

# RAHUL VAZE

## Contact Address

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## Education:

- 2006-2009:* Ph.D.  
Dept. of Electrical and Computer Engg.  
University of Texas at Austin  
Dissertation Title: *Transmission Strategies for Multiple Antenna Wireless Ad-hoc and Relay Networks*
- 2002-2004:* Master of Engineering (M.E.) Telecommunications  
Dept. of Electrical Communication Engg.  
Indian Institute of Science, Bangalore India.  
CGPA: 7.0/8.0
- 1998-2002:* Bachelor of Engineering (B.E.) Electronics  
Madhav Institute of Technology and Science,  
Gwalior (M.P.) India.  
79.16% and ranked 1<sup>st</sup> among 120 students.

## Academic Position:

Reader (Tenured, eq. to Assoc. Prof.) Since Jan 2015

School of Technology and Computer Science

Tata Institute of Fundamental Research

Homi Bhabha Road

Mumbai 400001

Reader (Oct. 2009-Dec. 2014)

School of Technology and Computer Science

Tata Institute of Fundamental Research

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### **Industry Experience: (August 2004 - May 2006)**

Worked as a Design Engineer with Beceem Communications Pvt. Ltd., Bangalore, where I was involved in the design and development of physical layer algorithms for the IEEE 802.16-e standard.

### **Research Interests:**

- Wireless Communication Theory.
- Resource Allocation
- Online Algorithms
- Network Information Theory.
- Wireless Communication Networks.
- MIMO-OFDM.

### **Details of project being implemented/ completed as Principal Investigators/ Co-PI**

- Uncoordinated, secure and energy aware access in distributed wireless networks, DeiTy, Govt. of India, Amount of grant: Rs 3 crore for 3 years across 4 institutes. Start date Jan 1st, 2014 People: Prof. Bikash Dey, Dr. Sibi Pillai, IIT-Bombay, Dr. Vinod Prabhakaran, TIFR-Mumbai, Dr. Sripathi Acharya, NIT-Surathkal, Dr. Sumeet Kundu, NIT-Durgapur
- CEFIPRA Indo-French joint program on D2D Communications for LTE-Advanced Cellular Networks. Amount Rs 10 Lacs for TIFR for 3 years. Start date. 15 Apr. 2015 People Involved : Prof. Neelesh Mehta, Prof. Chandra Murthy, Indian Institute of Science, Bangalore. Dr. Ketan Rajawat, IIT-Kanpur, Dr. Vinod Kumar, Dr. Philippe JACQUET Alcatel-Lucent, Paris, Dr. Michele Wigger, Dr. Marceau Coupechoux Institut Mines-Telecom (IMT) / Telecom ParisTech, Paris.
- Indian National Science Academys Young Scientist Award Grant: Design of Efficient Spatial Wireless Networks using Stochastic Geometric tools. Start Date: 1st June 2014 Period- 3 years Amount: 5 Lacs per year No Co-PI

### **Awards and Distinctions**

- Editor for IEEE Journal of Selected Areas of Communications, since Apr 2015.
- TPC Co-Chair for IEEE SPCOM 2016.

- TPC Co-Chair for IEEE Globecom 2014.
- Won the Ramanath Cowsik Medal from TIFR in 2014 for best paper in last 5 years for people under the age of 35 from TIFR.
- Won the best paper award in the Networks track of the National Conference on Communications 2014 held at IIT-Kanpur for the paper " Maximizing Utility Among Selfish Users in Social Groups" co-authored with Ashwin Pananjady and Vivek Bagaria.
- Won the Indian National Academy of Engineering's Young Engineer Award for the year 2013.
- Won the Indian National Science Academy's Young Scientist Award for the year 2013.
- Won the Eurasip Best Paper Award for the best journal paper published in Eurasip Journal on Wireless Communication and Networking for the year 2010.
- Awarded the H.R. Seetharam Babu Gold Medal for the Best M.E. Thesis in the Department of Electrical Communication Engineering, Indian Institute of Science, Bangalore India, 2004.
- Awarded gold medal for securing first rank in B.E. (Electronics) by Madhav Institute of Technology and Science, Gwalior, India, 2002.
- Secured University first rank in B.E. (Electronics), Rajiv Gandhi Prodyougiki Vishwavidyalaya, Bhopal, M.P. India, 2002.

## **Books**

- Rahul Vaze, "Random Wireless Networks - An Information Theoretic Perspective", Cambridge University Press, Mar. 2015
- Robert Heath, Jr., Angel Lozano, Rahul Vaze, Chan Byoung Chae, Kaibin Huang, Robert Daniels, Takao Inoue, "MIMO Communication", (textbook on multiple antenna communication) to be published by Cambridge University Press, 2015.

## **Publications:**

### Journal

1. Kiran, T., Thangaraj, A. and Vaze, R., "Combinatorial Resource Allocation Using Submodularity of Waterfilling, IEEE Transactions on Wireless Communications, to appear, accepted Aug. 2015.

2. Tianyang Bai, Vaze, and R. Heath, R.W., "Analysis of Blockage Effects on Urban Cellular Networks IEEE Transactions on Wireless Communications, vol. 13 , no. 9, 2014 , pp. 5070 5083
3. Thangaraj, A. and Vaze, R., "Online Algorithms for Basestation Allocation, IEEE Transactions on Wireless Communications, vol. 13, no. 5, 2014 , pp. 2966 2975
4. Srikanth Iyer and Rahul Vaze, "Percolation on the Information Theoretically Secure Signal to Interference Ratio Graph", Journal of Applied Probability, vol. 51, no. 4, Dec, 2014.
5. Rahul Vaze, Rachit Garg, and Neetish Pathak, "Dynamic Power Allocation For Maximizing Throughput in Energy Harvesting Communication System", in IEEE/ACM Trans. on Networking, vol. 99, Sept. 2013.
6. Rahul Vaze and Robert W. Heath Jr., "Cascaded Orthogonal Space-Time Block Codes for Wireless Multi-Hop Relay Networks", Eurasip Journal on Wireless Communications and Networking, Apr. 2013.
7. Rahul Vaze and Harish Ganapathy, "Sub-modularity and Antenna Selection in MIMO systems", IEEE Communications Letters, no. 99, Sept. 2012.
8. Rahul Vaze and Robert W. Heath Jr., "Transmission Capacity of Ad-hoc Networks with Multiple Antennas using Transmit Stream Adaptation and interference Cancellation", IEEE Transactions on Information Theory, vol. 58, Feb. 2012, pp. 780-792.
9. Rahul Vaze, "Transmission Capacity of Spectrum Sharing Ad-hoc Networks with Multiple Antennas", IEEE Transactions on Wireless Communications, vol.10, pp. 2334 - 2340, July 2011.
10. Rahul Vaze, Kien Truong, Steven Weber, and Robert. W. Heath, Jr., "Two-Way Transmission Capacity of Wireless ad-hoc Networks", IEEE Transactions on Wireless Communications, vol. 10, June 2011, pp. 1966-75.
11. Rahul Vaze, "Throughput-Delay-Reliability Tradeoff with ARQ in Wireless Ad Hoc Networks", IEEE Transactions on Wireless Communications, vol. 10, July 2011, pp. 2142 - 2149.
12. Rahul Vaze and Robert W. Heath Jr., "On the Capacity and Diversity-Multiplexing Tradeoff of the Two-Way Relay Channel", IEEE Transactions on Information Theory, vol. 57, June 2011, pp. 4219 - 4234.
13. Rahul Vaze and Robert W. Heath Jr., "End-to-End Joint Antenna Selection and Distributed Compress and Forward Strategy for The Multi-Hop Relay Channel", special issue on Cooperative Communication in Eurasip Journal on Wireless Communication and Networking, vol. 2009, Article ID 295418, 12 pages, 2009. **[Won the Eurasip Best Paper Award 2011]**

14. Rahul Vaze and Robert W. Heath Jr., "To Code in Space and Time or Not in a Multi-Hop Relay Channels", *IEEE Transactions on Signal Processing*, vol. 57, July 2009, pp. 3736-2747.
15. Rahul Vaze and B. Sundar Rajan, "On Space-Time Trellis codes Achieving Optimal Diversity Multiplexing Tradeoff", *IEEE Transactions on Information Theory*, Vol.52, No.11, Nov. 2006, pp. 5060 - 5067.

#### Conference

1. "S. Satpathi, R. Nagda and R. Vaze, "Optimal Offline and Competitive Online Strategies for Transmitter-Receiver Energy Harvesting, in Proc. IEEE International Conference on Communications, June 2015.
2. "V. Bagaria, A. Pananjady, and R. Vaze, "The Online Disjoint Set Cover Problem and its Applications, in Proc. IEEE INFOCOM Apr. 2015, Hong Kong.
3. "Subramanian, G. Kanth, S. Moharir, and R. Vaze, "Offline and Online Incentive Mechanism Design for Smart-phone Crowd-sourcing, to appear in Proc. IEEE WIOPT, May 2015, Mumbai
4. "S. Iyer and R. Vaze, "Achieving Non-Zero Information Velocity in Wireless Networks, to appear in Proc. IEEE SPASWIN, May 2015, Mumbai
5. "Kumar, S. Pillai, R. Vaze, and A.Gopalan "Optimal WiFi Sensing via Dynamic Programming, , to appear in Proc. IEEE RAWNET, May 2015, Mumbai.
6. "J. Doshi and R. Vaze, "Long term Throughput and Approximate Capacity of Transmitter-Receiver Energy Harvesting Channel with Fading, in Proc. IEEE ICCS 2014, Macau
7. "R. Vaze and K. Jagannathan "Finite-Horizon Optimal Transmission Policies for Energy Harvesting Sensors, in Proc. IEEE ICASSP 2014, Florence Italy.
8. "N. Ajaykrishnan and N. Prem and V. Prabhakaran and R. Vaze "Critical Database Size for Effective Caching, in Proc. National Conference on Communication, Feb.28-Mar. 2, 2015, IIT-Bombay, Mumbai
9. "Maximizing Utility Among Selfish Users in Social Groups", Ashwin Pananjady (Indian Institute of Technology Madras, India); Vivek Bagaria (Indian Institute of Technology Madras, India); Rahul Vaze (TIFR Mumbai, India), in Proc. Of the National Conference on Communication, Feb.28-Mar. 2, 2014, IIT-Kanpur.
10. "On White-Space Detection, Localization and Coverage", B. Santhana Krishnan, Rahul Vaze, D. Manjunath, in Proc. Of the National Conference on Communication, Feb.28-Mar. 2, 2014, IIT-Kanpur.

11. "On Whitespace Identification Using Randomly", Deployed Sensors Rahul Vaze and Chandra R. Murthy, Proc. of the IEEE Comsnets, Bangalore, Jan 7-10, 2014
12. Rahul Vaze, "Transmission Capacity of Wireless Ad Hoc Networks with Energy Harvesting Nodes," to appear in the Proc. of IEEE Globasip, Dec. 3-5, 2013, Austin, Tx.
13. Rahul Vaze, "Online Power Allocation For Maximizing Mutual Information in Cognitive Radio System," to appear in Proc. of IEEE Wireless Communications and Networking Conference (WCNC), 2013 to be held in Shanghai, Apr. 7-10, 2013.
14. Rahul Vaze, "Competitive Ratio Analysis of Online Algorithms to Minimize Data Transmission Time in Energy Harvesting Communication System", to appear in the Proc. of the IEEE international Conference on Computer Communications (IEEE INFOCOM 2013), Turin, Apr. 14-17, 2013.
15. Naqeeb Warsi, Rahul Vaze, and Tapan Shah, "Communicating Under Channel Phase Uncertainty", in Proc. of the National Conference on Communications, IIT-Delhi, Feb. 2013.
16. Rahul Vaze and Piyush Gupta, "Bounds on Minimum Number of Anchors for Iterative Localization and its Connections to Bootstrap Percolation", invited Paper, IEEE SPCOM 2012, IISc Bangalore, July 2012.
17. Tianyang Bai, Rahul Vaze, and Robert W. Heath, Jr., "Using Random Shape Theory to Model Blockage in Random Cellular Networks", invited Paper, IEEE SPCOM 2012, IISc Bangalore, July 2012.
18. Rahul Vaze, "Percolation and Connectivity on the Signal to interference Ratio Graph", in Proc. of the IEEE international Conference on Computer Communications (IEEE INFOCOM 2012), Orlando, Mar. 25-29, 2012.
19. Rahul Vaze, "Transmission capacity of spectrum sharing ad-hoc networks with multiple antennas", in Proc. of the IEEE international Symposium on Modeling and Optimization in Mobile, Ad Hoc and Wireless Networks (WiOpt), 2011, May 2011, Princeton.
20. Rahul Vaze, "Throughput-delay-reliability tradeoff in ad hoc networks", in Proc. of the IEEE international Symposium on Modeling and Optimization in Mobile, Ad Hoc and Wireless Networks (WiOpt), 2010, Mar. 31- June 4, 2010, Avignon.
21. Rahul Vaze, Kien Truong, Steven Weber, and Robert. W. Heath, Jr., "Two-Way Transmission Capacity of Wireless ad-hoc Networks", in Proc. of the IEEE international Symposium on Information Theory (ISIT), 2010, June 2010, Austin.
22. Rahul Vaze and Robert. W. Heath, Jr., "Transmission Capacity of Multiple Antenna Ad-Hoc Networks without Channel State Information at the Transmitter and interference Cancellation at the Receiver, in Proc. of the Forty Third Asilomar Conference on Signals, Systems and Computers, 2009., 1-4 Nov. 2009, Pacific Grove, CA **invited**.

23. Rahul Vaze and Robert. W. Heath, Jr., "Optimal Amplify and Forward Strategy for Two-Way Relay Channel with Multiple Relays", in Proc. of the IEEE Information Theory Workshop, Volos, Greece, June 2009.
24. Rahul Vaze and Robert. W. Heath, Jr., "How to Use Multiple Antennas in an Ad-Hoc Wireless Network", in Proc. of the IEEE Signal Processing Advances in Wireless Communications, 2009, Perugia, Italy.
25. Rahul Vaze and Robert. W. Heath, Jr., "End-to-end antenna selection strategies for multi-hop relay channels", in Proc. of the IEEE Asilomar Conference On Signals Systems and Computers, 26-29 Oct. 2008, pp. 1506-1510 **invited**.
26. Rahul Vaze and Robert W. Heath Jr., "Maximizing Reliability in Multi-Hop Wireless Networks, in Proc. of the IEEE international Symposium on Information Theory (ISIT 2008), Toronto, Canada, 6-11 July 2008.
27. Rahul Vaze and Robert W. Heath Jr., "To Code or Not to Code in Multi-Hop Relay Channels", IEEE in Proc. of the Communication Theory Workshop (CTW 2008), US. Virgin Islands, 11-14 May 2008.
28. Rahul Vaze and Robert W. Heath Jr., "Capacity Scaling for MIMO Two-Way Relaying", in Proc. of the IEEE international Symposium on Information Theory (ISIT 2007), Nice, France, 24-29 June 2007.
29. Rahul Vaze and B. Sundar Rajan, "On space-time trellis codes achieving optimal diversity-multiplexing tradeoff", in Proc. of the IEEE international Conference on Communications (ICC 2006), Istanbul, Turkey, June 11-15, 2006.
30. Rahul Vaze, V. Shashidhar and B. Sundar Rajan, "A high-rate generalized coded delay diversity scheme and its diversity-multiplexing tradeoff", in Proc. of the IEEE international Conference on Communications (ICC 2005), Seoul, Korea, May 15-19, 2005, pp.448-52.
31. Rahul Vaze and B. Sundar Rajan, "High-rate STBC-MTCM Schemes for Quasi-static and Block-fading channels", in Proc. of the IEEE Global Telecommunications Conference (GLOBECOM 2004), Dallas, Texas, 29 Nov-3 Dec., 2004, pp.535-539.

### Contributions to 802.16-e Standard

- "Enhancement to 3 Tx Open-loop STC Transmission, IEEE 802.16 Broadband Wireless Access Working Group", Rahul Vaze et.al. Beceem Communication together with several other companies.
- "Closed Loop MIMO Precoding, IEEE 802.16 Broadband Wireless Access Working Group", Rahul Vaze et.al Beceem Communication together with several other companies.