EE/CE/TE PhD Qualifying Examination, Part 2

Presentation Schedule
Spring 2017
<table>
<thead>
<tr>
<th>Slide #</th>
<th>Last Name</th>
<th>First Name</th>
<th>Title of Presentation</th>
<th>PhD Advisor</th>
<th>Date &amp; Time</th>
<th>Venue</th>
</tr>
</thead>
<tbody>
<tr>
<td>4</td>
<td>Amin</td>
<td>Tanjil</td>
<td>DOA Estimation with Sub-Nyquist Sampling</td>
<td>Murat Torlak</td>
<td>April 04 3:30pm</td>
<td>ECSN 4.728</td>
</tr>
<tr>
<td>5</td>
<td>Broadfoot</td>
<td>Thomas</td>
<td>Reverse Engineering of Digital Microfluidic Biochips</td>
<td>Jeyavijayan Rajendran</td>
<td>March 22 12:00-3:00pm</td>
<td>ECSN 4.728</td>
</tr>
<tr>
<td>6</td>
<td>Byreddy</td>
<td>Pranith Reddy</td>
<td>Concepts and Methods in Optimization of Integrated LC VCOs</td>
<td>Kenneth O</td>
<td>April 03 10:00-11:00am</td>
<td>ECSN 3.802</td>
</tr>
<tr>
<td>7</td>
<td>Chandra Shekar</td>
<td>Ram Charan</td>
<td>Auditory Model-Based Dynamic Compression Controlled by Subband Instantaneous Frequency and Speech Presence Probability Estimates</td>
<td>Issa Panahi</td>
<td>April 12 2:00pm</td>
<td>ECSN 4.728</td>
</tr>
<tr>
<td>8</td>
<td>Chen</td>
<td>Ziyu</td>
<td>Gallium-based Liquid Metals and Applications in Flexible and Reconfigurable Devices</td>
<td>Jeong-Bong Lee</td>
<td>April 07 2:00-2:30pm</td>
<td>ECSN 4.702</td>
</tr>
<tr>
<td>9</td>
<td>Dai</td>
<td>Yucheng</td>
<td>New Receiver Architectures for Massive MIMO Beamforming Application</td>
<td>Hlaing Minn</td>
<td>April 10 11:00-12:30pm</td>
<td>ECSN 4.728</td>
</tr>
<tr>
<td>10</td>
<td>El Bouanani</td>
<td>Lidia</td>
<td>Electrical Characteristics of 2D Transition Metal Dichalcogenides Deposited by Pulsed Laser Deposition</td>
<td>Manuel Quevedo-Lopez</td>
<td>April 07 11:00am</td>
<td>ECSS 3.503</td>
</tr>
<tr>
<td>11</td>
<td>Gemsheim</td>
<td>Alex</td>
<td>Surface Behavior based on Ion-Induced Secondary Electron Emission from Semi-Insulating Materials in Breakdown Evolution</td>
<td>Lawrence Overzet</td>
<td>April 06 9:00-11:00pm</td>
<td>ECSN 4.728</td>
</tr>
<tr>
<td>12</td>
<td>Hu</td>
<td>Xuan</td>
<td>Dual-Gate Ambipolar Carbon Nanotube FET Circuits Design &amp; Analysis</td>
<td>Joseph S. Friedman</td>
<td>March 31 11:00am</td>
<td>ECSN 4.728</td>
</tr>
<tr>
<td>13</td>
<td>Jafarzadeh</td>
<td>Mohsen</td>
<td>Object Manipulation using Humanoid Powered by Novel Actuators and Vision System</td>
<td>Yonas Tadesse</td>
<td>April 10 2:00-3:00pm</td>
<td>ECSN 4.728</td>
</tr>
<tr>
<td>14</td>
<td>Joglekar</td>
<td>Aditya</td>
<td>Deep Learning Applications in Speech Recognition</td>
<td>John H.L. Hansen</td>
<td>March 28 2:00-3:00pm</td>
<td>ECSN 4.728</td>
</tr>
<tr>
<td>Slide #</td>
<td>Last Name</td>
<td>First Name</td>
<td>Title of Presentation</td>
<td>PhD Advisor</td>
<td>Date &amp; Time</td>
<td>Venue</td>
</tr>
<tr>
<td>--------</td>
<td>-------------</td>
<td>------------</td>
<td>----------------------------------------------------------------------------------------</td>
<td>---------------</td>
<td>---------------------------</td>
<td>--------</td>
</tr>
<tr>
<td>16</td>
<td>Kothapally</td>
<td>Vinay</td>
<td>Distant Speech Recognition</td>
<td>John Hansen</td>
<td>March 28 3:00-4:00pm</td>
<td>ECSN 4.728</td>
</tr>
<tr>
<td>17</td>
<td>Lee</td>
<td>Craig</td>
<td>Internet of Things for Smart Cities</td>
<td>Andrea Fumagalli</td>
<td>April 14 1:30-2:30pm</td>
<td>ECSN 4.702</td>
</tr>
<tr>
<td>18</td>
<td>Liang</td>
<td>Jingchen</td>
<td>Torque Ripple Minimization in Interior Permanent Magnet Synchronous Motors (IPMSMs) Using Advanced Power Electronics Control Method</td>
<td>Babak Fahimi</td>
<td>April 05 10:00am</td>
<td>ECSS 3.504</td>
</tr>
<tr>
<td>19</td>
<td>Maharjan</td>
<td>Lizon</td>
<td>Utilization of remote computational capabilities for improvement of power distribution system</td>
<td>Babak Fahimi</td>
<td>April 13 10:00am</td>
<td>ECSN 4.728</td>
</tr>
<tr>
<td>20</td>
<td>Rajavendra</td>
<td>Gaurav</td>
<td>State-of-the-Art in Lithographic Hotspot Detection</td>
<td>Georgios Makris</td>
<td>April 20 9:00am</td>
<td>ECSN 4.728</td>
</tr>
<tr>
<td>21</td>
<td>Ramadan</td>
<td>Yahia</td>
<td>Hybrid Analog-Digital Precoding for Secure Millimeter Wave MISO-OFDM Systems</td>
<td>Hlaing Minn</td>
<td>April 10 9:30am</td>
<td>ECSN 4.728</td>
</tr>
<tr>
<td>22</td>
<td>Shahshahani</td>
<td>Masoud</td>
<td>Embedded FPGA based platform for deep learning</td>
<td>Dinesh Bhatia</td>
<td>April 14 3:00pm</td>
<td>ECSN 3.712</td>
</tr>
<tr>
<td>23</td>
<td>Taghizadeh</td>
<td>Nasim</td>
<td>Literature review of supervised and unsupervised learning schemes for sound signal classification</td>
<td>Nasser Kehtarnavaz</td>
<td>April 19 10-11:am</td>
<td>ECSS 4.910</td>
</tr>
<tr>
<td>24</td>
<td>Taherkhani</td>
<td>Nima</td>
<td>Channel Capacity and Interference Spectrum of a Wireless Network with Poisson Distributed Interferers</td>
<td>Kamran Kiasaleh</td>
<td>April 21 3:00-4:30pm</td>
<td>ECSN 4.728</td>
</tr>
<tr>
<td>25</td>
<td>Thakur</td>
<td>Sneha</td>
<td>Resonant Converters with PWM control for applications in DC Microgrids</td>
<td>Poras T. Balsara</td>
<td>April 20 10:30am</td>
<td>ECSN 3.712</td>
</tr>
<tr>
<td>26</td>
<td>Xia</td>
<td>Wei</td>
<td>Speaker Recognition with Nonlinear Distortion: Clipping Analysis and Impact</td>
<td>John Hansen</td>
<td>March 28 4:00-5:00pm</td>
<td>ECSN 4.728</td>
</tr>
<tr>
<td>27</td>
<td>Xiong</td>
<td>Jiu</td>
<td>High Speed Continuous-Time FIR Equalizer for Wireline Communications</td>
<td>Jin Liu</td>
<td>March 22 9:30-10:30am</td>
<td>ECSN 4.702</td>
</tr>
<tr>
<td>28</td>
<td>Yanik</td>
<td>Muhammet Emin</td>
<td>Spatial Filtering of RF Interference in Radio Astronomy Systems</td>
<td>Murat Torlak</td>
<td>April 4 2:00pm</td>
<td>ECSN 4.728</td>
</tr>
</tbody>
</table>
DOA Estimation with Sub-Nyquist Sampling

Tanjil Amin

April 4, 2017 | 3:30 pm | ECSN 4.728

Abstract: Cyclostationarity property is very common in many modulated signals. As it is helpful to negate the impact of interference and noise, cyclostationarity can be applied in detection of arrival (DOA) estimation. Existing MUSIC and ESPRIT algorithms can be used in case of narrowband cyclostationary signals for DOA estimation but they are not effective if the cyclostationary signal is wideband. Spatial and temporal properties of cyclostationary signals can be taken into account to estimate DOA in wideband cyclostationary signals.

PhD Advisor: Dr. Murat Torlak
Digital microfluidics is an alternative technology for lab-on-a-chip systems based upon micromanipulation of discrete droplets. Unit sized packets of fluid are transported, stored, mixed, reacted, or analyzed. Applications include polymerase chain reaction (PCR) for DNA replication, in-vitro diagnostics (e.g. genetic testing, blood glucose, liver function, electrolytes, etc.), protein assay for analysis of protein content of a sample, and others. DMFBs may contain information about biological assays that are proprietary information to the designer of these devices. Commercial companies invest significant time and money in the development effort to design these protocols. Like semiconductors, DMFBs are vulnerable to reverse engineering and IP theft when these assays are implemented. Current DMFBs have no protection against reverse engineering attacks. Piracy is a major concern for the healthcare industry due to the potential loss of time and money invested in development of IP. A reverse engineer can recover an activation sequence which is the intellectual property (IP) of the designer of the DMFB. He can use the activation sequence to execute an assay that is at least functionally equivalent to the original activation sequence, if not exactly the same. This talk presents a threat model and a method for reverse engineering of DMFBs.
Concepts and Methods in Optimization of Integrated LC VCOs

Pranith Reddy Byreddy
April 3, 2017 │ 10:00-11:00 am │ ECSN 3.802

Abstract: Integrated LC voltage-controlled oscillators (VCOs) are common functional blocks in modern radio frequency communication systems and are used as local oscillators to upconvert and down convert signals. Various components in the circuit produce noise, which effects the amplitude and phase of the output signal. Although amplitude noise is naturally rejected by the oscillator, phase noise is free running. So, it is very critical to improve the phase-noise performance of integrated LC VCOs. Design and optimization of integrated LC VCOs pose many challenges as simultaneous optimization of multiple variables is required. A design strategy based on inductance selection scheme is executed to optimize phase noise subject to design constraints such as power dissipation, tank amplitude, tuning range, startup conditions and diameters of spiral inductors. Concepts like waste of inductance and waste of power in two different modes of operation named current and voltage limited regimes have been observed. Overall, the design strategy of the oscillator is based on inductance selection, that improve the phase noise performance of the oscillator while satisfying all the design specifications.

PhD Advisor: Dr. Kenneth O
Abstract: Sensorineural hearing loss typically results in elevated thresholds and steepened loudness growth significantly conditioned by a damage of outer hair cells (OHC). In hearing aids, amplification and dynamic compression aim at widening the limited available dynamic range. However, speech perception particularly in complex acoustic scenes often remains difficult. Here, a physiologically motivated, fast acting, model-based dynamic compression algorithm (MDC) is introduced which aims at restoring the behaviorally estimated basilar membrane input–output (BMI/O) function in normal-hearing listeners. A system-specific gain prescription rule is suggested, based on the same model BM I/O function and a behavioral estimate of the individual OHC loss. Cochlear off-frequency component suppression is mimicked using an instantaneous frequency (IF) estimate. Increased loudness as a consequence of widened filters in the impaired system is considered in a further compensation stage. In an extended version, a subband estimate of the speech presence probability (MDC+SPP) additionally provides speech-selective amplification in stationary noise. Instrumental evaluation revealed that the IF control enhances the spectral contrast of vowels and benefits in quality predictions at higher signal-to-noise ratios (SNRs) were observed. Compared with a conventional multiband dynamic compressor, MDC achieved objective quality and intelligibility benefits for a competing talker at lower SNRs. MDC+SPP outperformed the conventional compressor in the quality predictions and reached comparable instrumental speech intelligibility as achieved with linear amplification. The proposed algorithm provides a first promising basis for auditory model-based compression with signal-type and bandwidth-dependent gains.
Gallium-based Liquid Metals and Applications in Flexible and Reconfigurable Devices

Ziyu Chen

April 7, 2017 | 2:00-2:30 pm | ECSN 4.702

Abstract: Gallium-based liquid metals are eutectic alloys that are liquid at room temperature. Due to their liquidity, non-toxicity and relatively high electrical conductivity, these alloys provide incomparable advantages over other materials in highly flexible and stretchable electronic devices and reconfigurable devices, such as frequency reconfigurable antennas and metamaterial devices. This presentation covers the characteristics of gallium-based LMs, methods to fabricate and to actuate micro-scaled LMs, and the applications in flexible and reconfigurable devices are reviewed. The current challenges and proposed solutions are also discussed.

PhD Advisor: Dr. Jeong-Bong Lee
New Receiver Architectures for Massive MIMO Beamforming Application

Yuchen Dai

April 10, 2017 | 11:00 am - 12:30 pm | ECSN 4.702

Abstract: Owing to its reduction in hardware complexity and power consumption, hybrid beamforming has become one of the most promising substitutes for Fully Digital Beamforming (FDB) in large antenna array systems. In Conventional Hybrid Beamforming (CHB) architecture, phase shifters are designed to operate at RF band and inaccuracies of the RF phase shifts are unavoidable in practice. Furthermore, these RF phase shifters still consume considerable power if implemented as active devices or a large space/area on dice (form factor) if implemented as passive devices. This issue becomes more critical for massive MIMO systems where lower power consumption and smaller form factor are much desired due to the large number of antenna elements. Aiming at reducing power consumption and form factor of the receiver, we investigate a new method to insert phase shift via adjusting sampling-offset on sample and hold (S\H) circuit. Based on this method, a new receiver architecture with RF under-sampling technique and adjustable S\H circuit is proposed. We also develop a method to find out the required phase shifts for the beam-forming in the proposed receiver architecture. Performance evaluation at 28 GHz band shows that the proposed scheme gives comparable bit error rate (BER) performance to CHB architecture. More importantly, our novel receiver architecture has potential to lower power consumption and layout size, which makes it appealing for massive MIMO systems.

PhD Advisor: Dr. Hlaing Minn
Electrical Characteristics of 2D Transition Metal Dichalcogenides Deposited by Pulsed Laser Deposition

Lidia El Bouanani
April 7, 2017 │ 11:00 am │ ECSS 3.503

Abstract: Two-dimensional (2D) semiconductors, such as transition-metal dichalcogenide (TMD) monolayers, have attracted intense interest because of their direct band gaps. While their monolayer band gaps are direct, they may be tuned indirectly by increasing their number of layers. Two-dimensional TMDs are materials ideal for low-cost application in optoelectronics. The photocurrent conversion at the characteristic photon energies that corresponds to their band gaps is extraordinary, making them great candidates for wavelength selective photodetectors. These few-layer and single-layer nanosheets have diverse application that include optoelectronics, energy harvesting, phototransistors, and flexible thin film transistors. The combination of single and multilayered 2D TMDs coupled with either Si or II-VI semiconductors can result in robust and reliable photodetectors. Integrating single and multiple layer TMDs in phototransistors in future research can exhibit new mechanisms and phenomena in photocurrent generation. In my current research, I am studying varying parameter deposition effects on Molybdenum diselenide, a 2D TMD, deposited by pulsed laser deposition (PLD). Depositing 2D TMDs by PLD offers several advantages such as thickness and stoichiometric ratio control and avoids the use of expensive and harmful precursors. This presentation will be a literature review that covers the unique properties of 2D TMDs, the advantages of depositing using the PLD, as well as a review of this material’s applications and their electrical characteristics.

PhD Advisor: Dr. Manuel Quevedo-Lopez
Surface Behavior Based on Ion-Induced Secondary Electron Emission from Semi-Insulating Materials in Breakdown Evolution

Alex Gemsheim
April 6, 2017 | 9:00–11:00 am | ECSN 4.728

Abstract: This study focuses on analyses of secondary electron emission (SEE) at semiconductor surfaces when the sufficient conditions of space–time distribution occur. Experimental measurements and calculations with the approach of Townsend coefficients, which include the evaluations of ionization coefficient (a) and SEE coefficient (g) were performed in high-ohmic InP, GaAs, and Si semiconductor cathodes with argon and air environments in a wide range of \( E/N \) (300–10 000 Td). The direct calculations of g were carried out to determine the behavior of cold-semiconductor cathode current in a wide range of microgaps (45–525 mm). Paschen curves are interpreted in the dependence of large pd range on breakdown voltage through g and a/N. Ion-induced secondary electrons exhibit the direct behaviors affecting the timescale of breakdown evolution in the vicinity of the Paschen minimum during the natural bombardment process with ions of semiconductor cathodes. Also, when a/N rapidly drops and the excitations of gas atoms densely occupy the gas volume, we determined that the photoelectric effect provides a growth for electron emission from semiconductor surfaces at the breakdown stage at the reduced values of E/N. At all pressures, the emission magnitudes of electrons liberated by semiconductor cathodes into vacuum are found as \( g_{\text{InP}} > g_{\text{GaAs}} > g_{\text{Si}} \) in breakdown evolution.

PhD Advisor: Dr. Lawrence Overzet
Dual-Gate Ambipolar Carbon Nanotube FET Circuits Design & Analysis

Xuan Hu
March 31, 2017 | 11:00 am | ECSN 4.728

Abstract: As CMOS technologies reach their physical limits, advanced devices and circuit structures are needed to enable compact circuit design. Carbon nanotube field-effect transistors (CNTFETs) are compelling alternatives to MOSFETs, and their ambipolarity provides a route to reduce device count through higher expressive power with dual-gate CNTFETs. However, previous models do not permit switching of the device polarity and the full leveraging of these properties. In this paper, we present the first model that enables the transient simulation of dual-gate ambipolar CNTFET circuits in which the CNTFET polarities can be switched between n- and p-type. This model is based on experimental behavior and is shown to provide an interchangeable source and drain. The utility of the model is then demonstrated through the simulation and analysis of cascaded XOR logic gates and a one-bit full adder that utilize the ability to switch the CNTFET polarity. This model therefore enables the further development of ambipolar CNTFET logic circuits towards their potential replacement of CMOS.

PhD Advisor: Dr. Joseph S. Friedman
Object Manipulation using Humanoid Powered by Novel Actuators and Vision System

Mohsen Jafarzadeh
April 10, 2017 | 2:00–3:00 pm | ECSN 4.728

Abstract: Humanoid robots are becoming important companions that can assist humans in various sectors. It is desired if these robots manipulate different objects in cluttered environment through vision system and suitable actuation system. Recently, novel soft actuators such as Twisted and Coiled Polymer (TCP) muscles are introduced for articulation of the robots and very few researches on the control of TCP muscles are available. In this research, we aim to investigate various algorithms including classical and modern control systems to improve the performance of a humanoid robot, which uses these novel actuators to manipulate objects. We will demonstrate very difficult task such as interacting with soft materials using the humanoid hand and vision system. We also intend to implement the control systems for facially expressive robot and demonstrate novel applications. The research is expected to have significant impact on health care and accomplishment of task that are dangerous for human beings.

PhD Advisor: Dr. Yonas Tadesse
Deep Learning Applications in Speech Recognition

Aditya Joglekar
March 28, 2017 | 2:00–3:00 pm | ECSN 4.728

Abstract: In the last decade, Deep Learning has grown to be one of the most important tools in the modern industry. With the advent of deep neural nets and its variants, the improvement in the performance and scope has been exponential. Deep Neural Networks are easily outperforming the best machine learning techniques presently used. The idea of modeling high level abstractions in speech data for the purpose of speech recognition has been gaining continued interest. This presentation aims at explaining in concise the deep learning techniques successfully used for speech recognition. Analysis of techniques like Convolutional and Recurrent Neural Networks at different stages of ASR (Automatic Speech Recognition) will be presented with their attributes, implementation details and the changes in accuracy caused by technique modifications. The goal of the first part of the presentation is to illustrate the possible reasons for the success of each of the algorithm and use that knowledge to suggest alternate approaches to further improve on the techniques presently being used. The second part of the presentation would deal with application of that knowledge to perform Multi-channel ASR on the Apollo Speech Data. This part will elaborate on the analysis of Multi-channel data to create a deep learning based ASR system and present the observations of the research.

PhD Advisor: Dr. John Hansen
Frequency Multiplexed Computing: An Approach for Emerging Energy-Efficient Systems

Matthew Joslin
March 22, 2017 | 3:30 pm | ECSS 3.503

Abstract: Emerging systems are becoming increasingly constrained by energy. Meanwhile, applications increasingly rely on exploiting parallelism to reach performance goals. Conventional computing systems use either space or time multiplexing for parallelism. In this paper, we propose to use frequency multiplexing as the basis for doing analog general purpose computations. The key insight for this approach is that frequency multiplexed symbols can be robustly processed on the same hardware simultaneously. We introduce the first hardware to perform frequency multiplexed general-purpose computations.

PhD Advisor: Dr. Joseph Callenes-Sloan
Distant Speech Recognition

Vinay Kothapally
March 28, 2017 | 3:00–4:00 pm | ECSN 4.728

Abstract: With the technical advancements in the area of human-machine interactions with voice-driven applications, the requirement for robust speech recognition systems have increased rapidly. There are many speech preprocessing & recognition algorithms which perform fairly well with microphones placed closely to the talker. However, with the emerging need of hands-free interfaces for electronic devices, far-filed recognition and teleconference like applications, the need exists for efficient algorithms which work on microphone(s) placed at a distance from the talker. Two significant problems are faced in distant speech recognition which include interference from undesired signals and reflections of the desired signals. In this presentation, we address research solutions for these issues and also discuss an approach for speech activity detection (SAD), which is the first step towards speech recognition to handle reverberant environmental conditions. Performance of this SAD will be evaluated against the conventional Phase-Magnitude SAD and a robust Combo-SAD.

PhD Advisor: Dr. John Hansen
Internet of Things for Smart Cities

Craig Lee

April 14, 2017 | 1:00–2:30 pm | ECSN 4.702

Abstract: Presentation based upon paper: Internet of Things for Smart Cities, By Zanella, Bui, Castellani, Vangelista, and Zorzi

The Internet of Things (IoT) shall be able to incorporate transparently and seamlessly a large number of different and heterogeneous end systems, while providing open access to selected subsets of data for the development of a plethora of digital services. Building a general architecture for the IoT is hence a very complex task, mainly because of the extremely large variety of devices, link layer technologies, and services that may be involved in such a system. In this paper, we focus specifically to an urban IoT system that, while still being quite a broad category, are characterized by their specific application domain. Urban IoTs, in fact, are designed to support the Smart City vision, which aims at exploiting the most advanced communication technologies to support added-value services for the administration of the city and for the citizens. This paper hence provides a comprehensive survey of the enabling technologies, protocols, and architecture for an urban IoT. Furthermore, the paper will present and discuss the technical solutions and best-practice guidelines adopted in the Padova Smart City project, a proof-of-concept deployment of an IoT island in the city of Padova, Italy, performed in collaboration with the city municipality. Candidate will expand upon paper and include relevant examples of Smart City Technologies.

PhD Advisor: Dr. Andrea Fumagalli
This presentation focuses on analyzing the torque ripple generation mechanism of Interior Permanent Magnet Synchronous Motors (IPMSMs) and minimization methods using its power electronics drive. IPMSMs have been widely used in high performance variable speed applications, robotics, and machine tools with the superior performance including high power density and high torque to inertia ratio. However, torque ripple exists in IPMSMs due to interaction between flux linkage harmonics, non-sinusoidal currents, as well as magnetic attraction between the rotor mounted permanent magnets and stator teeth. These torque ripples cause oscillation phenomenon at the motor speed, especially under low-speed conditions, furthermore results in undesirable mechanical vibrations. Instead of trying to regulate the input 3-phase current to be ideally sinusoidal wave, my goal is to minimize the torque ripple by adding harmonics to fundamental current that can cancel out the higher harmonics generated in motor which will cause torque ripples. First, the generation mechanism of the torque ripple in IPMSM is studied. Then, the relationship between the torque and the drive current is built using ANSYS Maxwell simulation. Third, based on the theoretical analysis and simulation result, advanced drive current control method is proposed to cancel out the effect of high-order harmonic and reduce the torque ripple. At last, the simulation results verify the feasibility of the proposed control method using MATLAB Simulink. This approach can be adaptively programmed in microcontrollers.
Utilization of Remote Computational Capabilities for Improvement of Power Distribution System

Lizon Maharjan
April 13, 2017 │ 10:00 am │ ECSN 4.728

Abstract: The evolution of micro and nano grids from being independent modules to collective systems has been further assisted by development in the field of wireless data transfer. However, modern communication systems, big data, and data analytical tools have more to offer than what has been exploited thus far. Inclusion of wireless communication not only enables inter unit communication, but also gives access to cloud computation. This can relocate the computational requirements to remote location, and provide access to infinite computational capacity. Hence, more data can be collected and processed from additional sensors. The power modules can be equipped with necessary and redundant sensors to improve the hardware and system reliability. The operational data from such sensors can be accessed live and stored for long term analyses. Trigger commands can be sent back to the individual units to make live parameters updates, software upgrades, or change in operational algorithms. These new features add prospect of implementing novel set of secondary control parameters which can introduce functionalities to grid infrastructure which has not been realized before. Such controls can be directed towards improving grid reliability during uncertainties, improving hardware reliability by effective monitoring of sensor data, performing algorithms such as pattern recognition and predictive analyses for fault prediction and prevention.

PhD Advisor: Dr. Babak Fahimi
State-of-the-Art in Lithographic Hotspot Detection

Gaurav Rajavendra Reddy
April 20, 2017 | 9:00 am | ECSN 4.728

Abstract: Continuous technology scaling and the introduction of advanced technology nodes has exposed new manufacturability issues in Integrated Circuit (IC) fabrication. Lithographic hotspots are one of such problems which are a result of complex process interactions. While these hotspots are known to vary from design to design, foundries expect such hotspots to be predicted early and corrected in the design stage itself, as opposed to a process fix for every hotspot, which would be intractable. Various efforts have been made in the past to address this issue by using a known database of hotspots as a source of information. Most of these works use either Machine Learning or pattern matching techniques to identify and predict hotspots in new incoming designs. In this presentation, details about Lithographic Hotspots, their causes and effects, the State-of-the-Art in hotspot identification and prediction, current challenges and possible research directions will be discussed.

PhD Advisor: Dr. Babak Fahimi
Hybrid Analog-Digital Precoding for Secure Millimeter Wave MISO-OFDM Systems

Yahia Ramadan

April 10, 2017 | 9:30 am | ECSN 4.728

Abstract: Due to the tiny wavelength of millimeter waves (mmWave), tens of antennas can be packed into a small area in mmWave transceivers. However, implementing a radio-frequency (RF) chain for each antenna is impractical due to the high cost and power of mixed-signal devices. To reduce the hardware complexity and the power consumption, the antenna array with \( N_T \) elements is connected via an analog RF precoder to \( N_{RF} \) RF chains \((N_{RF} < N_T)\) which process the digitally-precoded transmitted stream. In this presentation, we design the hybrid analog-digital precoders for physical layer security. We consider two degrees of channel knowledge at the transmitter. With full channel knowledge at the transmitter, we provide theoretical limits on the minimum number of RF chains needed to realize the performance of the fully digital precoding. Then, the hybrid precoders are designed to maximize the secrecy rate. With partial channel knowledge at the transmitter, we derive a secrecy outage probability upper bound. Then, the hybrid precoders are designed to maximize the secrecy throughput. The secrecy throughput maximization problem is converted into a sequence of secrecy outage probability minimization problems. Performance results show that the proposed hybrid precoders designs outperform the conventional secrecy schemes.

PhD Advisor: Dr. Hlaing Minn
Embedded FPGA Based Platform for Deep Learning

Masoud Shahshahani
April 14, 2017 | 3:00 pm | ECSS 3.712

Abstract: In recent years, Convolutional Neural Network (CNN) based methods have achieved great success in a large number of applications and have been among the most powerful and widely used techniques in computer vision. However, CNN-based methods are computational-intensive and resource-consuming, and thus are hard to be integrated into embedded systems such as smart phones, smart glasses, and robots. FPGA is one of the most promising platforms for accelerating CNN, but the limited bandwidth and on-chip memory size limit the performance of FPGA accelerator for CNN. I go deeper with the embedded FPGA platform on accelerating CNNs and propose a CNN accelerator design on embedded FPGA for Image-Net large-scale image classification. I first present an in-depth analysis of state-of-the-art CNN models and show that Convolutional layers and Fully-Connected layers are memory-centric. Then the dynamic-precision data quantization method and a convolver design that is efficient for all layer types in CNN are proposed to improve the bandwidth and resource utilization.

PhD Advisor: Dr. Dinesh Bhatia
Literature Review of Supervised and Unsupervised Learning Schemes for Sound Signal Classification

Nasim Taghizadeh Alamdari
April 19, 2017 | 10:00-11:00 am | ECSS 4.910

Abstract: Many studies have been conducted in the literature on sound signal classification. A typical noise classifier incorporates two major components: a feature extractor and a classifier. This presentation will cover various supervised and unsupervised learning schemes that have been previously developed for the purpose of performing sound signal classification in hearing improvement devices including hearing aids, cochlear implants, and smart headphones. Besides providing a comprehensive review of the existing schemes for sound signal classification, their pros and cons are discussed. In addition, possible improvements that can be made to these schemes are also presented.

PhD Advisor: Dr. Nasser Kehtarnavaz
Channel Capacity and Interference Spectrum of a Wireless Network with Poisson Distributed Interferers

Nima Taherkhani
April 21, 2017 | 3:00-4:30 pm | ECSN 4.728

Abstract: In wireless networks, interference modeling is essential for performance analysis and protocol design. We present a mathematical model for communication channel subjected to both network interference and noise, where the interferers are distributed according to a spatial Poisson process, and are operating asynchronously in a wireless environment subject to path loss, shadowing, and multipath fading. Based on the underlying model, the capacity of wireless channel is characterized, and the power spectral density metric is used to analyze the aggregate radio-frequency emission in a network with a Poisson field of interferers. The concept of spectral outage probability as the criterion for controlling the interference in wireless networks is also introduced.

PhD Advisor: Dr. Kamran Kiasaleh
Resonant Converters with PWM control for applications in DC Microgrids

Sneha Thakur
April 20, 2017 | 10:30 am | ECSN 3.712

Abstract: The advent of smart grids and microgrids has created the need for fast, reliable and compact power electronic systems which can support bidirectional power flow at reduced switching losses. Conventional power converters suffer from high switching losses during transition from on-off or vice-versa when voltage and current are non-zero. Hence, it is must to explore new topologies of efficient power converters for better regulation of power flow. Resonant power converters with Zero Voltage Switching and Zero Current Switching presents a scope to tackle these issues. Various topologies of resonant converters with different control techniques exist in literature and many are still to be explored. The presentation will focus on review of resonant converters and two resonant converter topologies designed to meet specific microgrid applications.

PhD Advisor: Dr. Poras T. Balsara
Speaker Recognition with Nonlinear Distortion: Clipping Analysis and Impact

Wei Xia

March 28, 2017 | 4:00–5:00 pm | ECSN 4.728

Abstract: Speech, speaker, and language technology systems have traditionally relied on carefully collected speech material for training acoustic models. However, today there is an overwhelming abundance of publicly accessible audio material available for training. A major challenge, however, is that such found data is not professionally recorded, and therefore may contain a wide diversity of background noise, nonlinear distortions, or other unknown environmental or technology based contamination or mismatch. There is a critical need for automatic analysis to screen such unknown data sets before acoustic model development, or to perform input audio purity screening prior to classification. In this study, we propose an algorithm for waveform clipping detection and analyze the impact of clipping at different severities on speech quality measures and automatic speaker identification systems.

PhD Advisor: Dr. John Hansen
High Speed Continuous-Time FIR Equalizer for Wireline Communications

Jiu Xiong
March 22, 2017 | 9:30-10:30 am | ECSN 4.702

Abstract: This presentation will discuss two equalizers. The first one is an adaptive finite impulse response (FIR) equalizer with continuous-time wide-bandwidth delay line in CMOS 0.25- m process for 2.5-Gb/s to 3.5-Gb/s data communications. To achieve wide bandwidth, fractionally spaced structure is used and an inverter with active-inductor load design is used as the delay cell of the tap delay line. Close loop adaptation of the fractionally spaced FIR equalizer is demonstrated using a low-power and area-efficient pulse extraction method as on-chip error detector. The equalizer achieves over 75% horizontal eye opening when the channel loss at the half-data-rate frequency varies from 4 dB to 21 dB at 2.5-Gb/s data rate. At 3.5-Gb/s data rate, the equalizer achieves 68% horizontal eye opening when the channel loss is about 9.3 dB at the half-data-rate frequency. The second one is a 10Gbps continuous-time FIR receiver equalizer design with a ¼ symbol-period differential self-biased active inductor delay line in 0.12μm CMOS for wired line data communications. The delay line, together with an active inductor Cherry-Hooper transimpedance load at the FIR filter summing node, increases the equalizer speed, while reducing the equalizer power consumption to only 18Mw. The equalizer can compensate for 15dB channel loss at 5GHz for 10Gbps data transmission.

PhD Advisor: Dr. Jin Liu
Spatial Filtering of RF Interference in Radio Astronomy Systems

Muhammet Emin Yanik
April 4, 2017 | 2:00 pm | ECSN 4.728

Abstract: Radio astronomy synthesis imaging array antennas are designed to be extremely sensitive to detect faint emissions from astronomical sources. Unfortunately, celestial objects on the sky are not the only sources that can emit radio waves received by the sensitive telescope antennas. Satellites, radars, TV and radio stations, and many other sources emit waves that disturb astronomical observation. All such signals are called Radio Frequency Interference (RFI). At this presentation, signal processing data model in radio astronomy where array signal processing contributes is considered. Then spatial filtering techniques for RFI subtraction in radio astronomical observations are investigated. Finally, LoFASM Array is modelled in MATLAB environment, image formation and its relation to beamforming are discussed via simulations and real LoFASM data.

PhD Advisor: Dr. Murat Torlak
THANK YOU!

ERIK JONSSON
SCHOOL OF ENGINEERING & COMPUTER SCIENCE

FEARLESS® engineering

THE UNIVERSITY OF TEXAS AT DALLAS