

SENHUA HUANG

Google voice: 530-231-0722

Email: senhua@ece.ucdavis.edu

Web: <http://www.ece.ucdavis.edu/~senhua>

Research Interests

Wireless communications and networks, Distributed computing, and Optimization

Education

University of California at Davis, Ph. D. (2010) in Electrical Engineering (Minor: Mathematics) GPA:4.0/4.0

Dissertation topic: Non-intrusive dynamic spectrum access in cognitive radio networks

Advisors: Zhi Ding and Xin Liu

University of Science and Technology of China (USTC), Master of Engineering (Jul. 2006) in Communications and Information System, GPA: 90/100.

Master thesis: Research on multi-antenna downlink multiuser multiplexing methods

Advisor: Ling Qiu

University of Science and Technology of China (USTC), Bachelor of Engineering (Jul. 2003) in Electrical Engineering

Awards

- Block Grant Fellowship, University of California at Davis, 2009 spring, 2010 winter
- NSF Travel Grant for INFOCOM 2008
- Graduate Student Travel Award, University of California at Davis, 2007
- Summer Graduate Research Award, University of California at Davis, 2007, 2008, 2009
- OGS fellowship, University of California at Davis, 2006 fall/2007 spring
- Guanghua Education Scholarship, USTC, 2003-2004
- Outstanding Student Leader, USTC, 2000-2001
- Outstanding Student Scholarship, USTC, 1999-2002

Professional Services

Reviewer for IEEE Trans. on Wireless Communications, IEEE Trans. on Signal Processing, IEEE Trans. on Mobile Computing, IEEE Trans. on Vehicular Technology, Physical Communication, and several international conferences on communications (GLOBECOM, WCNC, PIMRC and etc.), TPC of ICC Cognitive Radio and Networks Symposium 2010.

Publications

- P1. **S. Huang**, X. Liu, , and Z. Ding, "Decentralized Cognitive Radio Control based on Inference from Primary Link Control Information," *accepted by JSAC Special Issue on Advances in Cognitive Radio Networking and Communications*.
- P2. **S. Huang**, X. Liu, and Z. Ding, "Distributed Power Control for Cognitive User Access based on Primary Link Control Feedback," *to appear at IEEE INFOCOM, 2010, San Diego, USA*.
- P3. **S. Huang**, X. Liu, and Z. Ding, "Optimal transmission strategies for dynamic spectrum access in cognitive radio networks," *in IEEE Trans. on Mobile Computing*, vol. 8, no. 12, pp. 1636-1648, December 2009.
- P4. **S. Huang**, X. Liu, and Z. Ding, "Optimal sensing-transmission structure for dynamic spectrum access," *in Proc. IEEE INFOCOM*, pp. 2295-2303, April 2009, Brazil.
- P5. **S. Huang**, X. Liu, and Z. Ding, "Opportunistic spectrum access in cognitive radio networks," *in Proc. IEEE*

INFOCOM, pp. 1427-1435, April 2008, USA.

- P6. **S. Huang**, Z. Ding, and X. Liu, "Non-intrusive cognitive radio networks based on smart antenna technology," in *Proc. IEEE GLOBECOM*, pp. 4862-4867, November 2007, USA.
- P7. F. E. Lapicciarella, **S. Huang**, X. Liu, and Z. Ding, "Feedback-based access and power control for distributed multiuser cognitive networks," *UCSD ITA workshop*, Feb. 2009.
- P8. **S. Huang**, X. Liu, and Z. Ding, "On Optimal Sensing and Transmission Strategies for Dynamic Spectrum Access," *Short Paper, IEEE DySPAN*, October 2008, USA.
- P9. **S. Huang**, L. Qiu, and S. Lin, "Zero-forcing beamforming with receiver antenna selection in downlink multi-antenna multi-user system," in *Journal of Systems Engineering and Electronics*, vol. 19, no. 6, pp. 1258-1263, December 2008.
- P10. **S. Huang** and L. Qiu, "Improving the multiuser diversity with beamforming codebook in multiple antenna systems," in *China Journal of Electronics*, vol. 16, no. 1, pp. 182-186, 2007.
- P11. **S. Huang**, L. Qiu, and J. Zhu, "The effect of channel estimation error on the throughput of zero-forcing beamforming," in *Journal of Applied Science*, vol. 24, no. 5, pp. 441- 446, 2006.
- P12. **S. Huang** and L. Qiu, "A novel receiver aided beamforming technique," in *Proc. IEEE PIMRC*, vol. 4, pp. 2447-2451, 2005, German.

Talks

- "Non-intrusive opportunistic spectrum access for cognitive radio networks," Special seminar, ECE colloquium, University of Connecticut, September 18, 2009
- "Non-intrusive opportunistic spectrum access for cognitive radio networks," Network research seminar, University of California at Davis, August 18, 2009
- "Distributed power control for cognitive user access based on primary link outage feedback," Graduate student presentation, Industrial Affiliates Conference, department of Electrical and Computer Engineering, University of California at Davis, January 29, 2010

Research and Professional Experience

Software Engineer, Cisco System, Inc.

07/2010~present

- Cloud computing infrastructure, Data center switching software

Intern, DOCOMO USA Labs, Palo Alto, CA

10/2009 ~ 01/2010

- Designed laboratory experiments to collect body movement data using both of a tri-axis accelerometer and gyroscope; proposed a walking detection algorithm that uses a unique feature of walking to locate different phases of each walking step (gait analysis) and estimate the number of steps walked accurately; learned the usage of Hadoop, a cloud computing platform.

Research Assistant, University of California at Davis

08/2006 ~ 06/2010

- Characterized the fundamental limits of opportunistic spectrum access schemes for secondary users in cognitive radio networks under the protection constraints from the primary user of the spectrum; and quantified the trade-off between the secondary user's spectral efficiency and the primary user's QoS guarantee.
- Proposed various PHY/MAC schemes for secondary users to approach the performance limits by exploiting different levels of cognition on the radio environment:
 - Three random access schemes that can be utilized in scenarios where the idle (inactive) time of the primary user follows exponential distribution [P5].
 - An optimal threshold-based spectrum access scheme with general primary user's traffic patterns and a distributed access algorithm for multiple independent secondary users without complete knowledge about the primary user's traffic pattern [P3].
 - A cognitive beamforming scheme for secondary users with antenna arrays [P6].

- An optimal sensing-transmission structure that generalizes static and periodic frame structures for listen-before-talk spectrum access strategy and exploits the acknowledgment information from the secondary receiver to achieve a better awareness of the primary user's busy/idle status [P4 and P8].
- Distributed power control schemes for multiple secondary users by exploiting the feedback control channel in typical two-way primary user systems [P2, P7, and P1].
- Analyzed the performance and properties of the above proposed schemes using probability theory, stochastic programming, convex optimization, and stochastic approximation theories.

Research Assistant, Personal Communication Networks Lab, USTC 06/2002 ~ 07/2006

- Presented a hybrid multiple access scheme exploiting the multiuser diversity gains in spatial, time, and frequency domain for the 4th generation cellular systems at China Communication Standards Association Annual conference 2006.
- Proposed a random beamforming scheme with multiple precoding matrices for MIMO downlink channels in cellular systems [P10 and P12]. The proposed scheme can increase the probability of having multiple orthogonal channels especially when the number of users in the system is small and achieve larger throughput than schemes using a single matrix. Proposed a zero-forcing beamforming scheme with receiver antenna selection [P9] and analyzed its performance loss under imperfect channel information [P11].
- Implemented the PHY layer of the uplink subsystem for HSDPA user equipment (UE) prototype with FPGA, DSP, and MPC860 from scratch in a cooperative project with UTStarcom. The designed system successfully communicated with a commercial HSDPA base station.

Filed Patents

1. "A Receiver-aided Beamforming Technique," with L. Qiu, Chinese Patent Application Serial No. 200510038596.1.
2. "A Downlink Multiuser Technique Combining Receiver Antenna Selection and Zero-forcing Beamforming," with L. Qiu and Y. Liu, Chinese Patent Application Serial No. 200610039439.0.
3. "A Low Complexity Zero-forcing Beamforming Technique with Partial Feedback," with L. Qiu and Y. Liu, Chinese Patent Application Serial No. 200610039440.3.

Teaching Experience

- Teaching assistant at UC Davis, spring 2007 Course name: Engineering Problem Solving
Supervised a lab session per week; Graded students' Matlab assignments and exams.
- Teaching assistant at UC Davis, winter 2007 Course name: Electronic Circuits and Systems
Supervised a lab session per week; Graded students' lab reports and exams.
- Teaching assistant at USTC, fall 2004 Course name: Elements of Information Theory
Held an office hour session per week; Graded students' homework and exams.

Relevant Graduate Courses

- Communications
Information Network, Networks, Multi-Access Communications Theory, Digital Communications, Wireless Communications, Error Correcting Codes I/II, Signal Processing for Communication, Signal Estimation & Detection, CDMA Communications, Wireless Communication Principles and Applications, Higher Order Spectral Analysis,
- Mathematics
Game Theory, Graph Theory, Random Signals & Noise, Numerical Optimization