Center for

Wireless and Microwave Information Systems

Department of Electrical Engineering
University of South Florida

Annual Report 2008

Center Director – Dr. Thomas Weller

Members: Dr. Huseyn Arslan, Dr. Charles Baylis, Dr. Lawrence Dunleavy, Dr. Jing Wang

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The Center for Wireless and Microwave Information Systems conducts research across a broad range of technical areas that include device modeling and characterization, RF microelectromechanical systems, advanced materials and nanoscale devices, active antennas, cognitive radio and next generation wireless architectures. Research projects focus on basic scientific development as well as applications such as biomedical sensing, communications, robotics and transportation. Active collaborations are pursued with multiple industry and university partners as well as several centers at the University of South Florida.

In 2007/08 the Center will support 35 MS and PhD students and 5-7 undergraduate students. Center faculty submitted 45 research proposals in the past year; of these 23 proposals were funded including 7 from government agencies. The WAMI faculty had more than 60 publications in journals, conferences and book chapters.

Newsworthy Notes

- Approximately ten years to the date since the first offering of the Wireless Circuits and Systems Design Laboratory (the “WAMI” Lab) the WAMI Center will launch “WAMI Lab 2.” The new course, entitled Wireless Communications Laboratory is being developed by Dr. Arslan and will be offered for the first time in Spring 2008. Support for the new course was provided through an education grant from the National Science Foundation (NSF), the University of South Florida (USF), and Agilent Technologies. Agilent provided a very generous equipment and software discount that allowed the NSF/USF support to be nearly tripled in value. The total value of the new instrumentation in this laboratory is over $500K, and will provide our students with a
unique opportunity to gain hands-on experience with truly state-of-the-art resources. In the past 10 years over 1,000 students have learned about wireless communications in the WAMI Lab, and we look forward to the great addition that WAMI Lab 2 brings to our educational program.

- The 11th annual WAMI Advisory Board meeting will be held on April 17-18, 2008. We look forward to another successful meeting, with a more than 30 expected attendees. Following the 2007 format, there will be a half-day Industry/University Wireless Forum on the second day of the event.

- The date is set for the 10th annual Wireless and Microwave Technology Conference. The conference will be held on Sand Key on April 20-21, 2009. Paper abstracts are due September 15, 2008.

- In 2007 the WAMI Advisory Board members contributed $65,000 to the WAMI Foundation Account, providing much needed discretionary funding to support various center activities. These funds are primarily used for equipment repair/replacement and faculty and student conference travel support. Contributors included Raytheon ($30K), ITT ($20K) and Harris ($15K).

- A new research thrust area of the WAMI Center has been launched, broadening the already existing interest in active device/circuit modeling and characterization to include investigation of active circuit design techniques. The newly formed RF Active Circuits and Measurements (RACAM) Research Group, under Dr. Charles Baylis, is performing research in areas related to the RF/microwave active circuit design cycle (design, modeling, and characterization techniques).

- In addition, Dr. Wang and his MEMS Transducers Research Group have been focusing on development of MEMS devices and technologies to reduce the sizes and enhance the performance of the RF passives as well as sensors and actuators. Dr. Wang’s group has recently purchased an Atomic Layer Deposition (ALD) tool and is currently in the process of setting it up. ALD is a chemical vapor deposition technique based on sequential self-terminating gas–solid reactions, thus enabling deposition of uniform, conformal, and pin-hole free inorganic material layers with well-controlled thickness down to the nanometer range. Such a process is crucial for both RF MEMS and RFIC’s.

- The Center has a new logo! Many thanks to Bill Graves (Trak Microwave) for his creative insight, and the design specialist that he assigned to turn his idea into a professional-looking graphic.

- In 2007 the Center began development of a new website. The new format will be more functional than the previous design and provide much easier access to information on the research and education aspects of the program. It will also feature an on-line reservation system for our instrumentation, making sure that students have as much time in the labs as possible!
Research Highlights – Current & Recent Projects


- **NIRT: Nanocrystalline Thin Film Diamond for MEMS and Biomedical Applications**, P.I. Ashok Kumar, Co-PIs: T. Weller, S. Bhansali, and I. Oleynik, Granting Agency: The National Science Foundation. Diamond thin films will be developed for use in high-power, high-reliability RF MEMS phase shifters.

- **Communication System and Network Design for Unmanned Systems: A Feasibility Study for Autonomous Underwater Vehicles**, Kimon Valavanis and Huseyin Arslan, Research and feasibility student for developing AUV and communication of the AUV with each other using underwater acoustic

- **Interference Cancellation and Avoidance for OFDM based Future Generation Wireless Cellular Communications Systems**, Huseyin Arslan, Understanding and handling various interference sources in 4-G cellular systems.

- **Introducing Advanced Signal Analysis tools to Spectrum Analyzers**, Huseyin Arslan, Enhancing the spectrum analyzer functionality significantly by introducing advanced time-frequency analysis.

- **Research and Development of Software Defined Radio Test-bed and Mobile WiMAX OFDMA Transceivers**, Huseyin Arslan, Research and development of software defined radio test-bed and using this platform for developing enhanced mobile WiMAX transceivers.

- **Ultra-wideband Channel Modeling for Disaster and Emergency Rescue**, Huseyin Arslan, Modeling ultra wideband communication channel in disaster environments.


The WAMI faculty continues to advance the educational opportunities provided to undergraduate and graduate students in USF’s Electrical Engineering Department. The Wireless Communications Laboratory, being developed by Dr. Arslan, will be offered for the first time in Spring 2008. A new course, Wireless Sensor Systems Design, is under development and will be offered for the first time in Fall 2008. The sensors course is a collaborative effort between USF (Dr. Weller) and Northern Arizona University, the University of Vermont and the University of Hawaii. Funding to develop both courses was obtained through competitive Course, Curriculum and Laboratory Improvement grants from The National Science Foundation. The curriculum summary shown in the figure below illustrates how these two new courses fit into the overall WAMI program.
Course Syllabus

Course No. & Title: EEL 4936/EEL 6936 Wireless Communication Systems Lab

Term & Meeting Info: Spring 2008

Instructor Info:
Dr. Hüseyin Arslan;
E-mail Address: arslan@eng.usf.edu
Office: ENB 361
Phone: (813) 974-3940
Office Hours: Tuesday-Thursday, 1:45 – 2:45 p.m.

Catalog Description:
An extensive hands-on introduction to digital communications and wireless communication systems; involving testing, modeling, simulation, and measurements of the performance of digital communication systems at both sub-system and complete system levels. Not available on an S/U basis.

Semesters Offered: Spring Each Year

Prerequisites: Introduction to Communication Systems or equivalent

Suggested Co-requisites: WAMI lab, DSP/FPGA labs, Personal & Mobile Communication, Advanced Topics on Wireless Communications.

Courses that require this course as a direct prerequisite: None

Level: Senior level undergraduate and graduate
Credits: 3 Class Duration: 1 Hour and 45 minutes lecture + 4 hours lab

Text Info: Instructor will provide the required documents.
You are not granted permission to sell notes or tapes of class lectures.

Reference (supplemental reading) Related reading material will be provided via web postings and handouts.

Wireless Communications Lab syllabus
!! New Course Announcement !!

**EEL 4935 WIRELESS SENSOR NETWORK DESIGN**

**1ST OFFERING FALL 2008**

This is a new senior-level elective being developed and taught collaboratively by multiple universities. The course will focus on system-level perspectives of real-world, wireless sensor networks. Preparation for the capstone senior design project is emphasized. There is one 1-hour in-class lecture each week, and students are also expected to review two hours of on-line material each week.

**Credit Hours:** 3  
**Pre-Requisites:** EEL 4471 – Electromagnetics  
Web-based Tutorial Modules (contact instructor)

**Contact:** Dr. Tom Weller, weller@eng.usf.edu  
**Web Site:** www.tbd.123

- **Course Topics**
  - Sensors/Transducers
  - A/D Conversion
  - Wireless Interface
  - Digital Communications
  - Networks
  - Embedded Computing

- **Course Features**
  - Web-based Lectures
  - Team Presentations
  - Case Studies
  - Snr. Project Preparation
  - University Collaboration
  - Introductory Tutorials
Professional Activities

- **2008 Radio and Wireless Symposium** – This conference was held in Orlando in January 2008 as a joint-event with the Wireless and Microwave Technology Conference (WAMIcon). Several regular members of the WAMIcon Steering Committee, including WAMI faculty members, participating in conference organization.

- **Microwave and Wireless Technology Conference 2009** – The 10th annual conference will be held April 20-21, 2009 in Sand Key, Florida. The WAMI Center faculty continues to play a key role in organizing this IEEE MTT-sponsored event. However, there is now a strong supporting cast of outside participants that are helping to make this conference a mainstay among the annual international microwave conferences.

- **WAMI 2008 Advisory Board Meeting** – The 11th meeting of the WAMI Center’s External Advisory Board will be held in April 2008. Approximately 30 attendees are expected, representing more than 20 companies, universities and government agencies.

- **2014 International Microwave Symposium** – Drs. Dunleavy and Weller are chair and co-chair, respectively, for the IEEE MTT Society’s flagship conference that will be held in Tampa in 2014. While the event is still several years away, planning is already in progress!
Recent Publications – 2007


57. H. Arslan, "Teaching SDR through a laboratory based course with modern measurement and test instruments," Accepted for publication in 2007 SDR Forum Technical Conference, Denver, CO.


