

Harpreet Singh Dhillon

Curriculum Vitae

June 2011

Wireless Networking and Communications Group (WNCG),
Department of ECE, The University of Texas at Austin.
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Education

- The University of Texas at Austin
Ph.D., Electrical Engineering
Dissertation: Modeling and Analysis of Heterogeneous Cellular Networks
Austin, TX
Fall 2010 - Spring 2013
- Virginia Tech
M.S., Electrical Engineering (GPA: 4.0/4.0)
Thesis: Optimal Sum-Rate of Multi-Band MIMO Interference Channel
Blacksburg, VA
Fall 2008 - Summer 2010
- Indian Institute of Technology (IIT)
B.Tech, Electronics and Communications Engineering (Top 2% with GPA: 9.12/10)
Thesis: An Adaptive Space Time Decoder with Quadrant-Localized Search Algorithm
Guwahati, India
Fall 2004 - Spring 2008

Research Interests

- Tractable Analytical Models for Heterogeneous Cellular Networks
- Application of Stochastic Geometry in Wireless Networks
- Capacity Characterization of K -user Interference Channel
- Dynamic Resource Allocation in Cognitive Radios
- Space Time Coding and Lattice Decoding for MIMO Systems
- Application of Wireless Signals for Non-Invasive Respiration Monitoring

Awards and Honors

- Microelectronics and Computer Development (MCD) Fellowship
Offered to top 1% applicants by the graduate school of The University of Texas at Austin.
UT Austin, 2010-11
- Agilent Engineering and Technology Award (for developing *Sleep Apnea Monitor*)
Awarded each year to the best undergraduate research project in electronics, communications or life sciences in the country. The winner is invited to the Agilent's R&D Labs in Santa Clara, CA, for a brief demonstration of the innovation.
Agilent Technologies, 2008
- Pratt Fellowship (*offer*)
Typically offered in addition to research assistantship to make a competitive Ph.D. offer to top applicants.
Virginia Tech, 2010
- NASA Tech Briefs Create the Future Design Contest
"Low-Cost Sudden Infant Death Syndrome Monitor" adjudged among top 3 innovations worldwide in the medical category.
NASA, 2007
- International Exhibition for Young Inventors (IEYI '06)
Selected to be a part of the national team comprising of 25 innovative students to represent India in this exhibition.
India, 2006
- Featured in the Graduate Students of Distinction
Virginia Tech, 2008-09
- Intel National Science Fair
Among 60 students selected nationwide to participate in "Initiative for Research and Innovation in Science (IRIS)" fair.
IRIS, Intel, 2006
- Regional Mathematical Olympiad (RMO)
Secured 27th rank in RMO and represented North-west region of India in Indian National Mathematics Olympiad 2003.
India, 2002
- Best and Second Best Student Paper Awards, Techscribe
National level paper presentation contest organized as a part of Techniche, IITG's annual techno-management festival.
IIT Guwahati, 2006

- Best Design Project Award IIT Guwahati, 2007
Designed and developed “Wireless Remote Controller for Home Appliances” as a part of the undergraduate design lab.
- Second Best Hardware Project Award, national level open hardware contest, Techniche IIT Guwahati, 2006
- Sleep Apnea Monitor was selected to be the part of IIT Guwahati Portal of industrial and innovative products.
- Merit certification for scoring 100% marks in mathematics in AISSE CBSE, India, 2002
- Listed among top 0.5% students appearing in IIT JEE-2004 for the admission to IITs IIT-JEE, 2004

Research/Work Experience

- Alcatel-Lucent Bell Labs Holmdel, NJ
Summer Intern June 2011 – Aug. 2011
Will be working with Reinaldo Valenzuela and Howard Huang at Bell Labs’ Broadband and Wireless Access Center.
- Wireless Networking and Communications Group (WNCG), UT Austin Austin, TX
Ph.D. Student, MCD Fellow Aug. 2010 – June 2011
*Developed a tractable and accurate model for a K-tier downlink heterogeneous cellular network (HCN).
Derived closed form expressions for coverage and average rate achievable by a randomly located mobile user both in closed and open access HCNs.*
- Mobile and Portable Radio Research Group (MPRG), Virginia Tech Blacksburg, VA
Graduate Research Assistant July 2008 – May 2009 & Aug. 2009 – Aug. 2010
*Developed a mathematical framework to evaluate optimal ergodic sum-rate of an N-user interference channel (IC).
Developed rules of thumb for the optimal power allocation in various interference scenarios of an IC.
Was a student lead on Qualcomm sponsored hardware project with the goal of demonstrating the feasibility of DSA in the TV band white spaces.*
- QUALCOMM Inc. (QCT Wireless Connectivity - Bluetooth) San Diego, CA
Summer Intern May 2009 – Aug. 2009
*Performance test of Bluetooth profiles, such as FTP and OPP, over various Bluetooth stacks (including Android).
Baseband throughput analysis: Understanding the effect of channel conditions on packet type selection.*
- Indian Institute of Technology (IIT) Guwahati, India
Undergraduate Research May 2006 – May 2007 & July 2007 – May 2008
*Proposed a new quadrant-localized decoding algorithm for space time codes.
Developed and demonstrated a low-cost fully-functional sleep apnea monitor (targeted for developing nations).*
- CERCOM, Dipartimento di Elettronica, Politecnico di Torino Torino, Italy
Research Intern May 2007 – July 2007
*Implemented a soft output sphere decoder for the Golden space-time code in MATLAB and C++.
Proposed a new method to estimate optimum starting value of the sphere radius based on noise variance.*

Journal Publications

1. H. S. Dhillon, R. K. Ganti, J. G. Andrews and F. Baccelli, “Modeling and Analysis of K-Tier Downlink Heterogeneous Cellular Networks”, submitted to *IEEE Journal on Sel. Areas in Communications*, Mar. 2011.
2. H. S. Dhillon and R. M. Buehrer, “Ergodic Sum-Rate of a Multi-Carrier MIMO Interference Channel”, to be submitted to *IEEE Trans. Wireless Communications*.
3. H. S. Dhillon, J.-O Jeong, D. Datla, M. Benonis, R. M. Buehrer and J. H. Reed, “A Sub-Space Method to Detect Multiple Wireless Microphone Signals in TV Band White Space”, under revision, *Springer Journal on Analog Integrated Circuits and Signal Processing*.
4. H. S. Dhillon, H. Singhal and H. B. Nemade, “Respiration Movement Based Sleep Apnea Monitor”, *Electronics Letters*, vol. 44, no. 6, pp. 398-399, Mar. 2008.

5. H. S. Dhillon and A. Mitra, "A Reduced-Bit Multiplication Algorithm for Digital Arithmetic", *Int. J. Computational and Mathematical Sciences*, vol. 2, no. 2, pp. 64-69, 2008.
6. A. Mitra and H. S. Dhillon, "Evaluating Sinusoidal Functions by a Low Complexity Cubic Spline Interpolator with Error Optimization", *Int. J. of Electrical and Computer Engineering*, vol. 2, no. 2, pp. 110-117, 2007.
7. H. S. Dhillon and A. Mitra, "A Low Power Architecture of Digital Sinusoidal Generator Using Cubic Spline Interpolation", *IETE Journal of Education*, vol. 47, no. 3, pp. 129-136, July-Sept. 2006.

Refereed Conference Publications

1. H. S. Dhillon, R. K. Ganti, F. Baccelli and J. G. Andrews, "Average Rate Achievable in K -Tier Downlink Heterogeneous Cellular Networks", submitted to *IEEE Global Comm. Conf. (GLOBECOM)*, 2011.
2. H. S. Dhillon, R. K. Ganti and J. G. Andrews, "A Tractable Framework for Coverage and Outage in Heterogeneous Cellular Networks", in *Proc. Information Theory and Applications (ITA) Workshop*, San Diego, CA, 2011.
3. H. S. Dhillon and R. M. Buehrer, "On the Sum-Rate of MIMO Interference Channel", in *Proc. IEEE Global Comm. Conf. (GLOBECOM)*, Miami, 2010.
4. H. S. Dhillon and R. M. Buehrer, "On the Maximum Sum-Rate of Cognitive MIMO Interference Channel", in *Proc. IEEE Military Comm. Conf. (MILCOM)*, San Jose, 2010.
5. H. S. Dhillon and R. M. Buehrer, "Cognitive MIMO Radio: Incorporating Dynamic Spectrum Access in Multiuser MIMO Network", in *Proc. IEEE Global Comm. Conf. (GLOBECOM)*, Honolulu, HI, Nov. 30 - Dec. 5, 2009.
6. D. Datla, H. S. Dhillon, J.-O Jeong, M. Benonis, R. M. Buehrer and J. H. Reed, "A Sub-Space Method to Detect Multiple Wireless Microphone Signals in TV Band White Space", in *Proc. SDR Forum Technical Conference and Product Exposition - Research and Development*, Washington, D.C., 2010. (R&D Best Paper)
7. H. S. Dhillon, H. Aggarwal and A. Mitra, "A Simple Direction-Based Lattice Decoding Algorithm for Golden Code", in *Proc. National Conf. Comm. (NCC 2009)*, Guwahati, India, Jan. 2009.
8. K. Patil, H. S. Dhillon and A. Mitra, "A Telephone Based Wireless Remote Controller for Home Appliances", in *Proc. National Conf. Comm. (NCC-2008)*, Bombay, Feb. 2008.
9. H. S. Dhillon and A. Mitra, "A Digital Multiplier Architecture using Urdhva Tiryakbhyam Sutra of Vedic Mathematics", in *Proc. IEEE Int. Conf. Comput., Comm., Control and Instru. (IEEE-IC3)*, Bangalore, Nov. 2007.
10. H. S. Dhillon and A. Mitra, "Architecture of a Low Power Digital Sinusoid Generator using a Two Interval Cubic Spline Interpolation Method with Error Optimization", in *Proc. IEEE Int. Conf. Comput., Comm., Control and Instru. (IEEE-IC3)*, Bangalore, Nov. 2007.
11. H. S. Dhillon and H. Singhal, "Novel Electronics Hardware for Continuous Time Respiration Signal Monitoring and Sleep Apnea Detection", in *Proc. Int. Conf. on Advances in Electronics and Comm. Tech. (ICAECT)*, Punjab, Dec. 2006.
12. H. S. Dhillon and A. Mitra, "Digital Sinusoid Generator with Two-interval Cubic Spline Interpolation: A Low Power Architecture", in *Proc. Int. Conf. on Advances in Electronics and Comm. Tech.*, Punjab, Dec. 2006.
Note: Refer to <https://webspace.utexas.edu/hd3496/www/publications.html> for the electronic version of my publications.

Patents

1. H. Singhal, H. S. Dhillon and H. B. Nemade, "Sleep Apnea Monitor to Detect All the Forms of Apnea", 2007.

Selected Posters and Talks

1. H. S. Dhillon, R. K. Ganti, J. G. Andrews and F. Baccelli, "A New Framework to Analyze Heterogeneous Cellular Networks", *Wireless Networking and Communications Group (WNCG) Open House*, UT Austin, Jan 28 2011.
2. H. S. Dhillon et al., "New Framework to Analyze Heterogeneous Cellular Networks", *School of Information Theory*, UT Austin, May 2011.

3. H. S. Dhillon and R. M. Buehrer, "Cognitive Radios in TV Band White-Space", *Wireless Internet Center for Advanced Technology (WICAT) Research Review and Industry Advisory Board (IAB) meeting*, Polytechnic Institute of NYU, April 2010.
4. H. S. Dhillon and R. M. Buehrer, "Power Control in Cognitive MIMO Interference Channels", *VT Symposium on Wireless Personal Communications*, Blacksburg, VA, June 2-4 2010.
5. H. S. Dhillon and R. M. Buehrer, "Spatio-spectral optimization of Throughput in Cognitive MIMO Radios", *VT Symposium on Wireless Personal Communications*, Blacksburg, VA, June 3-5 2009.
6. H. S. Dhillon, A. Tarable and S. Benedetto, "Soft Output Sphere Decoder for the Golden Code: Implementation and Complexity Analysis", *Technical Report*, Politecnico di Torino, Italy, 2007.
7. H. S. Dhillon, H. Singhal and H. B. Nemade, "Sleep Apnea Monitor", *Finals of the Agilent Engineering and Technology Award*, IIT Delhi, India, 2008.
8. H. S. Dhillon, H. Singhal and H. B. Nemade, "Sleep Apnea Monitor", *Agilent R&D*, Santa Clara, CA, 2009.
9. H. S. Dhillon, "Second Order Markov Model Based Proactive Password Checker", Department of Mathematics, IIT Guwahati.
10. H. S. Dhillon et al., "Differences in Organizational Learning Process: A Comparative Study", Department of Humanities and Social Sciences, IIT Guwahati, 2008.

Relevant Courses

- Graduate Courses (UT Austin): Information Theory and Statistics, Advanced Wireless Communications, Probability and Stochastic Processes, Analysis and Design of Communication Networks.
- Graduate Courses (Virginia Tech): Multi-channel Communications, Spread Spectrum Communications, Coding Theory, Digital Communications - Advanced Theory and Analysis, Stochastic Signals and Systems, Optimization.
- Undergraduate Courses (IIT): Smart Antennas for Wireless Communications, Mobile Comm., Information Theory and Coding, Detection and Estimation Theory, Queuing Models for Performance Analysis, Digital Comm., Comm. Systems Engineering, Comm. Networks, Principles of Comm., Probability and Random Processes, Digital Signal Processing.

Programming and Software Skills

- Languages: C, C++, VHDL, HTML, \LaTeX .
- R, especially its library *Spatstat*, for analyzing spatial point patterns.
- Matlab including some of its toolboxes such as communications toolbox, filter design toolbox, signal processing toolbox, simulink and control systems toolbox.
- Software defined radio (SDR) design and implementation using GNURadio and universal software radio peripherals.
- Conversant with cellular testing tools such as QXDM, QPST, ASIA Test Manager and TRACE32 JTAG Debugger.
- Conversant with various Microprocessor Programming languages and kits, specifically 8085, 8086 (8088).
- Radio frequency simulation softwares such as Ansoft HFSS, Ansoft Serenade.
- Circuit simulation softwares such as WinSPICE, SPICE; mask layout designing using MAGIC.

Professional Service

Technical reviewer for:

- IEEE Transactions on Communications
- IEEE Transactions on Wireless Communications
- IEEE Journal on Selected Areas in Communications
- IEEE Communications Letters

- Journal of Communications and Networks
- Journal of Computer Systems, Networks, and Communications (Hindawi Publishing Corporation)
- Several IEEE conferences including GLOBECOM and MILCOM

Technical Program Committee: PESARO 2011, Budapest, Hungary.

Main Collaborators and Co-authors

- Bell Laboratories, Alcatel-Lucent: Dr. Reinaldo A. Valenzuela and Dr. Howard C. Huang
- The University of Texas at Austin: Prof. Jeffrey G. Andrews and Dr. Radha Krishna Ganti
- Virginia Tech: Prof. R. Michael Buehrer and Prof. Jeffrey H. Reed
- INRIA, France: Prof. François Baccelli
- Politecnico di Torino, Italy: Prof. Sergio Benedetto and Dr. Alberto Tarable
- Indian Institute of Technology Guwahati: Prof. Abhijit Mitra and Prof. Harshal B. Nemade
- Johns Hopkins University: Hari Singhal

Sports Interests

- Badminton
 - Best player award in badminton in SGHPS Sports Meets in the years 2001 and 2003.*
 - Represented IIT Guwahati in badminton in 41st Inter-IIT Sports Meet-2005 held at IIT Roorkee.*
- Athletics
 - Gold medal in CBSE inter-school athletics meet 1997–98 in 100 meters event.*

References Available upon Request