

# Timothy X Brown

May 14, 2017

Dept. of Engineering and Public Policy  
Dept. of Electrical and Computer Engineering  
Carnegie Mellon University,  
Pittsburgh, PA 15213 Kigali, Rwanda  
720-318-5189 +250 787 674 062  
timxb@cmu.edu

- EDUCATION — **Ph.D. in Electrical Engineering** 1991  
California Institute of Technology, Pasadena  
Thesis: Neural Network Design for Switching Network Control  
Advisor: Dr. E. C. Posner
- **M.S. in Electrical Engineering** 1987  
California Institute of Technology, Pasadena
- **B.S. in Physics** 1986  
Pennsylvania State University, University Park

RESEARCH AND TEACHING AREAS — Wireless networking. Subject areas include; cognitive radios, cybersecurity, stochastic geometry, and unmanned aircraft systems.

- HONORS AND AWARDS — 2013: Invited speaker at Ninth Workshop on Spatial Stochastic Models for Wireless Networks (SpaSWiN), Tsukuba Science City, Japan.
- 2012: Faculty Thesis Opponent (primary examiner), Linkoping University, Sweden.
- 2011: University of Colorado Champion of Education for International Students Award.
- 2008: IEEE-SA Standards Board appreciation award.
- 2007: University of Colorado Provost Faculty Achievement Award.
- 2005–2006: National Research Council Committee on Using Information Technology to Enhance Disaster Management.
- 2003: Global Wireless Education Consortium’s (GWEC) Educator of the Year Award.
- 2001: Keynote speaker at the SPIE Conf. on Internet Performance and Control of Network Systems II, Denver.
- 2000: Faculty Thesis Opponent (primary examiner), University of Uppsala, Sweden.
- 1999: Invited speaker at the SPIE Conf. on Applications and Science of Neural Networks, Fuzzy Systems, and Evolutionary Computation, Denver.
- 1998: University of Colorado Junior Faculty Development Award.
- 1997: Invited Tutorial at the Fifth IFIP Workshop on Performance Modeling & Evaluation of ATM Networks, Ilkley, U.K..
- 1996–2000: National Science Foundation Faculty CAREER Development Award.
- 1996: Keynote Speaker at the Swedish Neural Network Society Annual Meeting, Stockholm.
- 1982–1985: J. & E. Teas Scholarships in Physics.
- 1981: Excused from attending final year of high school.
- 1981: Eagle Scout.

- EXPERIENCE — **Distinguished Service Professor:** Carnegie Mellon University, Rwanda 2013+
- Helped to start new CMU location in Kigali, Rwanda serving as Associate Director for Academics. Oversees all academic programs and course offerings. Recruited for the campus throughout Africa. Helped to raise \$11M in funding to support program. Taught classes in Information Technology. Studied spectrum, energy, and unmanned aircraft issues in developing countries.
- **Professor:** University of Colorado, Boulder 2009+
- Research focuses on challenged wireless networks. Developed analytic results for the performance of randomly deployed radio systems. Developed efficient learning methods to control node mobility to improve network performance. Advised FAA and RTCA on unmanned aircraft communication. Currently on leave at Carnegie Mellon University.
- **Director:** Interdisciplinary Telecommunications Program, CU, Boulder 2008–2012
- Managed a 140 student and 20 faculty/instructor graduate program in engineering. Created and gained approvals for new Ph.D. in Telecommunications as well as three new certificates and a concurrent BS/MS degree with Electrical Engineering. Started \$2M Department of Energy funded Digital Energy Program to provide graduate training in smart energy grids.
- **Associate Professor:** University of Colorado, Boulder 2002–2009
- Contributed harmful interference models to the public debate on dynamic spectrum access. Built and instrumented a large outdoor wireless test bed for networks of radios in ground and air vehicles. Fielded novel delay tolerant networking protocols with support for simple sensors. Exposed denial of service vulnerabilities in several classes of wireless networks. Designed and implemented energy-aware and quality-of-service aware ad hoc routing protocols. Committee member for numerous workshops and conferences in my field. Taught wireless networks, probability and random processes, digital filters, and software defined radios.
- **Assistant Professor:** University of Colorado, Boulder 1995–2002
- Researched machine learning applied to communication systems. Developed random cellular network design and analysis tools. Studied quality of service mechanisms in packet networks. Explored packet switching architectures. Taught courses on wireless and cellular communication, communication theory, networking, and pattern recognition. Created a new masters capstone option. Developed web-labs that let students control lab equipment over the web.
- **Member Technical Staff:** Bell Communications Research, Morristown 1992–1995
- Worked in neural network design group. Developed interfaces and novel algorithms to control hardware neural networks. Patented a nonlinear adaptive equalizer implementation. Developed robust adaptive ATM access control methods. Studied learning under rare events. Designed a wireless mobility management strategy.
- **Member Technical Staff:** Jet Propulsion Laboratory, Pasadena 1990–1992
- Worked in a neural network hardware group. Started a research program to study learning methods for analog neural network hardware culminating in a space-based experiment. Optimized neural network learning algorithm to quickly configure a hardware neural networks. Developed hardware neural network learning system.
- **Graduate Research Assistant:** California Institute of Technology 1986–1990

Developed neural network techniques for solving constraint satisfaction problems which are provably stable, and satisfy all constraints. Explored role of massively parallel neural networks in communications. Applied neural network methods to control algorithms for circuit and packet switches. Designed a PCS paging method. Supervised an EE laboratory class.

—**Summer Researcher:** Bell Communications Research, Red Bank, NJ 1988

Studied the effect of non-optimal base station placement and frequency assignment on PCS performance.

—**Undergraduate Research Assistant:** Department of Physics, Penn State 1983–86

Studied the physisorption of nitrogen gas on a graphite substrate under Moses Chan. Designed and built an apparatus to measure the number of atomic layers deposited on graphite.

- PATENTS
1. A. N. Mody, T. X Brown, “Method for Collaborative Discrimination Between Authentic and Spurious Signals in a Wireless Cognitive Network,” US patent 8,670,721 B2, March 11, 2014.
  2. J. R. Modes, D., T. X Brown, D. E. Epel, “Systems, Methods and Devices for Area-Based Localization,” US patent 7,551,083, June 23, 2009.
  3. A. Jayakumar, T. X Brown, and J. Alspector, “A Low-Power Adaptive Non-Linear Equalizer Structure,” US patent 5,504,780, April 2, 1996.

BOOK CHAPTERS

1. T. X Brown, D. C. Sicker, “Spectrum Sharing Vulnerability and Threat Assessment,” in J. D. Matyjask, S. Kumar, F. Hu, eds., *Spectrum Sharing in Wireless Networks: Fairness, Efficiency, and Security*, CRC Press, Apr. 2016.

*students are* 2. M. Saint, J. Hoyos, T. X Brown, “Securing Power Systems,” in A.-S. Khan Pathan, ed.,  
*underlined* *Securing Cyber-Physical Systems*, CRC Press, Oct. 2015, (27 pages)

3. T. X Brown, J. M. Peha, “Policy-Based Radios,” in E. Pietrosemoli, M. Zennaro eds., *TV White Spaces: A Pragmatic Approach*, ICTP, Dec. 2013, pp. 51–66. (16 pages)

4. T. X Brown, M. McHenry, S. Jaroonvanichkul, “Cognitive Radio Architectures for Unmanned Aircraft Systems,” in K. P. Valavanis, G. J. Vachtsevanos, eds., *Handbook of Unmanned Aerial Vehicles*, Springer, 2013. (32 pages)

5. T. Brown, B. Argrow, E. Frew, C. Dixon, D. Henkel, J. Elston, H. Gates “Experiments Using Small Unmanned Aircraft to Augment a Mobile Ad Hoc Network,” in B. Bing ed. *Emerging Technologies in Wireless LANs: Theory, Design, and Deployment*, pp. 695–718, 2008 (24 pages)

6. T. X Brown, “How can anyone afford mobile wireless mass media content?,” in J. Groebel, E. Noam, V. Feldmann ed. *Mass media content for mobile wireless communication*, pp. 3–19. Erlbaum, 2006. (17 pages)

7. T. X Brown, “Adaptive Statistical Multiplexing for Broadband Communications,” in ed. Kouvatsos, D. *Performance Evaluation and Application of ATM Networks*, Kluwer, 2000, pp. 51–79. (29 pages)

8. T. X Brown, “Neural Networks for Switching,” in *Neural Networks in Telecommunications*, eds. B. Yuh, et al. Kluwer, Boston, 1994. pp. 11–36. (26 pages)

EDITED BOOKS

1. R. R. Rao, Y. Arens, A. Botterell, T. X Brown, J. R. Harrald, R. Howard, N. Jesuale, D. Kehrlin, W. Maheu, R. R. Murphy, R. Neches, M. Shinozuka, P. Steenkiste, G. Wiederhold, ed. J. Eisenberg, T. Schmitt, *Improving Disaster Management: The Role of IT in Mitigation, Preparedness, Response, and Recovery*, National Academies Press. 2007. 176 p.

2. R. R. Rao, Y. Arens, A. Botterell, T. X Brown, J. R. Harrald, R. Howard, N. Jesuale, D. Kehrlein, W. Maheu, R. R. Murphy, R. Neches, M. Shinozuka, P. Steenkiste, G. Wiederhold, ed. J. Eisenberg, T. Schmitt, *Summary of a Workshop on Using Information Technology to Enhance Disaster Management*, National Academies Press, 2005. 39 p.
3. J. W. Allen, T. X Brown, D. C. Sicker, and J. Ratzloff, eds. *Proc. of the International Symposium on Advanced Radio Technologies*, NTIA Special Publication SP-04-409, Springfield, VA, 2004. 135 p.
4. J. W. Allen, T. X Brown, eds. *Proc. of the International Symposium on Advanced Radio Technologies*, NTIA Special Publication SP-03-401, Springfield, VA, 2003. 125 p.
5. J. Alspector, R. Goodman, and T. X Brown, eds. *Proc. of IWANNT3*, Erlbaum, Hillsdale, NJ, 1997. 292 p.
6. J. Alspector, R. Goodman, and T. X Brown, eds. *Proc. of IWANNT2*, Erlbaum, Hillsdale, NJ, 1995. 373 p.
7. J. Alspector, R. Goodman, and T. X Brown, eds. *Proc. of the International Workshop on Applications of Neural Networks to Telecommunications (IWANNT)*, Erlbaum, Hillsdale NJ, 1993. 310 p.

- REFEREED  
JOURNAL  
PUBLICATIONS
1. H. Mauwa, A. Bagula, M. Zennaro, E. Pietrosevoli, A. Lysko, T. X Brown “Analysis of Geo-Location and Spectrum Sensing as Access Methods to TV White Space,” *Journal of ICT Standardization*, v. 4, n. 1, 2017. pp. 147–176, 28p.
  2. P. Madhusudhanan, J. G. Restrepo, Y. Liu, T. X Brown, “Analysis of Downlink Connectivity Models in a Heterogeneous Cellular Network via Stochastic Geometry,” *IEEE T. on Wireless Communication*, v. 15, n. 6, Jun. 2016. pp. 3895–3907, 13p.
  3. P. Madhusudhanan, J. G. Restrepo, Y. Liu, T. X Brown, K. Baker, “Downlink Performance Analysis for a Generalized Shotgun Cellular System,” *IEEE T. on Wireless Communication*, v. 13, n. 11, Dec. 2014. pp. 6684–6696, 13p.
  4. P. Madhusudhanan, Y. Liu, T. X Brown, “On Primary User Coverage Probabilities and Faulty Cognitive Radios,” *IEEE T. on Wireless Communication*, v. 13, n. 11, Nov. 2014. pp. 6207–6218, 12p.
  5. P. Madhusudhanan, J. G. Restrepo, Y. Liu, T. X Brown, K. Baker, “Stochastic Ordering based Carrier-to-Interference Ratio Analysis for the Shotgun Cellular Systems,” *IEEE Wireless Communications Letters*, v. 1, n. 6, Dec. 2012. pp. 565–568, 4 p.
  6. B. Pearre, T. X Brown, “Model-Free Trajectory Optimisation for Unmanned Aircraft Serving as Data Ferries for Widespread Sensors,” *Remote Sensing*. 2012; v. 4, n. 10, pp. 2971–3005, 35 p.
  7. M. Heusse, G. Urvoy-Keller, T. X Brown, A. Duda, “Least Attained Recent Service for Packet Scheduling over Access Links,” *Pervasive and Mobile Computing*, v. 7, n. 4, Aug. 2011. pp. 479–494, 16 p.
  8. M. Heusse, S. Merritt, T. X Brown, A. Duda. “Two-way TCP connections: old problem, new insight,” *ACM SIGCOMM Comput. Commun. Rev.*, v. 41, n. 2, Apr. 2011, pp. 5–15, 11 p.
  9. H. Romero, K. Remley, D. Williams, C.-M. Wang, T. X Brown, “Identifying RF Identification Cards From Measurements of Resonance and Carrier Harmonics,” *IEEE T. on Microwave Theory and Techniques*, v. 58, n. 7, part 1, Jul. 2010. pp. 1758–65, 8 p.
  10. E. W. Frew, T. X Brown, “Networking Issues for Small Unmanned Aircraft Systems,” *Journal of Intelligent and Robotic Systems*, v. 54, n. 1–3 Mar. 2009, 17 p.

11. E. Frew, T. X Brown, "Airborne Communication Networks for Small Unmanned Aircraft Systems," *IEEE Proceedings*, v. 96 n. 12, Dec. 2008, pp. 2008–27, 20 p. (invited paper)
12. T. X Brown, A. Sethi, "Potential Cognitive Radio Denial-of-Service Vulnerabilities and Protection Countermeasures: a Multi-dimensional Analysis and Assessment," *Journal Mobile Networks and Applications*, v. 13, n. 5, October 2008, pp. 516–532, 17 p.
13. E. W. Frew, C. Dixon, J. Elston, B. Argrow, and T. X Brown. "Networked Communication, Command, and Control of an Unmanned Aircraft System," *AIAA Journal of Aerospace Computing, Information, and Communication*, v. 5, n. 4, April 2008, pp. 84–107, 24 p.
14. T. X Brown, D. C. Sicker, "Examining the Viability of Broadband Wireless Access under Alternative Licensing Models in the TV Broadcast Bands," *EURASIP Journal on Wireless Communications and Networking*, vol. 2008, Article ID 470571, Jan. 2008. 12 p.
15. Q. Wang, T. X Brown, "Public Safety and Commercial Spectrum Sharing via Network Pricing and Admission Control," *IEEE J. on Selected Areas in Communication*, v. 25, n. 25, April 2007, pp. 622–632, 11 p.
16. T. X Brown, "A Harmful Interference Model for Unlicensed Device Operation in Licensed Service Bands," *J. of Communications*, v. 1, n. 1, April 2006. pp. 13–25.
17. T. X Brown, H. Gabow, "Future Information in Input Queueing," *Computer Networks*, v. 42, n. 4, 15 July 2003, pp. 441–460.
18. H. Tong, T. X Brown, "Reinforcement Learning for Call Admission Control and Routing under Quality of Service Constraints in Multimedia Networks," *Machine Learning*, v. 49, n. 2/3, Nov./Dec. 2002, pp. 111–140.
19. S. Doshi, S. Bhandare, T. X Brown, "An On-demand Minimum Energy Routing Protocol for a Wireless Ad Hoc Network," *Mobile Computing and Communications Review*, v./ 6, n. 3, July 2002, pp. 50–66.
20. T. X Brown, "Cellular Performance Bounds via Shotgun Cellular Systems," *IEEE JSAC*, v. 18, n. 11, 2000, pp. 2443–2455.
21. H. Tong, T. X Brown, "Adaptive Call Admission Control under Quality of Service Constraints: a Reinforcement Learning Solution," *IEEE JSAC*, v. 18, n. 2, pp. 209–221, 2000.
22. T. X Brown, "A High Performance Two-Stage Packet Switch Architecture," *IEEE T. on Comm.*, v. 47, n. 12, pp. 1792–1795, 1999.
23. T. X Brown, S. Mohan, "Mobility Management for Personal Communications Systems," *IEEE Trans. on Veh. Tech.* v. 46 n. 2, pp. 269–278, 1997.
24. S. P. Eberhardt, R. Tawel, T. X Brown, T. Daud, A.P. Thakoor, "Analog VLSI Neural Networks: Implementation Issues and Examples in Optimization and Supervised Learning," *IEEE T. on Industrial Electronics*, v. 39, n. 6, pp. 552–564, 1992.
25. T. X Brown, M. D. Tran, T. Duong, T. Daud and A. P. Thakoor, "Cascaded VLSI Neural Network Chips: Hardware Learning for Pattern Recognition and Classification," *Simulation*, v. 58, n. 5, pp. 340–347, 1992.
26. S. P. Eberhardt, T. Daud, T. X Brown, and A. P. Thakoor, "Competitive Neural Architecture for Hardware Solution to the Assignment Problem," *Neural Networks*, v. 4, n. 4, pp. 431–442. 1991.
27. Y. N. Doganata, T. X Brown, and E. C. Posner, "Call Setup Strategy Tradeoffs for Universal Digital Portable Communications," *Computer Networks and ISDN-Systems*, North Holland, v. 20, pp. 455–464, 1990.
28. T. X Brown and K. H. Liu, "Neural Network Design of a Banyan Network Controller," *IEEE J. of Selected Areas in Comm.*, v. 8, n. 8, pp. 1428–1438, 1990.

29. T. X Brown, "Neural Networks for Switching," *IEEE Comm. Mag.* v. 27, n. 11 pp. 72–81, 1989.
30. A. E. Attard, T. X Brown, "Experimental Observations of Trapping Levels in BSO," *Applied Optics*, v. 25, n. 18, pp. 3253–3259. 1986.

REFEREED  
CONFERENCE  
PUBLICATIONS

1. T. X Brown, P. Madhusudhanan, "Fading in base station selection and evaluation," *Workshop on Spatial Stochastic Models for Wireless Networks (SpaSWiN)*, Tempe, AZ, May 2016.
2. D. T. Bennett, T. X Brown, "Simple Receding Horizon Approach to Scheduling Mobile Wireless Clients with Uncertainty," *Proc. IEEE Wireless Communications and Networking Conference (WCNC)*, New Orleans, Mar. 10, 2015. (6 pages) 45% acceptance rate
3. T. X Brown, E. Pietrosemoli, M. Zennaro, A. Bagula, H. Mauwa, S. M. Nleya, "A survey of TV white space measurements," *Proc. Sixth Int. Conf. on e-Infrastructure and e-Services for Developing Countries (Africomm)*. Kampala, Uganda, Nov. 24, 2014. (9 pages)
4. P. Madhusudhanan, J. G. Restrepo, Y. Liu, T. X Brown, "Downlink analysis for a heterogeneous cellular network," *Proc. Tenth Workshop on Spatial Stochastic Models for Wireless Networks (SpaSWiN)*, Hammamet, Tunisia, May 16, 2014. (8 pages, invited paper)
5. T. X Brown, "Policy-Based Radios for Spectrum Sharing," *IST-Africa Conference and Exhibition (IST-Africa)*, Nairobi, May 30 2013, (9 pages).
6. S. Brown, M. Saint, T. X Brown, "Study of SMS Air Interface Delay in the Presence of Strong and Weak Signals," *IST-Africa Conference and Exhibition (IST-Africa)*, Nairobi, May 29, 2013, (12 pages).
7. P. Madhusudhanan, Xing Li, Youjian Liu, T. X Brown, "Stochastic geometric modeling and interference analysis for massive MIMO systems," in *Proc. of 11th Inter. Symp. on Modeling and Optimization in Mobile, Ad Hoc and Wireless Networks (WiOpt)*, 2013 pp. 15–22, Tsukuba, Japan May 12, 2013. (8 pages, invited paper)
8. M. Stachura, J. Elston, E.W. Frew, B. Argrow, T. X. Brown, C. Dixon, "Multi-UAS Testbed for Wireless Communication Experiments," in *Proc. of IEEE International Conference on Robotics and Automation (ICRA)*, Karlsruhe, May 8, 2013. (4 pages)
9. T. X Brown, S. Jaroovanichkul, "Policy-based radios for UAS operations," *Proc. IEEE Third International Workshop on Wireless Networking for Unmanned Autonomous Vehicles: Architectures, Protocols and Applications*, (Wi-UAV) Anaheim, CA, Dec. 7 2012. (6 pages)
10. P. Madhusudhanan, J. Restrepo, Y. Liu, T. X Brown, "Downlink Coverage Analysis in a Heterogeneous Cellular Network," *Proc. IEEE Global Communications Conf. (Globecom)*, Anaheim, CA Dec, 3-7 2012. (6 pages, 38% acceptance rate)
11. B. Pearre, T. X Brown, "Energy conservation in sensor network data ferrying: a reinforcement metalearning approach," *Proc. IEEE Global Communications Conf. (Globecom)*, Anaheim, CA, Dec. 3-7 2012. (7 pages, 38% acceptance rate)
12. P. Madhusudhanan, T. X Brown, Y. Liu, "OFDMA cellular network with fractional frequency reuse under maximum SIR connectivity," *Proc. IEEE International Workshop on Emerging Technologies for LTE-Advanced and Beyond-4G (B4G)*, Anaheim, CA Dec. 3 2012. (6 pages)
13. J. Hoyos, M. Dehus, T. X Brown, "Exploiting the GOOSE protocol: A practical attack on cyber-infrastructure," *Proc. IEEE Workshop on Smart Grid Communications: Design for Performance (SGComm)*, Anaheim, CA, Dec. 3 2012. (6 pages)
14. P. Madhusudhanan, J. Restrepo, Y. Liu, T. X Brown, "Heterogeneous Cellular Network Performance Analysis under Open and Closed Access," *Proc. IEEE The 4th IEEE International Workshop on Heterogeneous and Small Cell Networks (HetSNets)*, Anaheim, CA Dec. 3 2012. (6 pages)

15. D. Bennett, T. X Brown, "Optimal Data Scheduling of Mobile Clients Serviced using Beamforming Antennas," *Proc. IEEE Military Communications Conference (MilCom)*, Orlando, Nov. 1, 2012. (10 pages)
16. B. Pearre, T. X Brown, "Self-monitoring Reinforcement Metalearning for Energy Conservation in Data-ferried Sensor Networks," *Proc. The Sixth International Conference on Sensor Technologies and Applications (SensorComm)*, Aug. 19-24, Rome 2012. (10 pages)
17. D. Bennett, T. Brown, "Wireless Data Scheduling of Clients Serviced using UAV Mounted Beamforming Antennas," *Proc. AIAA Infotech Aerospace Conf.* Garden Grove, California, 19-21 June 2012. (16 pages)
18. P. Madhusudhanan, T. X Brown, Y. Liu, "Interference characteristics and success probability at the primary user in a cognitive radio network," *Proc. Eighth Workshop on Spatial Stochastic Models for Wireless Networks (SpaSWiN)*, Paderborn, Germany, May 14, 2012. (6 pages)
19. T. X Brown, N. M. Balasubramanya, "Dynamic Outage, Availability, and Interference Models for Mobile Cognitive Radios," *Proc. IEEE Global Communications Conf. (Globecom)*, Houston, TX, Dec. 6-8, 2011. (6 pages, 37% acceptance rate)
20. P. Madhusudhanan, J. Restrepo, Y. Liu, T. X Brown, K. Baker, "Multi-tier Network Performance Analysis using a Shotgun Cellular System," *Proc. IEEE Global Communications Conf. (Globecom)*, Houston, TX, Dec. 6-8, 2011. (6 pages, 37% acceptance rate)
21. P. Madhusudhanan, T. X Brown, Y. Liu, "On the Interference to Multiple Low Power Primary Users from Cooperative Cognitive Radios," *Proc. 49th Annual Allerton Conference on Communication, Control, and Computing*, Sep. 28-30, 2011. (8 pages)
- 22+ B. Pearre, T. X Brown, "Fast, Scalable, Model-free Trajectory Optimization for Wireless Data Ferries," *IEEE International Conference on Computer Communication Networks (ICCCN 11)*, Maui, Hawaii, Jul. 31-Aug. 4, 2011. (8 pages, 29% acceptance rate)
23. B. Pearre, T. X Brown, "Model-free Trajectory Optimization for Wireless Data Ferries among Multiple Sources," *IEEE Globecom 2010 Workshop on Wireless Networking for Unmanned Aerial Vehicles*, Miami, FL, Dec 6, 2010. (6 pages)
24. P. Madhusudhanan, J. Restrepo, E. Liu, T. X Brown, K. Baker, "Modeling of Interference from Cooperative Cognitive Radios for Low Power Primary Users" *Proc. IEEE Global Communications Conf. (Globecom)*, Miami, FL, Dec. 7, 2010. (6 pages)
25. V. Vora, T. X Brown, "High Rate Video Streaming over 802.11n in Dense Wi-Fi Environments," *IEEE LCN Workshop on Network Measurements (WNM)*, Denver, October 11, 2010. (8 pages)
26. A. Carfang, E. Frew, T. X Brown, "Improved Delay-Tolerant Communication by Considering Radio Propagation in Planning Data Ferry Navigation," *AIAA Guidance, Navigation, and Control Conference*, Toronto, August 2010 (14 pages)
- 27+ M. Heusse, G. Urvoy-Keller, A. Duda and T. X Brown, "Least Attained Recent Service for Packet Scheduling over Wireless LANs," *World of Wireless, Mobile and Multimedia Networks (WoWMoM)*, Montreal, June 14-17, 2010. (9 pages, 28% acceptance rate)
28. T. X Brown, D. Sicker, "Secure Distribution of Spectrum Policies to Cognitive Radios in Unmanned Aircraft Systems," *Proc. AIAA Infotech Aerospace Conf.*, Atlanta, Apr. 20-22, 2010
29. P. Madhusudhanan, J. G. Restrepo, Y. E. Liu, T. X Brown, "Carrier to Interference Ratio Analysis for the Shotgun Cellular System," *Proc. of IEEE Global Communications Conf. (GLOBECOM)*, Honolulu, HI, Nov. 30, 2009. (6 pages, 35% acceptance rate)

top tier conferences  
are marked with a +

30. A. N. Mody, R. Reddy, T. Kiernan, T. X Brown, "Security in Cognitive Radio Networks: An Example Using the Commercial IEEE 802.22 Standard," *Proc. Military Communications Conf.* (MILCOM), Boston, Oct. 19, 2009. (6 pages)
- 31+S. Maru, T. X Brown, "Packet Classification in co-mingled traffic streams," *Proc. of Workshop on Secure Network Protocols (NPsec)*, Princeton, Oct. 13, 2009. (6 pages, 30% acceptance rate)
32. S. Maru, T. X Brown, "Denial of Service Vulnerabilities in the 802.16 Protocol," *Proc. of the Wireless Internet Conference (WICON)*, Maui, HI, Nov. 17–19, 2008. (9 pages)
- 33+A. Sethi, T. X Brown, "Hammer Model Threat Assessment of Cognitive Radio Denial of Service Attacks," *IEEE Dynamic Spectrum Access Networks (DySPAN)*, Chicago, Oct. 14–17, 2008. (12 pages, 29% acceptance rate)
- 34+R. Dhillon, T. X Brown, "Models for Analyzing Cognitive Radio Interference to Wireless Microphones in TV Bands," *IEEE Dynamic Spectrum Access Networks (DySPAN)*, Chicago, Oct. 14–17, 2008. (12 pages, 29% acceptance rate, one of few plenary talks)
35. E. W. Frew, T. X Brown, "Airborne Communication Networks for Small Unmanned Aircraft Systems," *Proc. International Symposium on Unmanned Aerial Vehicles (UAV 08)*, Orlando, Jun. 23–25, 2008. (5 pages)
36. D. Henkel, T. X Brown, "Towards Autonomous Data Ferry Route Design through Reinforcement Learning," *Proc. Autonomic and Opportunistic Communications Workshop*, Newport Beach, Jun. 23, 2008, 6pp.(6 pages)
37. R. Dhillon, T. X Brown, "Modeling and Analysis of the Interference Potential of Cognitive Radio Devices to Wireless Microphones Operating in TV bands," *International Symposium on Advanced Radio Technologies (ISART)*, Boulder, Jun. 2–4, 2008. (10 pages)
38. D. Henkel, T. X Brown, "Delay-Tolerant Communication using Mobile Robotic Helper Nodes," *Proc. The First Workshop on Wireless Multihop Communications in Networked Robotics*, Berlin, Germany, Apr. 4, 2008. (10 pages)
39. Y. Zhang, T. X Brown, "Aisle Routing for Mobile Ad Hoc Networks," in *Proc. IEEE Wireless Communications and Networking Conference (WCNC)*, Las Vegas, Mar. 31–Apr. 3 2008 6pp. (6 pages)
40. A. Jenkins, D. Henkel, T. X Brown, "Reliable Data Collection in Challenged Networks using Unmanned Aircraft," in *Proc. ACM MobiCom workshop on Challenged Networks (CHANTS)*, Montreal, Aug. 17 2007. 3pp. (3 pages)
41. T. X Brown, A. Sethi, "Potential Cognitive Radio Denial-of-Service Vulnerabilities And Protection Countermeasures: A Multi-dimensional Analysis/Assessment," *Proc. Second Int. Conf. on Cognitive Radio Oriented Wireless Networks and Communications (CrownCom)*, Orlando, FL, Aug 1–3, 2007. 10pp. (10 pages)
42. D. Henkel, T. X Brown, "Route Design for UA-based Data Ferries in Delay Tolerant Wireless Networks", *Proc. AIAA Infotech Aerospace Conference*, May 7–10, 2007. 9pp. (9 pages)
43. A. Jenkins, D. Henkel, T. X Brown, "Sensor Data Collection through Unmanned Aircraft Gateways," *Proc. AIAA Infotech Aerospace Conference*, May 7–10, 2007. 8pp. (8 pages)
44. J. B. Bernthal, T. X Brown, D. N. Hatfield, D. C. Sicker, P. A. Tenhula, P. J. Weiser, "Trends and Precedents favoring Regulatory Embrace of Smart Radio Technologies," *IEEE Dynamic Spectrum Access Networks (DySPAN)*, Dublin, April 17–20, 2007 (16 pages)
45. T. X Brown, D. Sicker, "Can Cognitive Radio Support Broadband Wireless Access?," *IEEE Dynamic Spectrum Access Networks (DySPAN)*, Dublin, April 17–20, 2007 (10 pages)



46. D. Henkel, T. X Brown, "Optimizing the Use of Relays for Link Establishment in Wireless Networks," in *Proc. IEEE Wireless Communications and Networking Conference (WCNC)*, Hong Kong, March 2007. (6 pages)
47. A. Jenkins, D. Henkel, T. X Brown, "Sensor Data Collection Through Gateways in a Highly Mobile Mesh Network," in *Proc. IEEE Wireless Communications and Networking Conference (WCNC)*, Hong Kong, March 2007. (6 pages)
48. T. X Brown, A. Sethi, "Potential Cognitive Radio Denial-of-Service Vulnerabilities and Countermeasures," in *Proc. Int. Symposium on Advanced Radio Technologies (ISART)*, Boulder, Feb. 2007. (8 pages)
49. B. Hartzog, T. X Brown, "WiMax - Potential Commercial-Off-The-Shelf (COTS) Solution for Tactical Mobile Mesh Communications," in *Proc. Military Communications Conference (MILCOM)*, Washington, Oct. 23–25, 2006. (7 pages)
50. C. Dixon, D. Henkel, E. W. Frew, T. X Brown, "Phase Transitions for Controlled Mobility in Wireless Ad Hoc Networks," in *Proc. AIAA Conference on Guidance Navigation and Control*, Keystone, CO, Aug., 2006. p. 3346–3356. (11 pages)
51. D. Henkel, C. Dixon, J. Elston, T. X Brown, "A Reliable Sensor Data Collection Network Using Unmanned Aircraft," in *Proc. Second International Workshop on Multi-hop Ad Hoc Networks: from theory to reality (REALMAN)*, Florence, May 26, 2006. (3 pages, 21% acceptance rate)
- 52+ T. X Brown, J. E. James, A. Sethi, "Jamming and Sensing of Encrypted Wireless Ad Hoc Networks," in *Proc. Seventh ACM International Symposium on Mobile Ad Hoc Networking and Computing (MobiHoc)*, Florence, 22–25 May 2006. (12 pages, 10% acceptance rate)
53. E. W. Frew, T. X Brown, C. Dixon, D. Henkel, "Establishment and Maintenance of a Delay Tolerant Network through Decentralized Mobility Control," in *Proc. IEEE International Conference On Networking, Sensing and Control*, Ft Lauderdale, FL, Apr. 23–25, 2006. p. 584–9. (6 pages, invited paper)
54. Q. Wang, T. X Brown, "Pricing versus admission control in multi-class loss networks," in *Proc. 40th annual Conference on Information on Sciences and Systems*, Princeton, NJ, March, 2006. (6 pages)
55. T. X Brown, D. Henkel, "On Controlled Node Mobility in Delay-Tolerant Networks of Unmanned Aerial Vehicles," in *Proc. of International Symposium on Advanced Radio Technologies (ISART)*, Boulder, CO, March 7–9, 2006. (10 pages)
- 56+ T. X Brown, "An Analysis of Licensed Channel Avoidance Strategies for Unlicensed Devices," in *Proc. First IEEE Int. Symposium on New Frontiers in Dynamic Spectrum Access Networks (DySPAN)*, Baltimore, MD, Nov. 8–11, 2005. (19 pages, 25% acceptance rate)
57. E. W. Frew, C. Dixon, B. M. Argrow, T. X Brown, "Radio Source Localization by a Cooperating UAV Team," *Proc. AIAA Infotech@Aerospace Technical Conference*, Arlington, VA, Sept. 26–29, 2005. (11 pages, invited paper)
- 58+ S. Jadhav, T. X Brown, S. Doshi, D. Henkel, R.-G. Thekkekkunnel, "Lessons Learned Constructing A Wireless Ad Hoc Network Test Bed," in *Proc. of the Wireless Network Measurement Workshop*, Trentino, Italy, 3 Apr. 2005. (6 pages)
59. T. X Brown, S. Doshi, S. Jadhav, D. Henkel, R.-G. Thekkekkunnel, "A Full-Scale Wireless Ad Hoc Network Test Bed," in *Proc. of International Symposium on Advanced Radio Technologies*, Boulder, CO, March 1–3, 2005. (10 pages)
60. F.E. Barnes, E.F. Fuchs, J. Tietjen, J. Silvestein, H.-Y. Ko, T. Lookabaugh, T. X Brown, D.C. Sicker, "Integrated Utilities Engineering Management M.S. Program," in *Proc. of 2004 37th Annual Frontiers of Power Conference*, Oct. 25–26, Stillwater, OK.

61. T. X Brown, S. Doshi, S. Jadhav, J. Himmelstein, “Test Bed for a Wireless Network on Small UAVs,” in *Proc. AIAA 3rd “Unmanned Unlimited” Technical Conference*, Chicago, IL, 20–23 Sep 2004.
62. T. X Brown, B. Argrow, S. Doshi, R.-G. Thekkekkunnel, D. Henkel, “Ad Hoc UAV Ground Network (AUGNet),” in *Proc. AIAA 3rd “Unmanned Unlimited” Technical Conference*, Chicago, IL, 20–23 Sep 2004.
- 63+S. Bhandare, S. Doshi, S. Sanghani, T. X Brown, “Comparison of two wireless ad hoc routing protocols on a hardware test-bed,” in *Proc. Wireless Communication Networking Conference*, IEEE, 2003. (6 pages, acceptance rate 25%)
- 64+S. Sanghani, T. X Brown, S. Bhandare, S. Doshi, “Tabletop Emulation of Mobile Ad Hoc Wireless Networks,” in *Proc. Wireless Communication Networking Conference*, IEEE, 2003. (6 pages, acceptance rate 25%)
- 65+T. X Brown, “Switch Packet Arbitration via Queue Learning,” *Advances in Neural Information Processing Systems 14*, ed. T.G. Dietterich et al., MIT Press, 2002. (7 pages, acceptance rate 26%)
66. T. X Brown, H. N. Gabow, “A comparison of energy aware routing objectives in a wireless ad hoc network,” *Proc. 39th Annual Allerton Conference on Communication, Control, and Computing*, Oct. 3–5, 2001. pp. 791–792.
- 67+T. X Brown, H. N. Gabow, Q. Zhang, “Maximum Flow-Life Curve for a Wireless Ad Hoc Network,” *Proc. ACM Symposium on Mobile Ad Hoc Networking and Computing (MobiHoc)*, 2001, pp. 128–136. (9 pages, acceptance rate 28%)
68. T. X Brown, “Statistical Classification Based Admission Control,” Keynote address in *Proc. SPIE Conf. on Internet Performance and Control of Network Systems II*, ed. R. D. van der Mei, et al., 2001. v. 4523, pp. 1–14.
- 69+T. X Brown, “Direct Classification with Indirect Data,” *Advances in Neural Information Processing Systems, 13*, ed. T.K. Leen et al., MIT Press, 2001. pp. 381–387. (7 pages, acceptance rate 30%)
- 70+T. X Brown, “Low Power Wireless Communication via Reinforcement Learning,” *Advances in Neural Information Processing Systems, 12*, ed. S.A. Solla et al., MIT Press, 2000. pp. 893–899. (7 pages, acceptance rate 32%)
71. T. X Brown, “Dynamic Channel Assignment in Shotgun Cellular Systems,” in *Proc. IEEE Radio and Wireless Conference (RAWCON)*, 1999. pp. 147–150.
72. T. X Brown, H. Tong, “Adaptive resource allocation in telecommunications,” Invited paper in *Proc. SPIE Conf. on Applications and Science of Neural Networks, Fuzzy Systems, and Evolutionary Computation*, ed. B. Bosacchi, 1999. v. 3812, pp. 213–224.
73. H. Tong, T. X Brown, “Adaptive Call Admission Control under Quality of Service Constraints in Multimedia Networks,” in *Engineers Conference Notes Network+Interop 99*, Las Vegas, May 12–13, 1999.
- 74+T. X Brown, “Classifying Loss Rates in Broadband Networks,” in *Proc. IEEE Conf. on Computer Communications (INFOCOM)*, 1999, v. 1, pp. 361–370. (10 pages, acceptance rate 30%)
- 75+T. X Brown, H. Tong, S. Singh, “Optimizing admission control while ensuring quality of service in multimedia networks via reinforcement learning,” in *Advances in Neural Information Processing Systems 11*, ed. M. Kearns et al., MIT Press, 1999, pp. 982–988. (7 pages, acceptance rate 32%)

76. H. Tong, T. X Brown, "Estimating Loss Rates in an Integrated Services Network by Neural Networks," in *Proc. IEEE Global Telecommunications Conference (GLOBECOM)*, 1998. v. 1, pp. 19–24.
77. T. X Brown, "Analysis and Coloring of a Shotgun Cellular System," in *Proc. IEEE Radio and Wireless Conference (RAWCON)*, 1998. pp. 51–54.
78. T. X Brown, "A High-Performance Two-Stage ATM Switch," *Fifth IFIP Workshop on Performance Modeling & Evaluation of ATM Networks*, Ilkley, U.K., July, 1997. pp. 42/1–8.
79. T. X Brown, "Bandwidth Dimensioning for Data Traffic," in *Proc. IWANNT3*, ed. J. Alspector, et al., Erlbaum, 1997. pp. 88–96.
- 80+ T. X Brown, "Adaptive Access Control Applied to Ethernet Data," *Advances in Neural Information Processing Systems 9*, ed. M. C. Mozer et al., MIT Press, 1997. pp. 932–938. (7 pages, acceptance rate 30%)
81. T. X Brown, "Mobility Models for Personal Communications Systems," *Proc. IEEE Wireless Communications Conference*, Boulder, CO, Aug. 1996. pp. 114–116.
82. T. X Brown, "A Technique for Mapping Optimization Solutions into Hardware," in *Proc. IWANNT2*, ed. J. Alspector et al., Erlbaum, 1995. pp. 129–136.
83. T. X Brown, "Classifying Loss Rates with Small Samples," in *Proc. IWANNT2*, ed. J. Alspector, et al., Erlbaum, 1995. pp. 153–161.
84. R. Tawel, T. X Brown, "High-speed Analog Neuroprocessors for Event Tagging and Data Management," *Proc. Earth & Space Science Information Systems*, AIP Press, 1993, pp. 870.
85. T. X Brown, "Neural Networks for Adaptive Equalization," in *Proc. IWANNT*, ed. J. Alspector et al., Erlbaum, 1993, pp. 27–33.
86. T. Daud, S. P. Eberhardt, T. X Brown, M. Tran, A. P. Thakoor, M. Dzwoncyk, M. Busa, M. LeBlanc, T. Sims, "Neural Network Building-Block Chips for Classification and Detection Applications," *Proc. Neural Networks and their Applications. NEURO NIMES*, 1992, pp. 565–575.

PUBLISHED 1. T. X Brown, "Review of *Cellular Radio: Analog and Digital Systems*, A. Mehrotra, Artech  
REVIEWS House, Boston, 1994, 460 pp." in *IEEE Personal Communications Mag.*, Feb. 1996.

- OTHER PAPERS 1. T. X Brown, S. Kannel. "The Smart Grid's Impact on the Utility Workforce," *Electric Energy Magazine*, Issue 3, 2011, pp. 16–24.
2. S. K. Black, T. X Brown, "Comments of the University of Colorado Interdisciplinary Telecommunications Program," *In the Matter of Facilitating the Deployment of Text-to-911 and Framework for Next Generation 911 Deployment*, Federal Communications Commission, Dockets No. 11-153 and 10-255, Dec. 12, 2011. 17 p.
  3. H. S. Berger, K. R. Kontson, A. E. Leu, T. X Brown, F. Frantz, D. M. Parker, V. Prasad, D. Stewart, "IEEE Recommended Practice for the Analysis of In-Band and Adjacent Band Interference and Coexistence Between Radio Systems," *IEEE Standard*, P1900.2-2008, 29 July, 2008. 106 p.
  4. T. X Brown, "A Model for Analyzing Unlicensed Device Operation in Licensed Broadcast Service Bands," *In the Matter of Implementation and Administration of a Coupon Program for Digital-to-Analog Converter Boxes*, National Telecommunications and Information Administration, Docket No. 06051 21 29-61 29-01, Oct. 31, 2006. 7 p.

5. P. Kolodzy, A. Lippman, R. Broderson, T. X. Brown, M. A. Sirbu, D. G. Sweeney, J.H. Snider, M. Calabrese, H. Feld, A. J. Schwartzman, "Technical Reply Comments," *In the Matter of Unlicensed Operation in the TV Broadcast Bands*, Federal Communications Commission Docket No. 04-186 Jan. 29, 2005. 20 p.
6. T. X Brown, "Enabling and Evaluating Unlicensed Operation in the TV Broadcast Bands," reply comments *In the matter of Unlicensed Operation in the TV Broadcast Bands*, Federal Communications Commission Docket No. 04-186, Jan. 29, 2005. 17 p.
7. T. X Brown, G. Argrow, H. Gates, "Wireless Communication Test Bed Final Report," to L3-Comcept, Nov. 29, 2004. 192 p.
8. T. X Brown, J. Alspector, "Adaptive ATM Access Control," Bellcore Internal Memo, Oct. 1994.
9. T. X Brown, "A Three-Stage Switch Path-Finder," Bellcore Internal Memo, Oct. 1993.
10. T. X Brown, J. S. Judd, "Defining the Easy/Hard Learning Boundary," *NASA Tech Briefs*, NPO-19045 Jan. 1993.
11. T. X Brown, "Calculating Necessary Neuron Gains for Winner-Take-All Networks," *NASA Tech Briefs*, NPO-18640 Aug. 1991.

CONFERENCE  
PRESENTATIONS  
(UNPUBLISHED)

1. T. X Brown, V. Pahwa, *Estimating the Path Loss Exponent with no Position Information*, Simmons Conference on Networks and Stochastic Geometry Austin, TX, May 19, 2015.
2. T. X Brown, *Defining Spectrum Efficiency*, Innovation Africa Digital Summit, Banjul, The Gambia, March 27, 2014.
3. T. X Brown, *Unlocking Spectrum's Potential*, Innovation Africa Digital Summit, Addis Ababa, Ethiopia, March 21, 2013.
4. T. X Brown, "Digital Energy Program: Graduate Training in Smart Grids." *Department of Energy Workforce Training Workshop*, Annapolis, MD, Jun. 8, 2011.
5. T. X Brown, "UAS Technologies Panel: Communication Technologies," *AIAA Infotech@Aerospace Technical Conference*, St. Louis, MO, Mar. 31, 2011.
6. T. X Brown, "Smart Grids and ECE," *ECE Department Heads Association New Energy Technologies Panel*, Phoenix, AZ, Mar. 11, 2011.
7. T. X Brown, "Denial of Service Challenges in Wireless Networks," *Wisenet Nordic Darkness School*, Uppsala, Sweden, Nov. 9, 2010.
8. T. X Brown, "Atmospheric Sensing in Tornadoes with Unmanned Aircraft," *Wisenet Nordic Darkness School*, Uppsala, Sweden, Nov. 9, 2010.
9. T. X Brown, "University of Colorado Digital Energy Program: Graduate Study in Smart Grid Technology," *Edison Electric Institute, Transmission, Distribution, and Metering Conference*, Denver, Oct. 4, 2010.
10. T. X Brown, "Security Issues Related to Cognitive Radios and Dynamic Spectrum Access," invited lecture *International Symposium on Advanced Radio Technologies (ISART)*, Boulder, CO Jul. 27 2010
11. T. X Brown, "Smart Grid 101: Workforce Prospects," *Connectivity Week*, Santa Clara, CA, May 26, 2010.
12. T. X Brown, "Ad-hoc Communications Strategies," *GEOSS Workshop on Mitigation and Management of Disasters Through Communications*, Honolulu, Nov. 30, 2009.
13. T. X Brown, "Cognitive Radios for UAS Communication," *SAE Aerotech Conference*, Seattle, WA, Nov. 10, 2009.

14. T. X Brown, "Broadband Access and the Future of Wireless Technology," *Coalition for a Connected West panel on The Future of Wireless in Colorado*, Denver, CO, Oct. 7, 2008.
15. T. X Brown, "Modularity and Interoperability," *USAF Academic Outreach UAS Symposium*, Grand Forks, ND, Aug. 6, 2009.
16. T. X Brown, "Trends in Wireless Technology and Regulation," *11th Annual Telecommunications Law Conference*, Denver, Dec. 8, 2008.
17. T. X Brown, "Threat Assessment to Primary and Secondary Users in a Centralized Cognitive Radio Network," *IEEE P802.22 Wireless RANs Plenary Meeting*, Denver, July 17, 2008.
18. T. X Brown, "Radio Technologies for UAS Communication," *NSF/AUVS/FAA/DHS Workshop on UAS Research Directions for the National Air Space*, June 10, 2008.
19. T. X Brown, "Wireless Networking Performance Axis for Disaster Management," *Emergency Communications and Disaster Management Workshop*, Honolulu, HI, Jan. 13, 2008.
20. T. X Brown, "Wireless Networking for Disaster Management," *GEOSS Workshop on Advanced Communications and Networking Technologies for Disaster Management*, Honolulu, HI, Jan. 12, 2008.
21. T. X Brown, "The Role of Communication in UAS in the Next 10 Years," *First Community Symposium dedicated to Civilian Applications of Unmanned Aircraft Systems (CAUAS)*, Boulder, CO, Oct. 2, 2007.
22. T. X Brown, "Understanding Software Defined and Cognitive Radios," *Wireless Revolution Conference*, Boulder, CO, Sep. 7, 2006.
23. T. X Brown, D. Henkel, "Sensor Data Collection through a Delay-Tolerant MANET of Small Unmanned Aircraft," *6th Scandinavian Workshop on Wireless Ad-hoc Networks*, Stockholm, Sweden, May 4, 2006.
24. T. X Brown, "Ad Hoc Networks: A Technology Perspective," *Ad Hoc Networks for the Enterprise - Applications and Technologies*, Stockholm, Sweden, May 6, 2004.
25. T. X Brown, "The Ad Hoc UAV Network (AUGNet) Test Bed," *4th Scandinavian Workshop on Wireless Ad-hoc Networks*, Stockholm Sweden, May 4, 2004.
26. T. X Brown, "A Full-Scale Mobile Ad Hoc Network Test Bed," *International Symposium on Advanced Radio Technologies*, Boulder, CO, March 6, 2004.
27. T. X Brown, "Ad Hoc Network Communities: Why Should Anyone Join?," *3rd Scandinavian Workshop on Wireless Ad-hoc Networks*, Stockholm Sweden, May 6, 2003.
28. Ta Te Huang, T. X Brown, "Auctions vs. Beauty Contests: an Empirical Study," *International Symposium on Advanced Radio Technologies*, Boulder, CO, March 4, 2003.
29. S. Doshi, T. X Brown, "An On-demand Minimum Energy Routing Protocol for a Wireless Ad Hoc Network," *Symposium on Mobile Ad Hoc Networking and Computing*, Lausanne, Switzerland, June 10, 2002.
30. T. X Brown, "Requirements for Mobile Wireless Mass Media Content," *CITI Conference on Mass-Media Content for Wireless Mobile Communications*, Columbia U. New York, April 5, 2002.
31. T. X Brown, "Next Generation Wireless: Who Needs Base Stations?," *International Symposium on Advanced Radio Technologies*, Boulder, CO, March 5, 2002.
32. T. X Brown, "Ad Hoc Networks in the Wireless Jungle," Panel presentation at the *IEEE LANMAN Conference*, Boulder, CO, March 20, 2001.

33. T. X Brown, S. Doshi, Q. Zhang, "Optimal Power Aware Routing in Wireless Ad Hoc Networks," in *LANMAN 2001: 11th IEEE Workshop on Local and Metropolitan Area Networks (LANMAN)*, Boulder, CO, Mar. 20, 2001.
34. T. X Brown, "Evaluating Value Functions can be Arbitrarily Harder than Evaluating Policies," *Neural Information Processing Systems Workshop*, Breckenridge, CO, Dec. 2, 2000.
35. T. X Brown, "Network Level Impact of Mobile Radio Links," Tutorial at *RAWCON 2000*, Denver, CO, Sept. 11, 2000.
36. T. X Brown, "Wireless Distance Learning Labs with Real Lab Equipment," *Global Wireless Education Consortium Faculty Workshop*, Richardson, TX, Aug. 11, 2000.
37. T. X Brown, "Direct Classification with Indirect Data," *Machines that Learn*, Snowbird, Utah, April, 2000.
38. T. X Brown, "Reinforcement Learning for Admission Control," *Machines that Learn*, Snowbird, Utah, April, 1998.
39. T. X Brown, "Adaptive Statistical Multiplexing for Broadband Communications," Invited Tutorial *Fifth IFIP Workshop on Performance Modeling & Evaluation of ATM Networks*, Ilkley, U.K., July, 1997.
40. T. X Brown, "Jump Connectivity," *Neural Information Processing Systems Workshop*, Snowmass, CO, Dec, 1996.
41. T. X Brown, "Adaptive Access Control for ATM," Opening Talk *Swedish Neural Network Society Annual Meeting*, Stockholm, Sweden, Nov. 1996.
42. T. X Brown, "Simulating Noise in Neural Networks," *Colorado Neural Networks Symposium*, Golden, CO, Oct. 11, 1996.
43. T. X Brown, "A Technique for Mapping Optimization Solutions into Hardware," *Neural Information Processing Systems Workshop*, Vail, CO, Dec, 1995.
44. T. X Brown, "Classifying Rare Events," *Neural Information Processing Systems Workshop*, Vail, CO, Dec, 1994.
45. T. X Brown, "Indirect Neural Network Admission Control for ATM Networks," *Neural Networks for Computing Conf.*, Snowbird, UT, April 1994.
46. T. X Brown, J. S. Judd, "Refining the Boundary of Tractable Loading Problems," *Neural Networks for Computing Conf.*, Snowbird, UT, April 1993.
47. T. X Brown, J. T. Connor, "Recursive Neural Network for Adaptive Equalization," *Neural Networks for Computing Conf.*, Snowbird, UT, April 1993.
48. T. X Brown, "Building Massively Parallel Machines for Switching Network Control," *Bellcore Symposium on Applications of Neural Networks to Telecommunications*, Morristown, NJ, Oct. 21, 1992.
49. T. X Brown, "Electronic Neural Networks for ASAS Applications," *APO Techbase Meeting*, Pasadena, CA, April 1992.
50. T. X Brown, "Fast Classifier Training," *Neural Networks for Computing Conf.*, Snowbird, UT, April 1992.
51. T. X Brown, "Neural Networks for Communications," *IEEE Microelectronics and Photonics in Communications Workshop*, New Seabury, MA, June 1989.
52. T. X Brown, "Neural Networks for Switching," *Symposium on Neural Networks*, Pasadena, CA, May 1989.

- INVITED OTHER PRESENTATIONS
1. T. X Brown *A Harmful Interference Model for Secondary Spectrum Access*, University of Pittsburgh, November 20, 2015.
  2. T. X Brown, *A View on ICT Education in East Africa*, Penn State, October 5, 2015.
  3. T. X Brown, *Securing Dynamic Spectrum Access for Future Wireless Communication*, Distinguished Lecture at University of Rwanda, Huye March 26, 2015.
  4. T. X Brown, *A taxonomy of regulatory models for harmful interference*, School on Applications of Open Spectrum and White Spaces Technologies, Int. Center for Theoretical Physics, Trieste, Italy, March 11, 2014.
  5. T. X Brown, *Introduction to Spectrum Efficiency*, School on Applications of Open Spectrum and White Spaces Technologies, Int. Center for Theoretical Physics, Trieste, Italy, March 11, 2014.
  6. T. X Brown, *Cognitive Radio Security*, School on Applications of Open Spectrum and White Spaces Technologies, Int. Center for Theoretical Physics, Trieste, Italy, March 10, 2014.
  7. T. X Brown, *Opportunities for White Space Radios to Provide Broadband Access*, iHub, Nairobi, Kenya, April 11, 2013.
  8. T. X Brown, *Communication Challenges in Atmospheric Sensing with Unmanned Aircraft*, Linkoping University, Sweden, Feb. 14, 2012.
  9. T. X Brown, *Random Cellular Deployments for Analysis of Multi-Tier Mobile Radio Network Performance*, Linkoping University, Sweden, Feb. 14, 2012.
  10. T. X Brown, *Communication and Networking for the Future Electric Power Grid*, Royal Institute of Technology, KTH, Stockholm, Sweden, Feb. 13, 2012.
  11. T. X Brown, "Smart Grid Workforce Needs," *RMEL Workforce Round Table*, Denver, Mar. 15, 2011.
  12. T. X Brown, "Smart Grid Workforce Needs," *RMEL Workforce Round Table*, Denver, Mar. 15, 2011.
  13. T. X Brown, *Digital Energy Program*, GridWise Architecture Council, Denver, June 1, 2010.
  14. T. X Brown, Amita Sethi, *Hammer Model Threat Assessment of Cognitive Radio Denial-of-Service Attacks*, FAA UAS Meeting, Palo Alto, CA, Oct. 21, 2009.
  15. T. X Brown, Varun Vora, *Data and Video Coexistence Analysis in Dense Wi-Fi Environments*, Intel Santa Clara, Oct. 19, 2009.
  16. T. X Brown, *Modularity and Interoperability*, USAF Academic Outreach UAS Symposium, Grand Forks, ND, Aug. 6, 2009.
  17. T. X Brown, *Wireless Networking for Disaster Management*, Colorado School of Mines, Golden, CO, Apr. 28, 2009.
  18. T. X Brown, *Technical and Regulatory Challenges to Cognitive Radios*, Technical University of Ilmenau, Apr. 20, 2009.
  19. T. X Brown, *Wireless Networking for Disaster Management*, Technical University of Ilmenau, Apr. 20, 2009.
  20. T. X Brown, *Networking Issues for Small UAS*, RECUV Symposium, Boulder, CO, Apr. 12, 2009.
  21. T. X Brown, *The Power of Green Wireless*, Wireless On-demand Network Systems and Services Conference, Snowbird, UT, Feb. 3, 2009.

22. T. X Brown, *Simian Generated Cellular Systems*, Complex Systems Seminar, Boulder, CO, Dec. 3, 2008.
23. T. X Brown, *Cognitive Radios for UAS Communication*, RECUV Symposium, Boulder, CO, April 14, 2008.
30. T. X Brown, *Controlled Mobility in Wireless Networks*, Presented variations on this talk at seven universities in China: The Hong Kong Polytechnic U.; The Chinese U. of Hong Kong; Southeast U. (Nanjing); Nanjing U.; Fudan U. (Shanghai); Beijing U. of Posts and Telecommunications; and Tsinghua U. (Beijing). Feb. 29 to Mar. 7, 2008.
31. T. X Brown, B. Argrow, *UAS Command, Control, and Communication*, FAA PI Meeting, Atlantic City, Oct. 23, 2007
32. T. X Brown, *The Role of Communication in the UAS*, FAA PI Meeting at Embry-Riddle U., Daytona Beach, FL, Sep. 5, 2007
33. T. X Brown, *Radio Wormholes for Wireless Label Switched Mesh Networks*, NSF NeTS PI Meeting, Chicago, July 13, 2007.
34. T. X Brown, *The role of controlled mobility in wireless networks*, ECE Department at Colorado State University, Fort Collins, Feb. 19, 2007.
35. T. X Brown, *UAV Enabled Delay Tolerant Networks*, AFRL, Rome, NY, Aug. 24, 2006
36. T. X Brown, *Software Defined and Cognitive Radios*, Wireless Revolution Conference, Boulder, CO Feb. 18, 2006.
37. T. X Brown, *Ad Hoc UAV Ground Network: Sensor Data Collection*, RECUV Symposium, Boulder, CO, Feb. 17, 2006
38. T. X Brown, *Harmful Interference Models for Unlicensed Devices in Licensed Bands*, IEEE P1900 Standards Meeting Boulder, CO Jan. 25, 2006.
39. T. X Brown, *Ad hoc UAV ground networks for disaster management*, Workshop on Using Information Technology to Enhance Disaster Management Washington, D.C., June 22–23, 2005.
40. T. X Brown, *Unlicensed Devices in Licensed Bands: It's about harmful interference*, Boulder Spectrum Policy Seminar Series: Boulder, CO, June 1, 2005.
41. T. X Brown, *Networked UAVs for Ad Hoc Network Jamming*, Air Force Research Labs, Dayton, OH, Feb. 17, 2005.
42. T. X Brown, *An Ad Hoc UAV Ground Network (AUGNet)*, Swedish Institute of Computer Science, Stockholm, Sweden, April 27, 2004.
43. T. X Brown, *Simian Generated Cellular Systems*, KTH, Royal Institute of Technology, Stockholm, Sweden, April 16, 2004.
44. T. X Brown, *Fairness in Ad Hoc Routing*, University of Uppsala, Uppsala, Sweden, April 15, 2004.
45. T. X Brown, *The Energy-Aware Dynamic Source Routing protocol for Wireless Ad Hoc Networks*, Siemens Corporate Research, Munich, Germany, July 17, 2003.
46. T. X Brown, *Wird 3G Top oder der Flop: An American Perspective*, Telecommunications Research Center, Vienna, Austria, June 17, 2002.
47. T. X Brown, *Energy-Aware Routing in Wireless Ad Hoc Networks*, Telecommunications Research Center, Vienna, Austria, June 17, 2002.
48. T. X Brown, *The Future of 3G Wireless: Should the Cellular Incumbents be Worried?*, Colorado State University, Fort Collins, CO, May 6, 2002.



49. T. X Brown, *Next Generation Wireless: Who Needs Base Stations?*, IEEE Communications Society, Denver, CO, April 16, 2002.
50. T. X Brown, WLAN Networking Panelist at *International Symposium on Advanced Radio Technologies*, Boulder, CO, March 6, 2002.
51. T. X Brown, *Machine Learning for Data Network Quality of Service*, Siemens Corporate Research, Munich, Germany, June 27, 2001.
52. T. X Brown, *Machine Learning for Network Admission Control* NASA Ames Research Center, Moffett Field, CA, March 28, 2001.
53. T. X Brown, *IS-95 air interface*, Data Fusion, North Glenn, CO, June 26, 2000.
54. T. X Brown, *Adaptive Protocols for Low Power Wireless Communication via Reinforcement Learning*, Nokia Research Center, Helsinki, Finland, May 18, 2000.
55. T. X Brown, *Wireless Personal Communications*, Boulder Chapter of Sigma Xi, April 6, 1999.
56. T. X Brown, *Adaptive Connection Access Control for Multimedia Networks*, School of Mines, Golden, CO, Feb. 26, 1999.
57. T. X Brown, *PCS: Technology and Trends*, AT&T, Denver, CO, March 1998.
58. T. X Brown, *Wireless Network Management*, NIST, Gaithersburg, MD, Jan. 1998.
59. T. X Brown, *Adaptive Statistical Multiplexing*, Northern Telecom, Harlow, UK, July 1997.
60. T. X Brown, *Decision Functions for Traffic Engineering* Royal Institute of Technology (KTH), Stockholm, Sweden, Nov. 1996.
61. T. X Brown, *Adaptive ATM Access Control* Penn State, June, 1995.
62. T. X Brown, *Adaptive Access Control* Siemens, Munich, Germany, June, 1995.
63. T. X Brown, *Will ATM Succeed?* Siemens, Vienna, Austria, June, 1995.
64. T. X Brown, *Adaptive ATM Access Control* Technical University of Vienna, Austria, June, 1995.
65. T. X Brown, *Mobility Models for Personal Communications Systems*, University of Colorado, Nov. 1994.
66. T. X Brown, *On-Chip Learning for Matching Optimization Theory with Reality*, Rensselaer Polytechnic Institute, March, 1994.
67. T. X Brown, *Building Massively Parallel Machines for Switching Network Control*, New Jersey Institute of Technology, Nov. 1992.
68. T. X Brown, *Neural Networks for Classification*, Jet Propulsion Laboratory, Pasadena, CA, July 1992.
69. T. X Brown, *Designing Massively Parallel Systems for Switching Networks and Beyond*, Siemens Corporate Research, Princeton, NJ, April 1992.
70. T. X Brown, *Designing Massively Parallel Systems for Switching Networks and Beyond*, Bell Communications Research, Morristown, NJ, April 1992.
71. T. X Brown, *Neural Network Learning*, California State University Los Angeles, May 1991.
72. T. X Brown, *Hybrid Neural Control for Large Broadband Packet Switches*, Caltech, April 1991.

73. T. X Brown, *Neural Networks for Switching Network Control*, AT&T Bell Labs, Holmdale and Murray Hill, NJ, May 1990.
74. T. X Brown, *Neural Network Design for Switching Network Control*, Bell Communications Research, Morristown, NJ, May 1990.
75. T. X Brown, *Neural Networks for Switching Network Control*, Carnegie Mellon University, April 1990.
76. T. X Brown, Y. N. Doganata, E. C. Posner, *Call Paging Strategy Tradeoffs for Universal Digital Portable Communications*, Bell Communications Research, Red Bank, NJ, Oct. 1989.

FUNDING —Grants, Awards, and Contracts. List includes funding source, *project title*, total amount, with T. X Brown portion in parenthesis if shared.

PI	DFID	<i>The African University Faculty Accelerator (Pending and shortlisted).</i>	\$5.7M	2017–2022
PI	Toyota	<i>Rwanda Drone Study.</i>	\$20k	2016–2017
Co-PI	MCF	<i>A Master Card Scholars Program at Carnegie Mellon University in Rwanda.</i>	\$10.8M	2016–2023
Co-PI	IEEE	<i>Developing Critical Engineering Thinking in Engineering Education in Africa.</i>	\$49k	2016–2017
Co-PI	NSF	<i>I/UCRC Center for Unmanned Aircraft Systems.</i>	\$800k (\$175k)	2012–2017
PI	NSF	<i>Wireless Spectrum Research and Development Senior Steering Group Workshop.</i>	\$25k	2012
PI	Intrado	<i>Evaluation of Texting to 911.</i>	\$40k	2011
PI	DOE	<i>Strategic Training in Networking for Power Systems.</i>	\$2.47M	2010–2014
PI	FAA	<i>Architecture for Cognitive Radio Operations for UAS.</i>	\$386k (\$163k)	2010–2012
PI	NGC	<i>Trajectory Planning for Optimized Unmanned Aircraft Sensor Data Collection.</i>	\$19k	2010–2011
PI	FAA	<i>The Role of Cognitive Radios in Remote Operation of UAS.</i>	\$189k (\$95k)	2008–2010
PI	Sumitomo	<i>WiFi Radio Resource Management.</i>	\$30k	2008–2009
PI	Intel	<i>Wireless Video Coexistence Analysis.</i>	\$32k	2008
PI	L3	<i>Networked Systems Test Bed Integration and Test.</i>	\$343 (\$171)	2007–2009
Co-PI	FAA	<i>Remote Operation of UAS and Technologies for Command, Control, Communications, and Computers.</i>	\$85k (\$42k)	2007–2008
PI	AFRL	<i>Anti-Jamming for Internet-based Airborne Networks.</i>	\$50k	2007–2008
Co-PI	Dept of Ed	<i>GAANN: Interdisciplinary Graduate Program in Disaster-Tolerant and Interoperable Communications.</i>	\$250k (\$0k)	2006–2008
PI	AirCell	<i>Airlink Traffic and Channel Models.</i>	\$10k	2007
Co-PI	NSF	<i>NeTS-NBD: Radio Wormholes for Wireless Label Switched Mesh Networks.</i>	\$600k (\$150k)	2006–2010

PI	Sumitomo	<i>Wireless Network Innovations.</i>	\$10k	2006–2007
Co-PI	AFOSR	<i>An Integrated Framework for Controlled Mobility in Ad-hoc Networks.</i>	\$450k (\$225k)	2006–2008
Co-PI	NSF	<i>CRI: Wireless Internet Building Blocks for Research, Policy, and Education.</i>	\$600k (\$150k)	2005–2009
Co-PI	Shared Spectrum	<i>Collaboration with SSC on DARPA XG Project.</i>	\$580k (\$116k)	2005–2007
PI	NSF	<i>SGER: Connection Admission Control and Network Pricing in Public Safety Spectrum Sharing.</i>	\$75k	2005–2007
PI	Fidelity Comtech	<i>Physical Layer Information Assurance for Wireless Networks using Phased Array Technology.</i>	\$23k	2005–2007
PI	BBN	<i>Flight Demonstration of Intelligent Jamming of Ad-hoc Mobile Networks.</i>	\$55k	2005–2006
PI	NSF	<i>Future Spectrum Technology and Policy Workshop.</i>	\$25k	2005–2006
PI	L3	<i>Sensor Data Collection.</i>	\$368k (\$123k)	2005–2007
PI	NSF	<i>ITR-ECS-soc: Spectrum Management Towards Spectrum Plenty.</i>	\$300k (\$75k)	2004–2007
PI	L3-Comcept	<i>Wireless Communications Test Bed, Phases 2 and 3.</i>	\$470k (\$235k)	2003–2004
PI	Comcept	<i>Wireless Communications Test Bed, Phase 1.</i>	\$120k (\$60k)	2003
PI	Comcept	<i>Airborne Wireless Communications Evaluation.</i>	\$40k (\$20k)	2002–2003
Co-PI	NSF	<i>ITR/SII Energy and Quality of Service Aware Ad-Hoc Networking.</i>	\$500k (\$250k)	2000–2003
PI	Agilent	<i>Web-based wireless lab development software and equipment grant.</i>	\$20k	2000
PI	LCC Ericsson	<i>Wireless lab development equipment grant.</i>	\$30k	1999
Co-PI	NSF	<i>Modular Wireless Curriculum Development and Dissemination for Four-Year Colleges.</i>	\$308k (\$10k)	1999–2002
PI	CU	<i>Junior Faculty Development Award: Adaptive Network Control for Wireless Multimedia Communication.</i>	\$5k	1998
Co-PI	CCHE	<i>Colorado Council on Higher Education grant for Telecommunications.</i>	\$1,250k (\$250k)	1998–2003
PI	CU	<i>Engineering Excellence Fund Voice over IP Lab.</i>	\$7k	1998–1999
Co-PI	NSF	<i>REU Supplement to: High-Performance Low-Power Wireless Communication.</i>	\$35k (\$9k)	1998–2000
PI	NSF	<i>REU and equipment supplement to CAREER award.</i>	\$15k	1997–2000
Co-PI	NSF	<i>High-Performance Low-Power Wireless Communication.</i>	\$1,034k (\$258k)	1997–2000
PI	Mobile Sys. Int.	<i>Cellular Planning Tools software and equipment grant.</i>	\$600k	1996

- PI NSF *CAREER: Adaptive Admission Control for Broad-band Communication.* \$200k 1996–2000
- Visiting Researcher: Siemens, Munich Germany, 2001; FTW, Vienna Austria, 2002; Uppsala University, Uppsala Sweden, 2004.
  - Paid Consulting: Celeritas, Irvine CA, 1996; Superconducting Core Technologies, Golden CO, 1996; AT&T, Denver CO, 1997; L3 Communications, East Camden NJ 1998; Centennial Funds, Denver CO, 1999; United Online, Englewood CO, 1999–2000; Data Fusion, North Glenn CO, 2000; Emperative, Boston MA, 2000; DACOM, Korea, 2000; Kagan, Boulder CO, 2002; Telecommunication Consultants, Boston MA, 2003; Merestone, Castle Rock CO, 2003–2006; New America Foundation, Washington DC, 2004, 2006–2007; Highland Association, Denver CO, 2004; McKinsey & Co., New York NY, 2005; Baker & Botts, Dallas TX; Intertainment, Denver CO, 2005; Counciltree Communications, Longmont CO, 2006; Air-Cell, Louisville CO, 2007; SEI Innovation Core, San Jose CA, 2007, Townsend, Townsend, and Crew, Denver CO, 2007–2008; BAE Systems, Merrimack, NH, 2009; Opportunity Education, Denver, CO, 2009. Finnegan, Washington, DC, 2009–2010; Echelon, San Francisco, CA, 2009–2011; Kellogg, Washington, DC, 2011.
- TEACHING
- Developed new concurrent M.S./B.S. between Telecommunications and Electrical, Computer, and Energy Engineering, 2013.
  - Developed new Telecommunications Ph.D., 2010.
  - Developed new Digital Energy Program, a graduate program that combines telecommunications and power systems, 2009.
  - Taught TLEN 5510 Wireless Communication Systems, 3 credit hours: Fall 1995, Summer 1996, Fall 1996, Summer 1997, Fall 1997, Summer 1998, Fall 1998, Fall 1999, Fall 2000, Fall 2001. 653 students total. Average course/instructor rating A-/A-.
  - Developed and organized TLEN 5710 Capstone Seminar, 1 credit hour: Fall 1997, Spring 1998, Fall 1998, Spring 1999, Fall 1999, Spring 2000, Fall 2000, Spring 2001, Fall 2001, Spring 2002, Fall 2002, Spring 2003, Fall 2010, Spring 2011, Fall 2011, Spring 2012, Fall 2012. 867 students total. (no rating).
  - Taught TLEN 5700 Research Methods, 1 credit hour: Fall 2010. 39 students. Average course/instructor rating B/B.
  - Developed and taught TLEN 5831 The Internet, 3 credit hours: Spring 1999. 14 students. Course/instructor rating B/B+.
  - Developed and taught TLEN 5320 Wireless Systems Lab, 3 credit hours: Fall 1999, Fall 2000. 20 students total. Average course/instructor rating B+/B+.
  - Taught ECEN 4242 Communication Principles, 3 credit hours: Spring 1996, Fall 2005. 37 students. Average course/instructor rating B/B.
  - Developed and taught ECEN 5032 Pattern Recognition 3 credit hours: Fall 1996. 10 students. Course/instructor rating A-/B+.
  - Taught ECEN 5032 Communication Networks 3 credit hours: Spring 2000, Spring 2001, Spring 2002, Spring 2006. 53 students. Average course/instructor rating B+/B+.
  - Developed and taught TLEN 5836 Internet Research 3 credit hours: Fall 2002. 6 students. Course/instructor rating B/B.
  - Developed and taught ECEN 5032 Wireless System Design 3 credit hours: Spring 2003. 25 students. Average course/instructor rating B/B.
  - Developed and taught TLEN 5520 Wireless LANs 3 credit hours: Fall 2003, Fall 2005, Fall 2006, Spring 2007. 70 students. Average course/instructor rating A-/A-.

- Taught ECEN 3810 Probability Theory 3 credit hours: Fall 2003. 66 students. Course/instructor rating D/D+
- Developed and taught ECEN 5042/CSCI 7000 Software Defined Radios 3 credit hours: Spring 2005, 10 students. Course/instructor rating C/B.
- Taught ECEN 4632 Introduction to Digital Filters 3 credit hours: Spring 2007, 15 students. Course/instructor rating B/B+.
- Taught ECEN 5612 Random Processes 3 credit hours: Fall 2007, Fall 2008, 49 students. Course/instructor rating B/B.
- Taught ECEN 1500 Sustainable Energy 3 credit hours: Spring 2010, 28 students. Course/instructor rating B-/B.
- Taught TLEN 5580 Energy Communications Networks 3 credit hours: Spring 2011, Spring 2012. 36 students. course/instructor rating B+/B+.
- Taught MSIT 04-635 Introduction to Information Security while on leave at Carnegie Mellon University in Rwanda 4 credit hours: Spring 2013, Spring 2014, Spring 2015, Spring 2017. 109 students. course/instructor rating A/A.
- Taught MSIT 04-641 Fundamentals of Telecommunications and Computer Networks while on leave at Carnegie Mellon University in Rwanda 4 credit hours: Fall 2013. 24 students. course/instructor rating B/B.
- Developed and taught MSIT 04-801 Wireless Systems Lab while on leave at Carnegie Mellon University in Rwanda 2 credit hours: Spring 2014, Spring 2015. 5 students.
- Developed and taught MSIT 04-801 Networking Lab while on leave at Carnegie Mellon University in Rwanda 2 credit hours: Fall 2014, Spring 2015. 5 students.
- Taught ECE 18-756 Packet Switching and Computer Networks while on leave at Carnegie Mellon University in Rwanda 4 credit hours: Fall 2014. 2 students.
- Taught ECE 18-859 Stochastic Geometry for Communication Networks while on leave at Carnegie Mellon University 2 credit hours: Fall 2015. 3 students.
- Taught EPP 19-801 IT Innovation and Business in Africa while on leave at Carnegie Mellon University 2 credit hours: Spring 2016, Spring 2017. 16 students.
- Taught EPP 19-802/19-432 Bitcoin and Cryptocurrencies while on leave at Carnegie Mellon University 2 credit hours: Spring 2016. 24 students.
- Taught ECE 19-802/19-432 Wireless Network Security while on leave at Carnegie Mellon University 2 credit hours: Fall 2016. 5 students.
- Taught EPP 19-802/19-432 Internet of Things while on leave at Carnegie Mellon University 2 credit hours: Fall 2016. 5 students.
- Ph.D. Students Graduated:
  - Prasanna Madhusudhanan. Thesis Topic: “Stochastic Geometric Modeling and Analysis of Wireless Communications Systems,” 2013
  - Ben Pearre. Thesis Topic: “Model-Free in situ Optimisation of Data-Ferried Sensor Networks,” 2013
  - Daniel Bennett. Thesis Topic: “Optimal Data Scheduling of Clients Serviced using Beamforming Antennas in Mobile Scenarios,” 2012
  - Dan Henkel. Thesis Topic: “The impact of controlled-mobility helper nodes on the performance of challenged networks,” 2008

Qi Wang. Thesis Topic: “Resource allocation in differentiated quality of service networks via network pricing and admission control,” 2006

Sheetalkumar Doshi. Thesis Topic: “MCQAR: Implementation of a multi-constrained quality of service aware routing framework for a mobile ad hoc network,” 2005

Hui Tong. Thesis topic: “Adaptive Admission Control and Routing under Quality of Service Constraints in Broadband Communications,” 1999

—Graduated 59 masters thesis students.

—Supervised 15 masters independent research projects.

—Advised 115 masters capstone students.

—Sat on 55 Ph.D. committees.

—Sat on 63 masters thesis committees.

—Supervised 17 undergraduate independent research projects.

#### PROFESSIONAL ACTIVITIES

—Co-organized the Workshop on Spatial Stochastic Models for Wireless Networks (SpaSWiN) in Paris, France 2017.

—Co-organized first, second, and third International Workshops on Applications of Neural Networks to Telecommunications. Held 1993, 1995, 1997, in Princeton, Stockholm, and Melbourne Australia. Acted as publications chair, served on the program committee, and assisted with local arrangements.

—Member Technical Program Committee: IEEE Radio and Wireless Conference (RAWCON), 2000; ITC Specialist Seminar on IP Traffic Measurement, Modeling, and Management, 2000; ACM International Symposium on Mobile Ad Hoc Networking and Computing (MobiHoc), 2004, 2007; IEEE Conference on Computer Communications (INFOCOM), 2009, 2010, 2011; Workshop on Spatial Stochastic Models for Wireless Networks (SpaSWiN), 2014.

—Session Chair at 1997 IFIP, 1993,1995,1997 IWANNT, 1999,2000 RAWCON, 2001 LANMAN.

—Co-Editor-In-Chief *Derwent Neural Networks and Intelligent Systems Newsletter*. 1995.

—Reviewed papers for 30 different journals: Ad Hoc Networks,AIAA J. of Aerospace Computing, Information, and Communication,Automatica,Computer Networks and ISDN Systems, ETRI Journal, European T. on Telecommunications, IEEE Communications Surveys and Tutorials,IEEE/ACM T. on Networking,IEEE J. of Selected Areas in Communications,IEEE T. on Circuits and Systems, IEEE T. on Communications,IEEE T. on Intelligent Transportation Systems,IEEE T. on Microwave Theory and Techniques, IEEE T. on Mobile Computing,IEEE T. on Multimedia,IEEE T. on Neural Networks,IEEE T. on Parallel and Distributed Systems,IEEE T. on Signal Processing,IEEE T. on Vehicular Technology,IEEE T. on Wireless Communications,IEE Proc. Communications,International J. of Neural Systems, J. of the ACM, J. of Computer Networks and Communications,J. of Parallel and Distributed Computing,J. of Selected Topics in Signal Processing,J. of Vacuum Science and Technology, Machine Learning, Neural Computation, Neural Networks.

- Reviewed papers for 27 different conferences: Advances in Neural Information Processing Systems (NIPS), ACM Int. C. on Mobile Computing and Networking (Mobicom), ACM Int. Sym. on Mobile Ad Hoc Networking and Computing (MobiHoc), ACM Int. W. on Mobile Opportunistic Networking (MobiOpp), Int. C. on Parallel and Distributed Computing Systems, IEEE Access and Home Networks Sym., IEEE American Control Conf., IEEE Conf. on Computer Communication (INFOCOM), IEEE Int. C. on Communication (ICC), IEEE C. on Decision and Control, IEEE Int. C. on Distributed Computing Systems, IEEE Consumer Communications and Networking C. (CCNC), IEEE Int. Dynamic Spectrum Access Networks (DySPAN) Sym., IEEE Global Communications C. (GlobeCom), IEEE Military Communications C. (MilCom), IEEE Radio and Wireless C. (RAWCON), IEEE Vehicle Technology C. (VTC), IEEE Wireless Communication and Networking C. (WCNC), IFIP W. on Performance Modeling & Evaluation of ATM Networks, Int. C. on Cognitive Radio Oriented Wireless Networks and Communications (CrownCom), Int. Joint C. on Neural Networks (IJCNN), ITC Specialist Seminar on IP Traffic Measurement, Modeling, and Management, Int. Sym. on Advanced Radio Technologies (ISART), Int. Sym. on Information Theory, Int. W. on Applications of Neural Networks to Telecommunications (IWANNT), Scandinavian W. on Wireless Ad-hoc Networks, W. on Spatial Stochastic Models for Wireless Networks (SpaSWiN).
- Reviewed one article for the Internet Encyclopedia
- Reviewed NSF, GENI, ARPA, CASI, Southeast Region Research Initiative (SERRI), and American Association for the Advancement of Science (AAAS) proposals.
- Technical Program Chair for the International Symposium on Advanced Radio Technologies (ISART), 2003, Boulder, CO. Technical Program Co-chair for ISART 2004.
- Program committee for the 4th Scandinavian Workshop on Wireless Ad-hoc Networks (ADHOC 04) May 4–5, 2004 Stockholm; and ADHOC 05 May 3–4, 2005 Stockholm; and ADHOC 06 May 3–4, 2006 Stockholm; Int. C. on Cognitive Radio Oriented Wireless Networks and Communications (CrownCom), 2013.
- Organizer for Second NSF-Joint Workshop on Future Spectrum Technology and Policy on 25-27 May 2005, Washington DC.
- Outside examiner for R. Ram Mohan Doss Ph.D. Thesis, RMIT University, Australia 2003.
- Faculty Opponent to Jakob Carlstrom Ph.D. Thesis: *Reinforcement Learning for Admission Control and Routing*. at University of Uppsala, Sweden, May 19, 2000. The faculty opponent publicly presents and critiques the candidates thesis to the committee.
- Faculty Opponent to Erik Kuiper Ph.D. Thesis: *Geographic Routing in Intermittently-Connected Mobile Ad Hoc Networks* at University of Linköping, Sweden, February 16, 2012.
- Outside reviewer for Mikhail Tarasov Ph.D. Thesis, Technical University of Ilmenau, Germany, 2013.
- External Examiner for Joseph Brian Mukwaya, M.S. Thesis, Makerere University, Kampala, Uganda, 2015.
- External Examiner for Isaac Nayabisa Oteyo, M.S. Thesis, Makerere University, Kampala, Uganda, 2016.
- National Research Council Committee on Using Information Technology to Enhance Disaster Management, 2005–2007.
- Participant in the Radio Technical Commission (RTCA) Special Committee 203 on Unmanned Aircraft Systems (UAS), 2010–2012.
- Advisory Board Member for the U. of Uppsala VINN Excellence Center for Wireless Sensor Networks (WISENET), 2010–2011.

- Interdisciplinary Telecommunications Program Associate Faculty Director, 2006–2008.
- Interdisciplinary Telecommunications Program Faculty Director, 2008–2012.
- Student recruiting for CMU-Rwanda: Kampala, Uganda (2013, 2014, 2016), Addis Ababa, Ethiopia (2013, 2016), Nairobi, Kenya (2013, 2015), Accra, Ghana (2013), Butare, Rwanda (2013,2015), Dar Es Salaam, Tanzania (2013), Banjul, The Gambia (2014), Dakar, Senegal (2014), Little Rock, AR (2016), Lagos, Nigeria (2016).



## Category Explanation and Summary

Student coauthors are underlined.

**Patents** are issued patents. (3 total)

**Book Chapters** are extended papers which appeared as book chapters in an edited book. (8 total)

**Edited Books** are proceedings for which I served as an editor. (7 total)

**Refereed Journal Publications** are papers appearing in any standard periodic transactions or journal publication. (30 total)

**Refereed Conference Publications** are papers appearing in any professional or scientific conference proceedings. Top tier papers that are at conferences where the acceptance rate was less than 33%, detailed reviews were received back from reviewers, are at least 6 pages, and are generally considered significant publications by the community are noted by a '+'. The remaining are other conferences or conferences which could not be documented as a top tier conference. (17 top-tier and 69 other total)

**Other Papers** includes documents published by employers, comments to the FCC, etc. (11 total)

**Published Reviews** are book reviews appearing in professional journals. (1 total)

**Conference Presentations (unpublished)** are papers that were presented at conferences or workshops which had no proceedings or only published short (one page or less) paper abstracts. (52 total)

**Invited Other Presentations** are papers presented at colloquia, seminars, tutorials, etc. at places other than where I was employed. (76 total)

**Funding** includes grants and awards supporting my teaching and research.

**Teaching** summarizes courses taught and students advised. (27 courses taught 65 times to 2188 students total)

**Professional Activities** includes conference organization, reviewing, and editing.