Song-Wen Huang

Contact Information

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Technical Skills

DSP, mmWave, WiGig, 802.11ad, MIMO, OFDMA, RF IC Design, FPGA
C, C++, Python, Linux, MATLAB, Verilog, VHDL, USRP, GNU Radio, SPICE
Wireless Communication, DSP Algorithm, Channel Modeling, Chirp Spread Spectrum
Resource Allocation, Optimization, Software-Defined Radio, Cognitive Radio

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

Algorithms and Signal Processing Engineer at Velodyne LiDAR, Inc. Jan. 2018 - present.

- Built LiDAR sensor modeling and simulation toolkit
- Developed low-power and efficient algorithm for sensing
- Applied machine learning in sensor algorithm

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

- Developed DSP algorithm in simulations for communication systems of various digital modulations. Implemented circuit design with in-house built prototypes with FPGA and 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.
- Designed mmWave beamforming antenna arrays for WiGig (802.11ad) at 60 Hz, 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.
- 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.

- Reviewed lecturing concepts, such as circuit analysis, signals and systems, communication systems, VHDL digital design, for students in recitation classes.
- Responsible for office hours for clarifying students' doubts for lectures or homework.
- Developed problems for homework or exams for examining students' studies.

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.

Mandatory Military Services at Taiwanese Army, Taiwan Oct. 2011 - Oct. 2012.

- Laid guns for tank artillery, and maintained artillery systems of tanks.

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

2$^{\text{nd}}$ Place, for Erie Hack All-region Finals, ExtremeComms Lab proposed underwater sensor distributed 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 11$^{\text{th}}$, for undergraduate score in the class of Electronics Engineering at National Chiao Tung University in Jun. 2009.

Patent

1 U.S. patent is in preparation.

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," *in preparation.*

2 **S.-W. Huang**, G. Sklivanitis, D. A. Pados, and S. N. Batalama,"Underwater Acoustic Communications Using Quasi-Orthogonal Chirps," 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 2018, IEEE SSP 2018, NoF 2017
- 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