms is a challenging EMI/EMC problem due to the large platform size and the complexity of modern antenna arrays. This short course will define the coupling parameters of interest to the systems engineer, and discuss analytical ray-based methods and numerical methods for calculating and understanding coupling mechanisms. Approaches are also presented for characterizing an antenna separately from the aircraft, including large phased arrays and conformal arrays, and then predicting the performance when mounted on the aircraft.

Radio Frequency Propagation over the Sea Surface: Mechanisms & Models - Caglar Yardim & Fernando Teixeira *1:30 pm – 5:00 pm*

Non-standard propagation in Earth's atmosphere can play an important role in radar and communications system design, particularly for systems operating at sea. The ducting propagation mechanism can cause changes in radar system performance, including the presence of coverage "holes" or extended detection ranges. 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 will describe the standard techniques used to describe the related atmospheric properties and to forecast the impact on radio frequency propagation. Recent developments in the use of radar measurements to remotely sense the atmospheric state will also be presented. Current research activities at the ElectroScience Laboratory involving both measurements and models for ducting propagation will also be presented.

Bio-Inspired Radar Design - Chris Baker *1:30 pm – 5:00 pm*

Bats, whales and dolphins are all examples of echolocating mammals that depend on active sensing of their environments for their survival. The echolocating bat has evolved a remarkably high level of capability fine tuned over a period of more than 50 million years. There are also examples of humans who are expert in echolocation in which they not only detect targets but can recognize them with a remarkable degree of fidelity. This short course begins by examining the methods used by the echolocating bat and draws lessons for the design and operation of radar systems. Specifically, the waveforms and strategies used by bats for detection and classification are introduced and put into a radar context. It is shown how they are able to use a combination of waveform diversity and self-orientation to navigate autonomously, to detect and distinguish prey from clutter. Examples, applying these bio-inspired concepts in radar systems are also given. The course then goes on to look at human echolocation, studying the relationship between transmitted waveforms and the ability to distinguish differing shaped objects. In this way, lessons for the design of future radar systems are examined.

Friday, August 8, 2014

Passive Radar - Chris Baker *8:30 am – 12:00 pm*

Passive radar is currently a hot topic with commercial systems starting to appear as well as a wealth of research being conducted by many of the leading laboratories around the world. It is a rapidly maturing technology showing great promise for a range of applications, especially those requiring air target detection and tracking. New modes of operation such as imaging and MIMO are also possible. Passive radar exploits emissions of opportunity to form an RF sensor. It is covert, can counter stealth technology and is inherently low cost. Passive radar also is both frequency and space diverse. Further, an increasingly congested spectral environment is set to continue to improve passive radar performance for the foreseeable future. This short course introduces the principles and practice of passive radar from basic principles, conceptual design, processing methods for detection, tracking and imaging as well as hardware requirements. Examples from full-scale experimentation are used throughout to illustrate achievable performance. Latest developments in imaging and use of wideband signals are also included.

RFIC Architectures and Design for Radar and Communication Systems - Waleed Khalil & Brian Dupaix *8:30 am – 5:00 pm*

The surge in demand for high performance and low cost wireless circuits has accelerated the shift to CMOS RFIC technology. As future wireless radios continue to push the available bandwidth and shift to mm-wave range, RF CMOS is expected to remain the predominant technology. This full day course will cover in depth the practical aspects of CMOS RF design at both the circuit and device level. The course will begin by an overview of the CMOS transistor and passives from RF perspective, analyzing key concepts in modeling and noise behavior. An overview of various RF circuit blocks highlighting design architectures and circuit implementation tradeoffs will be provided. The course will provide insightful guidance in the circuit design process including transistor sizing, layout effects, parasitic reduction techniques and tradeoffs between various circuit topologies.

ElectroScience Laboratory
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The Ohio State University's **ElectroScience Laboratory** Presents

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The ElectroScience Laboratory Short Courses: A three-day event featuring 10 short courses from renowned experts on electromagnetics, RF, antennas, radar, photonics and more.

The Ohio State University

Attend live in Columbus, Ohio or online
Get details and register online at ***go.osu.edu/eslshortcourses***