Song-Wen Huang

Contact Information

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Objective

Assistant Professor.

Available

Dec. 2017.

Research Interests

RF wireless and underwater acoustic communications, and signal processing, specifically in chirp spread spectrum (802.15.4a) and orthogonal waveform design in both single carrier and multicarrier architectures. Communication systems transceiver design, including higher order symbol modulation and demodulation, low-complexity channel estimation, and optimal coherent and non-coherent symbol detection. Moreover, orthogonal chirp waveforms are utilized in multicarrier chirp-division multiplexing (MCDM) systems and performance is evaluated in simulations, USRP-based software-defined radio in-house built modems.

Teaching Interests

Undergraduate and graduate courses and laboratories in principles of modern digital communications, communication systems, signals and systems, MIMO, smart antennas, circuit analysis, HDL based digital design with programmable logic, chirp spread spectrum in RF and underwater acoustic communications.

Education

State University of New York at Buffalo Aug. 2014 - Dec. 2017.
Ph.D. in Electrical Engineering
Dissertation: "Multicarrier Chirp-Division Multiplexing for RF and Underwater Acoustic Communications"
Advisor: Dr. Dimitris A. Pados. GPA: 3.92/4.00

National Chiao Tung University Sep. 2009 - Jul. 2011.
M.S. in Electronics Engineering
Thesis: "Coalitional Game Theoretic Power Control and Time Allocation in Cooperative Cognitive Radio Networks"
Thesis Advisor: Dr. Feng-Tsun Chien.

National Chiao Tung University Sep. 2005 - Jun. 2009.
B.S. in Electronics Engineering
Project: "Early Termination for 3GPP-LTE Turbo Code Using EXIT Chart"
Project Advisor: Dr. Hsie-Chia Chang.

Work Experiences

Research Assistant at State University of New York at Buffalo Aug. 2014 - present.

- Designed mmWave beamforming antenna arrays for 5G, capable of adjusting phases of incident signals to the desired reflective angles and eliminated potential interferences. Moreover, amplitude of reflective signals is enhanced by the weighted coefficients of the antenna array.
- Developed DSP algorithm in simulations for transceiver design of various modulations. Implemented circuit design with in-house built prototypes with PCB boards, including customized mixers, oscillators, filters as well as dipole antennas. Receiver design consists commercial software-defined radio antenna compatible with the PC, so received signals can be observed, stored, or further processed.
- Utilized orthogonal chirp waveforms as frequency subcarriers in multicarrier communication systems, e.g., OFDM, that have both advantages of chirps and multicarrier transmission.

Multicarrier chirping is also compatible with higher order modulations, e.g., 8-PSK, 16-QAM, for providing higher data rates in RF fading channels.

- Simulated and experimented a 2×2 MIMO system. With channel state information obtained by training symbols, precoding matrix is applied at the transmitter for BER and SNR performance enhancement in underwater acoustic multipath channels in Lake Erie experiments.
- Developed iterative joint channel estimation and data detection algorithm for blind symbol detection in spread spectrum underwater acoustic communication systems. The algorithm is guaranteed to converge after sufficient iterations.
- Designed ultra-wideband nano-transceivers on graphene, which can support waveform propagation on the surface. Communications conduct in Terahertz frequencies and can be applied in biomedical applications, such as intra-body sensor networks.

Teaching Assistant at State University of New York at Buffalo Aug. 2014 - Dec. 2017.

- EE 202 Circuit Analysis (Course work): Fall 2014, Fall 2015, and Fall 2017. (Size of class: 300)
- EE 205 Signals and Systems (Course work): Spring 2015. (Size of class: 200)
- EE 383 Communications Systems I (Course work & Project): Spring 2016, and Spring 2017. (Size of class: 100)
- EE 478 HDL Based Digital Design with Programmable Logic (Course work & Laboratory): Fall 2016. (Size of class: 100)

Senior Engineer at Macronix International Co., Ltd., Taiwan Feb. 2013 - May 2014.

- Designed DRAM circuits and collaborated with other R&D teams. Since memory elements are integrated in large numbers; speed, latency, and power consumption are the key design factors. Based on customers' requirements, customized NVM-based memory circuit design.
- Maintained Design Rule Checking (DRC) files for IC manufacturing process in 65 nm. Debugged the obscure descriptions that may result in design errors for clearly defining DRC rules for layout engineers.
- Modified and customized layout patterns by pre-sizing command files for specific design modifications, e.g. 65nm $\times$ 2μm of Metal 1, to reduce time consuming for 80% and to keep the product cycle on track.
- Automated generation of Question & Answer (QA) patterns for verifying DRC rules. During the process, some description errors in DRC rules were discovered and reported to the corresponding teams.

Research Assistant at National Chiao Tung University, Taiwan Sept. 2009 - Jul. 2011.

- Designed digital IC for various kinds of 64 bits multiplier-adders with CAD tools. Implemented with verilog, VHDL, RTL schematic, and layouts' verification. Conducted comparison of process time and power consumption between various designs of multiplier-adders.
- Conducted projects of simulation studies of QPSK and 16-QAM modulations with C/C++. Analyzed the iterative soft decoding of 3GPP Turbo Code by EXIT chart and Monte Carlo simulation for performance evaluation.
- Modeled cooperative cognitive radio networks with resource allocation, e.g., time allocation and power control. Formulated the problem objective as an optimization problem and solved by a coalitional game, in which all the PUs and SUs join a grand coalition to form a cooperative communication network.
- Utilized digital image processing techniques with C/C++ implementations to identify specific objects, e.g., human figures, for security or object identification. It can be also applied in color modification or softness for image enhancement.

Honors and Awards

2nd Place, for Erie Hack All-region Finals, proposed underwater sensor networks for real-time early warning of harmful algal blooms, awarded by Cleveland Water Alliance in May 2017.

Teaching Assistantship, awarded by State University of New York at Buffalo for tuition waiver and stipends for financial assistance of pursuit of Ph.D. degree from Aug. 2014 to Dec. 2017.

Rank 11th, for undergraduate score in the class of Electronics Engineering at National Chiao Tung University in Jun. 2009.

Patent

1 patent is under review.

Publications

Peered-reviewed Journals

2 **S.-W. Huang**, and D. A. Pados,"Adaptive Multiuser Chirp-Division Multiplexing for Underwater Acoustic Communications," *in preparation.*

1 **S.-W. Huang**, and D. A. Pados,"M-ary Orthogonal Chirp Modulation for Coherent and Non-coherent Underwater Acoustic Communications," *in preparation.*

Conferences

3 **S.-W. Huang**, and D. A. Pados,"Multicarrier Chirp-Division Multiplexing for Wireless Communications," *submitted for publication.*

2 **S.-W. Huang**, G. Sklivanitis, D. A. Pados, and S. N. Batalama,"Underwater Acoustic Communications Using Quasi-Orthogonal Chirps," to appear in *Asilomar Conference on Signals, Systems, and Computers*, Oct. 2017.

1 **S.-W. Huang**, Y.-W. Chan, F.-T. Chien and Y.-C. Chung, "Efficient Resource Allocation in Cooperative Cognitive Radio Networks: A Coalitional Game Approach," in *IET International Communication Conference on Wireless Mobile and Computing (CCWMC)*, Nov. 2011.

Services and Activities

- Technical Paper Reviewer for IEEE WCNC, International Conference on Network of the Future
- Member of IEEE Communications, Signal Processing, Power & Energy Societies
- Senator of Taiwanese Graduate Student Association at State University of New York at Buffalo
- Lecturer of Heart Chan Meditation Class at State University of New York at Buffalo
- Director of General Affairs of Student Association of EE at National Chiao Tung University
- President of Chan Meditation Club at National Chiao Tung University
- Executive Secretary of Global Youth Leadership Summit
- Chief Coordinator of Chan Meditation Retreat
- Volunteer of World Leadership Education Foundation in Taiwan