Dr. Ahmed K. Sadek

EDUCATION

University of Maryland, College Park

- Ph.D. in Electrical and Computer Engineering, **GPA = 4.0/4.0**, May 2007
  Thesis title: "Cross-Layer Design for Cooperative Communications and Networking"
- M.Sc. in Electrical and Computer Engineering, **GPA = 4.0/4.0**, 2006

Alexandria University, Egypt

- M.Sc. in Electrical Engineering, **GPA = 4.0/4.0**, 2003
  Thesis title: "Modern Techniques for Blind Equalization of High Data Rate Digital Communication Systems"
- B.Sc. in Electrical Engineering (Communications and Electrophysics Section), 2000. (**Ranked** $1^{st}/266$), cumulative grade " **Distinction With Honor** (93.97%)"
  Graduation Project: "Modern Signal Processing Techniques for Future Mobile Communications"

HONORS AND AWARDS

- ◇ **Distinguished Dissertation Fellowship**, University of Maryland, the Electrical and Computer Engineering Department, 2007.
- ◇ **Graduate School Fellowship**, University of Maryland, 2003–2005
- ◇ **Goldhaber Travel Grant**, University of Maryland, 2006
- ◇ **First Prize** in IEEE Egypt Section Undergraduate Student Contest, 2000
- ◇ **Certificate of Merit, First Class Honors**, Alexandria University, Egypt, 1996–2000

RESEARCH INTERESTS

- ◇ **Cognitive Networks and Opportunistic Spectrum Sharing** The unprecedented success and growth of wireless applications have led to limited available spectrum for future wireless technologies. Meanwhile, studies by the Federal Communications Commission (FCC) have shown that part of the licensed spectrum is under utilized. Cognitive radios have emerged as a potential technology to intelligently utilize the under utilized spectrum without causing significant interference to the licensed users. Research conducted in this new field includes
  - Developing optimal spectrum sharing protocols to enable the coexistence of heterogeneous networks. This is an important problem because there will be several networks trying to share the spectrum, and these networks will be potentially designed according to different specifications.
  - Developing techniques for interference mitigation and cancelation. Cognitive wireless systems will need such techniques for efficient utilization of the spectrum, and at the same time achieving robustness against interference from other networks.
  - Evaluate those techniques by developing simulations modeling the networks with and without the techniques utilized
  - Summarize the effectiveness of the proposed techniques.
- ◇ **Cooperative and Relay Wireless Networks**
  - Introduced novel cognitive multiple access protocols for wireless networks via relays. This work demonstrates that enabling cooperation during unused channel resources (cognitive feature) can achieve high performance gains in terms of network throughput capacity and delay performance

- Cooperative sensor networks. Taking into account the hardware constraints of sensor nodes, this work investigates when one should enable cooperative communications in sensor networks
- Studied optimal power allocation for multinode cooperative networks
- Designed distributed relay-assignment algorithms for wireless networks
- Investigated the impact of cooperation on throughput and delay in wireless networks
- Developed cooperative communications protocols for multiuser OFDM networks

◇ **MIMO-OFDM Wireless Systems**

- Characterized the maximum achievable diversity in MIMO-OFDM systems with arbitrary temporal and spatial correlation
- Investigated diversity achieving space-frequency and space-time-frequency codes for MIMO-OFDM systems
- Designed new beamforming techniques that take into account partial feedback information at the transmitter side

◇ **Statistical Signal Processing**

- Developed blind equalization algorithms for bandwidth efficient digital transmission that employ high-order QAM modulation, where a training sequence is not feasible or not desirable. The algorithms were tested on cable TV channels, digital microwave radio channels, and digital satellite video broadcasting (DVB-S) channels
- Developed higher-order statistics based techniques for modulation classification and covert detection in non-cooperative scenarios

Research Grants and Proposals

◇ Contributed to writing a proposal on "Cognitive Multiple Access" (with PI K. J. Ray Liu), funded by the Army Research Lab (ARL) CTA program, $65,000, Jan 2007-Jan 2008

◇ Participated in developing grant proposals and white papers for various government agencies

Research Experience

◇ **Corporate Research and Development, Qualcomm Incorporated**
Senior Engineer, May 2007–Present
San Diego, CA

◇ **University of Maryland**, College Park
Graduate Research Assistant, September 2003–May 2007
Department of Electrical and Computer Engineering, and Institute for Systems Research

◇ **Alexandria University**, Egypt
Graduate Research Assistant, September 2000–June 2003
Departemt of Electrical Engineering

Teaching Experience

◇ **University of Maryland**, College Park

- Teaching Assistant, September 2006–May 2007
Graduate Courses: Estimation and Detection Theory, Random Processes in Communications and Control
- Graduate Mentor, Summer 2006. Supervised undergraduate students in the Maryland Engineering Research Internship Teams (MERIT) program

◇ **Alexandria University**, Egypt

· Teaching Assistant, September 2000–June 2003
Undergraduate Courses: Digital Communications, Advanced Communication Systems, Electromagnetic Theory, Electronic Circuits

Publications

Books

1. K. J. R. Liu, **A. K. Sadek**, W. Su, and A. Kwasinski, *Cooperative Communications and Networking*, Cambridge University Press, 2008.

Book Chapters

1. **A. K. Sadek**, W. Su, and K. J. R. Liu, *Cooperative Sensor Communications*, Handbook on Array Processing and Sensor Networks, Wiley, in preparation.

Journal Publication

1. **A. K. Sadek**, W. Su, and K. J. R. Liu, "Diversity analysis for frequency-selective MIMO-OFDM systems with arbitrary spatial and temporal correlation", *IEEE Transactions on Communications*, vol. 54, no. 5, pp. 878-888, May 2006.
2. **A. K. Sadek**, W. Su, and K. J. R. Liu, "Multi-node cooperative communications in wireless networks", *IEEE Transactions on Signal Processing*, vol. 55, no. 1, pp. 341 - 355 , Jan. 2007.
3. K. Seddik, **A. K. Sadek**, W. Su, and K. J. R. Liu, "Outage analysis and optimal power allocation for multi-node amplify-and-forward relay networks," *IEEE Signal Processing Letters*, vol. 14, pp. 377-380, June 2007.
4. **A. K. Sadek**, K. J. R. Liu, and A. Ephremides, "Cognitive multiple-access via cooperation: Protocol design and performance analysis," *IEEE Transactions on Information Theory, Special Issue on Models, Theory, and Codes for Relaying and Cooperation in Communication Networks*, vol 53, no 10, pp.3677-3696, Oct 2007.
5. **A. K. Sadek**, Weifeng Su, and K. J. R. Liu, "Transmit beamforming design for space-frequency coded MIMO-OFDM systems with spatial correlation feedback," to appear, *IEEE Transactions on Communications.*
6. K.G. Seddik, **A.K. Sadek**, A.S. Ibrahim, and K.J.R. Liu, "Design Criteria and Performance Analysis for Distributed Space-Time Coding", to appear, *IEEE Trans. on Vehicular Technology.*
7. W. Su, **A. K. Sadek**, and K. J. R. Liu, "Cooperative communications in wireless networks: Performance analysis and optimum power allocation," to appear, *Wireless Personal Communications.*
8. W.P. Siriwongpairat, **A.K. Sadek**, and K.J.R. Liu, "Cooperative Communications Protocol for Multiuser OFDM Networks", to appear, *IEEE Trans. on Wireless Communications.*
9. A. Ibrahim, **A. K. Sadek**, W. Su, and K. J. R. Liu, "Multi-node cooperative communications with relay-selection: When to cooperate and whom to cooperate with?", to appear*IEEE Transactions on Wireless Communications.*

In Revision or Submitted

10. **A. K. Sadek**, Z. Han, and K. J. R. Liu, " Distributed relay-assignment protocols for coverage expansion in cooperative wireless networks", submitted to *IEEE Transactions on Wireless Communications.*

11. **A. K. Sadek**, W. Yu, and K. J. R. Liu, "On the energy efficiency of cooperative communications in wireless sensor networks", submitted to *ACM Transactions on Sensor Networks*.

Conference Publication

1. A. El-Sherif, **A. K. Sadek**, A. Kwasinski, and K.J.R. Liu, "Content-Aware Cooperative Multiple Access Protocol for Packet Speech Communications", *Proc. IEEE Globecom*, Washington DC, 2007.
2. K. Seddik, **A. K. Sadek**, A. Ibrahim, and K.J.R. Liu, "Synchronization-Aware Distributed Space-Time Codes in Wireless Relay Networks", *Proc. IEEE Globecom*, Washington DC, 2007
3. **A. K. Sadek**, W. Yu, and K. J. R. Liu, "Does cooperation have better performance in sensor networks?", in *Proceedings IEEE conference on Sensor, Mesh and Ad Hoc Communications and Networks (SECON)*, Reston, VA, 2006.
4. **A. K. Sadek**, K. J. R. Liu, and A. Ephremides, "Collaborative multiple-access protocols for wireless networks: Protocol design and stability analysis," in *Proceedings IEEE Conference on Information Sciences and Systems (CISS)*, Princeton, NJ, 2006.
5. **A. K. Sadek**, Z. Han, and K. J. R. Liu, "A distributed relay-assignment algorithm for cooperative communications in wireless networks", in *Proceedings IEEE International Conference on Communications (ICC)*, Istanbul, Turkey, 2006.
6. **A. K. Sadek**, Z. Han, and K. J. R. Liu, "An efficient cooperation protocol to extend coverage area in cellular networks", in *Proceedings IEEE Wireless Communications and Networking Conference (WCNC)*, Las Vegas, NV, 2006.
7. K. Seddik, **A. K. Sadek**, W. Su, and K. J. R. Liu, " Outage analysis for multi-node amplify and-forward relay networks," in *Proceedings IEEE Wireless Communications and Networking Conference (WCNC)*, Las Vegas, NV, 2006.
8. K. Seddik, **A. K. Sadek**, and K. J. R. Liu, "Protocol-aware design criteria and performance analysis for distributed space-time coding" in *Proceedings IEEE Global Telecommunications Conference (Globecom)*, San Francisco, CA, 2006.
9. W. P. Siriwongpairat , **A. K. Sadek**, and K. J. R. Liu, "Bandwidth-efficient cooperative protocol for OFDM wireless networks," in *Proceedings IEEE Global Telecommunications Conference (Globecom)*, San Francisco, CA, 2006.
10. **A. K. Sadek**, W. Su, and K.J.R. Liu, "Clustered cooperative communications in wireless networks", in *Proceedings IEEE Global Telecommunications Conference (Globecom)*, San Louis, Nov, 2005.
11. **A. K. Sadek**, Z. Han, and K.J.R. Liu, "Multi-node cooperative resource allocation to improve coverage area in wireless networks", in *Proceedings IEEE Global Telecommunications Conference (Globecom)*, San Louis, Nov, 2005.
12. A. Ibrahim, **A. K. Sadek**, W. Su, and K.J.R. Liu, "Cooperative communications with channel state information: When to cooperate?", in *Proceedings IEEE Global Telecommunications Conference (Globecom)* , San Louis, Nov, 2005.
13. **A. K. Sadek**, W. Su, and K.J.R. Liu, "A class of cooperative communication protocols for multi-node wireless networks", in *Proceedings IEEE International Workshop on Signal Processing Advances in Wireless Communications (SPAWC)*, New York, June 2005.
14. **A. K. Sadek**, W. Su, and K.J.R. Liu, "Eigen-selection approach for joint beamforming and space-frequency coding in MIMO-OFDM systems with spatial correlation feedback", in *Proceedings IEEE International Workshop on Signal Processing Advances in Wireless Communications (SPAWC)*, New York, June 2005.

15. **A. K. Sadek**, W. Su, and K.J.R. Liu, "Performance analysis for multi-node decode-and-forward relaying in collaborative wireless networks", in *Proceedings IEEE International Conference on Acoustic, Speech, and Signal Processing (ICASSP)*, Philadelphia, March 2005.
16. W. Su, **A. K. Sadek**, and K. J. R. Liu, "SER performance analysis and optimum power allocation for decode-and-forward cooperation protocol in wireless networks", in *Proceedings IEEE Wireless Communications and Networking Conference (WCNC)*, New Orleans, March 2005.
17. **A. K. Sadek**, W. Su, and K. J. R. Liu, "Maximum achievable diversity for arbitrary spatially correlated MIMO-OFDM systems", in *Proceedings IEEE Global Telecommunications Conference (Globecom)*, Dallas, Dec 2004.
18. S. E. El-Khamy and **A. K. Sadek**, "Space-time EVA blind equalization for high data rate wireless communications," in *Proceedings IEEE International Symposium on Antennas and Propagation*, California, June 2004.
19. S. E. El-Khamy, S. E. Shaaban, and **A. K. Sadek**, "A modified EVA/DD algorithm for the equalization of non-constant modulus signals based on eigen-analysis of cross-cumulants", in *Proceedings of the Twentieth National Radio Science Conference*, Cairo, Egypt, March 2003.

Presentations & Talks

◇ **Information Theory and Applications (ITA) Workshop, UCSD, Feb 2007**
Invited talk to present PhD research work. *Selected speakers for this event are among the best graduating students and postdoctoral fellows in the Information Theory and Applications area worldwide.*
Topic "Cognitive Cooperative Communications in Wireless Networks."

Professional Activities

◇ **Technical Program Committee**

· Member of Technical Program Committee for the MIMO Systems Symposium, International Wireless Communications and Mobile Computing Conference (IWCMC) 2007.

· Member of the Technical Program Committee for IEEE Wireless Communications and Networking Conference (WCNC) 2008

◇ **Technical Reviewer for International Journals**

· IEEE Transactions on Signal Processing

· IEEE Journal on Selected Areas in Communications (JSAC)

· IEEE Communications Surveys and Tutorials

· IEE Proceedings on Communications

◇ **Technical Reviewer for International Conferences**

· IEEE Global Telecommunications Conference (Globecom)

· IEEE International Conference on Communications (ICC)

· IEEE Wireless Communications and Networking Conference (WCNC)

· IEEE International Workshop on Signal Processing Advances in Wireless Communications (SPAWC)

· International Symposium on Personal Indoor and Mobile Radio Communications (PIMRC)