

ANURAG KUMAR

(homepage: <http://ece.iisc.ernet.in/~anurag>)

23 U.A.S. Layout	Dept. of Electrical Communication Engineering
R.M.V. Extension, Stage II	Indian Institute of Science
Bangalore 560 094	Bangalore 560 012
India	India
Phone: (+91) 80-2341-5032	Phone: (+91) 80-2360-0855
	Fax: (+91) 80-2360-0991
	e-mail: anurag@ece.iisc.ernet.in

RESEARCH INTERESTS:

- **Communication Networks:** Stochastic modeling, analysis, optimisation and control problems arising in communication networks and distributed systems. Analytical and experimental research in traffic modeling, traffic engineering, and quality of service techniques in communication networks. Optimal resource allocation in wireless access networks, and distributed algorithms for wireless ad hoc networks and wireless sensor networks.

EDUCATION

- *Doctor of Philosophy* in Electrical Engineering, January 1982, Cornell University, Ithaca, New York, U.S.A. *Major area:* Information and Decision Sciences; *Minor area:* Operations Research and Mathematics; (GPA 4.1).
- *Bachelor of Technology* in Electrical Engineering, (first division with distinction, and first rank, with cumulative performance index (CPI) = 10.0 out of 10; President's Gold Medal), May 1977, Indian Institute of Technology (IIT), Kanpur, U.P., India.

PROFESSIONAL EXPERIENCE

- 1 August 2014 – present: Director, Indian Institute of Science (IISc), Bangalore.
- July 2007 – July 2014: Chairman, Division of Electrical Sciences, Indian Institute of Science (IISc), Bangalore.
- January 2004 – July 2007: Chairman, Department of Electrical Communication Engineering, Indian Institute of Science (IISc), Bangalore.
- October 2000 - December 2003: Associate Chairman, Department of Electrical Communication Engineering, Indian Institute of Science (IISc), Bangalore.
- August 2008 - present: Professor - HAG, Department of Electrical Communication Engineering, Indian Institute of Science (IISc), Bangalore.
- October 1997 - present: Professor, Department of Electrical Communication Engineering, Indian Institute of Science (IISc), Bangalore.

- May 1996 - November 1996: Visiting Research Scholar, Wireless Information Network Lab (WINLAB), Rutgers University, Piscataway, N.J., 08854, U.S.A. (On sabbatical from IISc).
- October 1991 - September 1997: Associate Professor, Department of Electrical Communication Engineering, Indian Institute of Science (IISc), Bangalore.
- June 1988 - September 1991: Assistant Professor, Department of Electrical Communication Engineering, Indian Institute of Science (IISc), Bangalore.
- December 1981 - May 1988: Member of Technical Staff, Performance Analysis Department, AT&T Bell Laboratories, Holmdel, New Jersey, U.S.A. *Job Responsibility:* Performance engineering of telecommunication systems, research in stochastic modelling as applied to communication and computer systems.
- July 1979 - June 1980: Visiting research student, Information Systems Laboratory, Dept. of Electrical Engg., Stanford University
- September 1977 - December 1981: Teaching Assistant and Graduate Research Assistant, School of Electrical Engineering, Cornell University.

RESEARCH GUIDANCE

- Ph.D.: 17 awarded, and 2 under supervision. (Six of the Ph.D. theses have won best thesis medals at IISc: Alumni Medal (1996), Seshagiri Kaikini Medals (1996, 1997, 2000, 2005, 2012))
- M.Sc.(Engg.): 5 awarded
- Over 50 M.E. projects supervised

PUBLICATIONS: Books and Papers

- 78 journal papers, 119 refereed conference proceedings papers
- 2 published books, another book manuscript on my website, 2 invited book chapters, 3 conference proceedings edited
- Complete list of publications is attached at the end
- Citations (Google Scholar): 4870; h-index (Google Scholar): 34; i10-index (Google Scholar) 95

FELLOWSHIPS

- J.C. Bose National Fellowship (2011-2021)
- Fellow of the IEEE (Institute of Electrical and Electronics Engineers) (since 2005)
- Fellow of The World Academy of Sciences (TWAS)(since 2013)
- Fellow of the Indian National Science Academy (FNA) (since 2005)

- Fellow of the Indian Academy of Science (FASc) (since 2010)
- Fellow of the Indian National Academy of Engineering (FNAE) (since 1999)
- Fellow of the Institute of Electronics and Telecommunication Engineers (IETE), India (FIETE) (since 1992)

AWARDS and HONORS

- **Professional Awards:**

- VASVIK Award for Information Technology, 2015
- Distinguished Alumnus Award, IIT Kanpur, 2016
- Lifetime Achievement Award, Systems Society of India, 2016
- CDAC-ACCS (Advanced Computer & Communications Society) Foundation Award, 2009
- Indian Institute of Science Alumni Award for Excellence in Engineering Research, 2008
- S.V.C. Aiya Memorial Award (2001) for Excellence in Telecom Education, awarded by the Institution of Electronics and Telecommunications Engineers (IETE), Pune Centre

- **Editorships:**

- Area Editor, IEEE/ACM Transactions on Networking (wireless networks area) (2005-2009)
- Member Editorial Board, IEEE Communications Surveys and Tutorials (2002 – 2007)

- **Best Paper Awards:**

- Best paper award in the COMSNETS 2013 conference (Abhijit Bhattacharya, Akhila Rao, Deeksha G. Rao Sahub, Aniruddha Mallya, Rachit Srivastava, Sanjay M. Ladwa, S.V.R. Anand, and Anurag Kumar “Smart Connect: A System for Design and Deployment of Wireless Sensor Networks,” The 5th International Conference on Communication Systems and Networks (COMSNETS), Bangalore, January 2013)
- Best student paper award in WiOpt 2012 (K.P. Naveen and Anurag Kumar, “Relay Selection with Channel Probing for Geographical Forwarding in Wireless Sensor Networks,” *WiOpt’12: 10th Symposium on Modeling and Optimization in Mobile, Ad Hoc and Wireless Networks*, Paderborn, Germany, May 2012.)
- Best paper award in COMSNETS 2010 conference (Pranav Agrawal, Anurag Kumar, Joy Kuri, Manoj Panda, Ramchandra Ramjee, Vishnu Navda, and Venkat Padmanabhan, “Analytical Models for Energy Consumption in Infrastructure WLAN STAs Carrying TCP Traffic,” The 2nd International Conference on Communication Systems and Networks (COMSNETS), Bangalore, January 2010)
- Best demo/paper award in the WISARD 2010 workshop (“SmartDetect: An Efficient Wireless Sensor Network Implementation for Intrusion Detection,” WISARD, a workshop of COMSNETS, Bangalore, January 2010)

- Best paper award in the WISARD 2009 workshop (Malati Hegde, Pavan Kumar, K. R. Vasudev, S. V. R. Anand, Anurag Kumar, Joy Kuri, “Experiences with WM: A centralised scheduling approach for performance management of IEEE 802.11 wireless LANs,” Proceedings of WISARD, a workshop of COMSNETS, Bangalore, January 2009)
- Best student paper award in COMSNETS 2009 conference (Onkar Bharadwaj, G. V. V. Sharma, Manoj Panda, Anurag Kumar, “Modeling Finite Buffer Effects on TCP Traffic over an IEEE 802.11 Infrastructure WLAN,” The 1st International Conference on Communication Systems and Networks (COMSNETS), Bangalore, January 2009)
- Best paper award in the conference COMSWARE 2008 (Samuel David and Anurag Kumar, “Network Coding for TCP Throughput Enhancement over a Multi-Hop Wireless Network,” Proceedings of COMSWARE’08, Bangalore, January 2008)
- Best paper award: Institute of Electronics and Telecommunication Engineers (IETE) CDIL award (1993) (Anurag Kumar, B. Hareesh Kumar, and B. Madhavi, “Modelling and Performance Analysis of a Digital Switching System - Case Study of the C-DoT DSS”, Special Issue on Telematics of the *Journal of the Institution of Electronics and Telecommunications Engineers*, India, Vol. 39, No. 2, pp 77-97, March - April 1993)

• **Academic Awards:**

- President’s Gold Medal, L.N. Das Memorial Gold Medal, and Proficiency Prize, respectively for the best outgoing undergraduate student, the best undergraduate student in Electrical Engineering (Cumulative Performance Index (CPI) 10.0 out of 10), and best project work in Electrical Engineering, 1977, IIT Kanpur, India
- Merit scholarship at I.I.T. Kanpur for securing the rank of 33 in the IIT Joint Entrance Exam (JEE) 1972
- Silver Medal for securing the First Rank in the Panjab University Pre-Engineering Exam 1972

PATENTS GRANTED or FILED

- Anurag Kumar, S. V. R. Anand, Arun Augustine, Abhijit Bhattacharya, Rohan Krishnakumar, Sanjay Motilal Ladwa, Aniruddha Mallya, Shivanna Manjula, Akhila Suresh Rao, Deeksha G. Rao Sahib, Mohan Shyam, Rachit Srivastava, Senju Thomas Panicker, Lijo Thomas, and Jerry Daniel John, “Method and System for Designing a Multi-Hop Wireless Sensor Network,” Indian Patent Application, December 2012.
- Malati Hegde, Pavan Kumar, K. R. Vasudev, S. V. R. Anand, Arpita Agarwal, Sneha Aggarwal, Arpit Gupta, Sowmya N. Nambissan, Sumankumar Panchal, Anurag Kumar, Joy Kuri, “Methods and Apparatus for ADWISER: An Approach for Internet Access Bandwidth and WLAN Performance Management,” Indian Patent Application No. IP13348 2713/DEL/2009; filed 29.12.2010.
- Malati Hegde, Pavan Kumar, K. R. Vasudev, S. V. R. Anand, Anurag Kumar, and Joy Kuri, “A Centralized Wireless Manager (WiM) for Performance Management Of IEEE 802.11 and a Method thereof,” Indian Patent Application No. IP10607 2898/DEL/2008; filed 19.12.2008; PCT Application No. PCT0921 PCT/IN2009/000637; filed 12.11.2009.

- Anurag Kumar, Santosh P. Abraham, Greg M. Bernstein, Jeffrey T. Gullicksen, Gurpreet S. Chhabra, “Apparatus and Method for Providing Max-Min Fair Rate Control of ABR Sessions,” U.S.A. Patent No. 6,597,662; issued July 2003.

SYSTEM DEVELOPMENT

- *SmartConnect*: Conceptualised and guided the development of this system for the design an analysis of multihop wireless networks for industrial sensor network applications. The system was based on the idea of iteratively building a multihop wireless network on the field by a combination of mathematical models and field measurements. This work was done under a Dept. of IT funded project.
- *WM (WLAN Manager)*: Conceptualised and guided the development of this system for managing the quality of service in an IEEE 802.11 wireless local area network (WLAN). The system is based on the novel idea of an external centralised controller that can manage the network performance without any change in the wireless devices. This work was done under a Dept. of IT funded project. A paper based on the work in this project has won a best paper award (see awards list earlier).
- *NETMASTER*: Conceptualised and guided the development of this system for network monitoring, network quality-of-service management, and network design. Developed initially under the ERNET project at IISc, it was later acquired by Himachal Futuristic Communications Ltd. It was developed into a commercial product, underwent field trials in June and August 2004, and was branded as NETERA-BM.

SPONSORED RESEARCH PROJECTS (Government and Industry) (total research funding obtained: approx. Rs. 10 crores)

- Coinvestigator of a Defence Research and Development Organisation (DRDO) funded project on deployment of wireless sensor networks for intrusion detection, 2013-2017.
- Coinvestigator of a Dept. of Electronics and Information Technology (DeitY, formerly DIT) funded project (Indo-US collaborative project) on Wireless Sensor Networks for Forest and Wildlife Monitoring, Rs. 185 lakhs, 2012-2014.
- Coinvestigator of a Dept. of Science and Technology (DST) funded project (Indo-Brazil collaborative project) on Wireless Sensor Networks for Social Applications, 2010-2013.
- Coinvestigator of a Dept. of Information Technology (DIT) funded project for the development of a centralised quality-of-service manager for IEEE 802.11 wireless local area networks, Rs. 60 lakhs for the period 2010-2012.
- Joint principal investigator of a research project on Emerging Strategies for Wireless Communication Networks, funded by IFCPAR (Indo-French Centre for the Promotion of Advanced Research); the other principal investigator is Dr. Eitan Altman, INRIA, France; Rs. 59 lakhs for the period 2009-2010. The project obtained an **excellent** grading.

- Principal investigator of a Dept. of Information Technology funded project (jointly with C-DAC, Trivandrum) for design and development of sensor networking technology for certain industrial applications. IISc's part of the funding is Rs. 1 crore for 2009-2012.
- Principal investigator of a Microsoft funded research project on the energy consumption modeling of wireless LAN access devices. Rs. 8 lakhs for 2008-9.
- Principal investigator of a DRDO funded research project on Wireless Sensor Networks, a multi-faculty project with 10 other coinvestigators in the areas of communication and networking, operating systems, compilers, electronics and sensors; Rs. 2.7 crores, for the period 2006-2010.
- Coinvestigator of a project on Network Coding for Wireless Networks; Motorola India: Rs. 6.5 lakhs for 2006-2007
- Principal investigator of a Honeywell funded research project on the performance analysis of IEEE 802.15.4 wireless sensor networks for industrial monitoring applications; Rs. 10.5 lakhs for 2005.
- Joint principal investigator of a research project on New Strategies for Wireless Communication Networks, funded by IFCPAR (Indo-French Centre for the Promotion of Advanced Research); the other principal investigator is Dr. Eitan Altman, INRIA, France; Rs. 59 lakhs for the period 2003-2006. The project obtained an **excellent** grading.
- Joint Investigator of an Intel funded project for research on Quality of Service in Wireless Local Area Networks; Rs. 11.5 lakhs for the period 2003-2004; Rs. 12.5 lakhs for 2005-2006.
- Joint Investigator in the Himachal Futuristic Communications Limited (HFCL) – IISc Research Program (HIRP) for research in, and development and productisation of Internet communication technologies: specifically in the areas of Internet edge devices (with emphasis on quality of service and voice over IP), network management and network design; Rs. 71 lakhs for the period 2000-2003.
- Principal investigator of Nortel Networks (USA) funded research projects in the areas: “Assured Service for TCP Controlled Elastic Flows using the Differentiated Services Approach; Techniques for Quality of Service for Guaranteed Delay Services in Packet Networks; Network Based Congestion Control in the Internet; Performance of TCP over the ABR Service in an ATM Network; Traffic Control in ATM Networks,” Rs. 80 lakhs for the period 1996-2001.
- Principal investigator of an Intel Asia funded project on “Internet Service Provider Architecture,” Rs. 15 lakhs (equipment and funds) for the period 1999-2000.
- Coordinator of the Ministry of Information Technology's ERNET (Education and Research NETwork) project site at IISc (June 1989 - December 2002). The project group at IISc has equipment worth Rs. 100 lakhs, receives annual grants averaging to about Rs. 20 lakhs, and employs 7 full-time project engineers.

INDUSTRIAL CONSULTANCY

- TETCOS, Bangalore, April 2004 - ongoing: Advice on the development of a network simulation software package.
- Bell Laboratories, January 2006 - December 2006: Design and analysis of rural wireless broadband networks.
- Airtight Networks, Pune, 2005-2006: Advice on monitoring and performance aspects of wireless local area networks.
- Satyam Computers, February 2004 - January 2006: Modeling and performance analysis of communication network subsystems.
- Philips Telekom, Germany (1994 - 1996): Traffic engineering of a cell in the GSM system for mobile telephony, with full rate and half rate coded mobile stations. (Joint work with Dr. Kumar N. Sivarajan.)
- ITI, Bangalore (1994 - 1996): Performance analysis and performance optimisation of the call processing subsystem of the ITI Digital Switching System.
- SONATA (software division of IOCL), Bangalore (1993): Advice in the development of a Local Area Network simulation package.
- WIPRO Information Technologies, Bangalore (1991): Performance analysis of WIPRO's multiprocessor system architecture.
- C-DOT (Centre for Development of Telematics) (1989 - 1990): Performance analysis, performance optimisation, and development of overload controls for the call processing subsystem of the C-DOT Digital Switching System.

COURSES TAUGHT

- Probability Theory, Information Theory, Communication Networks, Stochastic Processes and Queuing Theory, Advanced Topics in Communication Networks, Statistical Theory of Communication, Switching and Statistical Multiplexing in Telecommunication Networks, Wireless Networking, Random Processes.

OTHER PROFESSIONAL ACTIVITIES

- Member IEEE Communications Society Fellows Evaluation Committee
- Member IEEE Koji Kobayashi Award Committee
- Member IEEE/ACM Transactions on Networking (TON) Steering Committee 2010-2014
- Co-General Chair, COMSNETS 2011, Bangalore, January 2011.
- Co-General Chair, International Conference on Distributed Computing and Networking (ICDCN), Kolkata, January 2010.

- President, COMSNETS Association, since 2009; COMSNETS Association organises the annual series of COMSNETS conferences on communication systems and networks.
- General Chair, Conference on Managing Complexity in a Distributed World (MCDES), the IISc Centenary Conference of the Division of Electrical Sciences, IISc, May 2008.
- Member (by invitation) of the IFIP (International Federation of Information Processing) WG 7.3 on Computer Performance Modeling and Analysis
- Co-General Chair, IEEE Workshop on Information Theory, Bangalore, October 2002.
- Co-Chairman, Program Committee, International Conference on Communications, Control and Signal Processing (CCSP2000), Bangalore, India, July 2000
- Chairman, Program Committee, Conference on Signal Processing, Communications, and Networking (SPCOM) , Bangalore, India, July 1997
- Chairman, Organizing Committee, International Teletraffic Congress (ITC) sponsored seminar on Teletraffic Analysis Methods, Bangalore, India, November 1993
- Member of program committees of several workshops and conferences
- Reviewer for various journals and magazines of IEEE, ACM, IETE, and the Computer Society of India

RECENT PROFESSIONAL VISITS OUTSIDE INDIA

- University of Avignon, France, May-June 2014 (research interaction under Indo-French project)
- Ohio State University, Columbus, Ohio, July 2013: for collaboration under an Indo-US (DeitY-NSF) collaborative project on Wireless Sensor Networks for Protecting Wildlife and Humans.
- Hamilton Institute, National University of Ireland, Maynooth, under invitation to speak at a workshop on Network Science, December 2011.
- University of Avignon, France, May 2011 (research interaction under Indo-French project)
- University of Avignon, France, June 2008 (research interaction under Indo-French project)
- Seoul National University, South Korea, May 2007 (invited lectures)
- University of Cyprus, Nicosia, April 2007 (invited lecture, and promotion committee)
- University of Avignon, France, June 2006 (research interaction under Indo-French project)
- INRIA (National Institute for Research in Information and Automation), Sophia-Antipolis, France, October-November, 2003 (research interaction under Indo-French project)
- Coordinated Sciences Lab, University of Illinois, Urbana-Champaign, USA, May-July 2003 (sabbatical)

- AT&T Shannon Labs, University of Pennsylvania, IBM Research Labs, and University of Illinois, Urbana-Champaign, all in USA, during June 2002 (to give talks)
- Nortel Networks, USA and Canada; several visits during 1996 to 2000 (in connection with research projects)
- INRIA (National Institute for Research in Information and Automation), Sophia-Antipolis, France (September 2000) (invited talks)
- Wireless Information Networks Lab (WINLAB), Rutgers University, New Jersey, U.S.A (June 1996 to December 1996) (sabbatical)
- Ecole Polytechnic, University of Montreal, Montreal, Canada (June 1997) (research discussions)
- AT&T Bell Laboratories, Holmdel, N.J., USA (June 1994) (for talks)
- Institute of System Sciences, National University of Singapore, Singapore (June 1993) (invited lectures)

SOME RECENT LECTURES AND KEYNOTE TALKS OUTSIDE IISc

- *Cyber Physical Systems over the Internet of Things*, Prof. A.C. Joshi Memorial Lecture, Panjab University, Chandigarh, 22 September 2016.
- *Towards World Class Institutions of Higher Education in Science and Engineering*, Indian National Academy of Engineering, Engineers Conclave 2016, 2 September 2016.
- *The Internet of Things: Technology and Prospects*, The Bangalore Science Forum, 23 July 2016
- *Design and Deployment of IEEE 802.15.4 (Zigbee) Wireless Networks for Internet of Things Applications*, Keynote at UbiComp, organised by Centre for Development of Telematics, Bangalore, 27 May 2016.
- *Internet of Things: Technology and Prospects*, Texas Instruments Developers Conference, 25 February 2016
- *Design and Deployment of IEEE 802.15.4 (Zigbee) Wireless Networks for Internet of Things Applications*, University of Melbourne, 28 January 2016.
- *Internet of Things: Technology and Prospects*, CSIR Foundation Day Lecture, National Aerospace Laboratories, 28 September 2015.
- *Internet of Things: Technology and Prospects*, Defence Science Forum, DRDO, New Delhi, 28 January 2015.
- *Design and Deployment of IEEE 802.15.4 (Zigbee) Wireless Networks for Internet of Things Applications*, Xerox Research Centre in India, Bangalore, 22 January 2015.

- *Internet of Things: Technology and Prospects*, International Conference on Emerging Electronics, Bangalore, 4 December 2014.
- *Internet of Things: Technology and Prospects*, Keynote at ACCS ADCOM Conference, Bangalore, 20 September 2014.
- *Design and Deployment of IEEE 802.15.4 (Zigbee) Wireless Networks for Internet of Things Applications*, Corporate Research, Robert Bosch Engineering Centre, Bangalore, 16 June 2014.
- *The Internet of Things*, The Second Annual Workshop of the National Knowledge Networks, IISc, Bangalore, 18 October 2013.
- *SmartConnect: A System for the Design and Deployment of Multihop Wireless Networks for Sensor Interconnection*, Cyber Physical Systems Workshop, IIT Hyderabad, 22 March 2013
- *Co-evolution of Content Popularity and Delivery in Mobile Opportunistic Networks*, keynote talk in the RAWNET Workshop, WiOpt Conference, Tsukuba Science City, Japan, May 2013.
- *Co-evolution of Content Popularity and Delivery in Mobile Opportunistic Networks*, Texas A&M University, USA, 25 October 2012.
- *Optimal Forwarding in Networks with Intermittent Links*, Workshop on Network Science, Hamilton Institute, National University of Ireland, 22-23 August, 2011.
- *Wireless Sensor Networks: Pervasive Systems for Measurement and Inference*, Invited Plenary Talk, International Conference on Methods and Models in Computer Science (ICM2CS-09), December 14-15, 2009 Jawaharlal Nehru University, New Delhi, India
- *Wireless Sensor Networks for Intrusion Detection*, keynote talk, COMSWARE 2008, Bangalore
- *Wireless Local Area Networks, and Wireless Sensor Networks*, Seoul National University, South Korea, May 2007
- *Wireless Sensor Networks*, University of Cyprus, Nicosia, April 2007
- *Wireless Sensor Networks: Pervasive Systems for Monitoring and Inference*, keynote talk, Willopan 2007 (in COMSWARE 2007), Bangalore
- *Modeling and Optimisation of Wireless Sensor Networks for Monitoring and Detection*, invited plenary talk, Wireless Networking Summit, Goa, April 8-9, 2006.
- *Optimising Network Delay in Sequential Detection on Ad Hoc Wireless Sensor Networks*, Workshop on Wireless Communications and Sensor Networks, TIFR, Mumbai, March 3, 2006.
- *Wireless Networking: The New Frontier*, Invited Talk, DST-GOF Indo-UK Workshop, IIT Madras, Jan 29 – Feb 2, 2006.

- *IEEE 802.11 Wireless Networks: New Insights from Stochastic Models*, Keynote Lecture, National Conference on Communications, January 27-29, 2006.
- *Wireless Networking: The New Frontier* Keynote address, Workshop on Wireless Networks and Network Security, IETE Bangalore Centre, October 22, 2005.
- *Analysis and Optimisation of IEEE 802.11 WLANs*, Keynote Lecture, WiOpt 2005 Symposium, Riva Del Garda, Italy, April 2005.
- *Wireless Networking: The New Frontier*, Centre for Development of Advanced Computing, Pune Campus, May 5, 2004, and ITI Bangalore, May 17, 2004, on the occasion of World Telecom Day.
- *Optimal Buffer Scheduling over a Fading Wireless Link*, National Institute of Standards and Technology (NIST), Gaithersburg, Maryland, USA, July 2003.
- *Long Range Dependence in Network Traffic and the Closed Loop Analysis of Buffers under Adaptive Window Control*, Institute for Systems Research, University of Maryland, College Park, MD, USA, July 2003.
- *Long Range Dependence in Network Traffic and the Closed Loop Analysis of Buffers under Adaptive Window Control*, Coordinated Sciences Lab, University of Illinois, Urbana-Champaign, USA, June 2003.
- *Telecommunication Networks: A Canvas for Analytical Research*, Keynote Lecture, National Conference on Communications, 2003, IIT Madras, January 2003.
- *Internet Performance and Traffic Engineering: Insights from Stochastic Models*, Cisco Systems, Bangalore, March 2002; University of Pennsylvania, Philadelphia, June 13, 2002; AT&T Labs Research, Florham Park, New Jersey, June 14, 2002; Lucent Bell Laboratories, New Jersey, June 14, 2002; University of Illinois at Urbana-Champaign, June 17, 2002; IBM T.J. Watson Research Centre, New York, June 20, 2002.
- *Intelligent Internet Traffic Engineering: A Model Based Approach*, Invited Talk, High Performance Computing Conference, December 2001
- *Wireless Ad Hoc Internet and Sensor Networks: Progress and Challenges*, Keynote Talk, Workshop on Ad Hoc Networking, Bhubaneswar, December 2001
- *Innovations for Intelligent Internet Engineering*, S.V.C. Aiya Award Conferral Talk, Institute of Electronics and Telecom Engineers, Pune, September 2001

Publications of Prof. ANURAG KUMAR

• Books

1. Anurag Kumar, D. Manjunath, and Joy Kuri, *Communication Networking: An Analytical Approach*, published by Morgan Kaufman Publishers (a division of Elsevier Science) in the Morgan Kaufman Networking Series (edited by David Clark), May 2004, 929 pages.
 - In addition to its use in graduate programs in India (including the Visvesvaraiya Technological University, Karnataka), this book has been used as a text book in California Institute of Technology, Drexel University, University of Maryland (College Park), Rensselaer Polytechnic Institute, University of California (Riverside), Rice University, University of Toronto, and University of Waterloo.
2. Anurag Kumar, D Manjunath, and Joy Kuri, *Wireless Networking*, published by Morgan Kaufman Publishers (a division of Elsevier Science) in the Morgan Kaufman Networking Series (edited by David Clark), March 2008, 450 pages.
 - This book has been used as a text book in Wayne State University, University of South Florida, Minnesota State University, Johns Hopkins University, and Auburn University. In May 2012, the Korea Advanced Institute of Science and Technology (KAIST) ran a course based (chapter-by-chapter) on this book; this course was instructed by and attended by professors from several academic institutions in Korea.
3. Anurag Kumar, *Discrete Event Stochastic Processes: Lecture Notes for an Engineering Curriculum*, 2012; manuscript available on the author's homepage.

• Invited Book Chapters and Survey/Tutorial Papers

1. Anurag Kumar and D. Manjunath, "A Tutorial Survey of Topics in Wireless Networking," *Sādhanā*, Indian Academy of Sciences Proceedings in Engineering Sciences, Vol. 32, No. 6, December 2007.
2. Anurag Kumar and Aditya Karnik, "Performance Analysis of Wireless Ad Hoc Networks," *The Handbook of Ad Hoc Networks*, CRC Press, December 2002.

• Conference Proceedings Edited

1. Anurag Kumar and V.U. Reddy, *International Conference on Communications Control and Signal Processing*, Bangalore, July 2000.
2. Anurag Kumar and V.U. Reddy, *Signal Processing, Communications and Networking*, Bangalore, July 1997.
3. Sanjay K. Bose and Anurag Kumar, *ITC Seminar on Teletraffic Analysis Methods for Current and Future Telecom Networks*, Bangalore, November 1993.

• Papers in preparation, or under review

1. Avinash Mohan, Arpan Chattopadhyay, and Anurag Kumar, "Low-Delay Decentralised MAC protocols for Time-Slotted Collocated Wireless Nodes," in preparation.

2. K. P. Naveen and Anurag Kumar, "Coverage Properties of One-Dimensional, Infrastructure-Based, Multi-Hop Wireless Access Networks," in preparation.

• **Journal Papers**

- J1. Arpan Chattopadhyay, Avishek Ghosh, and Anurag Kumar, "Asynchronous Stochastic Approximation Based Learning Algorithms for As-You-Go Deployment of Wireless Relay Networks Along a Line," *IEEE Transactions on Mobile Computing*, accepted for publication.
- J2. Abhijit Bhattacharya and Anurag Kumar, "Analytical Modeling of IEEE 802.11-Type CSMA/CA Networks with Short Term Unfairness," *IEEE/ACM Transactions on Networking*, accepted for publication, 2017.
- J3. Avishek Ghosh, Arpan Chattopadhyay, Anish Arora, and Anurag Kumar, "Measurement Based As-You-Go Deployment of Two-Connected Wireless Relay Networks," *ACM Transactions on Sensor Networks*, vol. 13, no. 3, July 2017.
- J4. Samrat Mukhopadhyay, Pramod M.J., Anurag Kumar, "Approximate Mean Delay Analysis for a Signalized Intersection with Indisciplined Traffic," *IEEE Transactions on Intelligent Transportation Systems*, accepted for publication, 2017.
- J5. Albert Sunny, Sumankumar Panchal, Nikhil Vidhani, Subhashini Krishnasamy, S.V.R. Anand, Malati Hegde, Joy Kuri, Anurag Kumar, "A generic controller for managing TCP transfers in IEEE 802.11 infrastructure WLANs," *Journal of Network and Computer Applications (Elsevier)*, vol. 93, pages 13-26, 2017.
- J6. Naveen Kolar Purushothama, Eitan Altman, Anurag Kumar, "Competitive Selection of Ephemeral Relays in Wireless Networks," *IEEE Journal on Selected Areas in Communications (JSAC)*, special issue on Game Theory for Networks, vol. 35, no. 3, pages 586-600, March 2017.
- J7. Arpan Chattopadhyay, Abhishek Sinha, Marceaux Coupechoux, and Anurag Kumar, "Deploy-As-You-Go Wireless Relay Placement: An Optimal Sequential Decision Approach using the Multi-Relay Channel Model," *IEEE Transactions on Mobile Computing*, vol. 16, no. 2, pages 341-354, February, 2017.
- J8. Chandramani Singh, Santosh Ramachandran, S. V. R. Anand, Malati Hegde, Anurag Kumar, Rajesh Sundaresan "Neighbor Oblivious and Finite-State Algorithms for Circumventing Local Minima in Geographic Forwarding," *Ad Hoc Networks*, (an Elsevier Journal), vol. 50, pages 1-12, 2016.
- J9. Arpan Chattopadhyay, Marceaux Coupechoux, and Anurag Kumar, "Sequential Decision Algorithms for Measurement-Based Impromptu Deployment of a Wireless Relay Network along a Line," *IEEE/ACM Transactions on Networking*, vol. 24, no. 5, pages 2954-2968, October, 2016.
- J10. Chandramani K. Singh, Anurag Kumar, and Rajesh Sundaresan, "Combined Base Station Association and Power Control in Multi-channel Cellular Networks," *IEEE/ACM Transactions on Networking*, vol. 24, no. 2, pp. 1065-1080, April 2016.
- J11. Rachit Srivastava, Sanjay Motilal Ladwa, Abhijit Bhattacharya, Anurag Kumar, "A Fast and Accurate Performance Analysis of Beaconless IEEE 802.15.4 Multi-Hop Networks," *Ad Hoc Networks*, (an Elsevier Journal), vol. 37, pages 435-459, 2016.

- J12. Abhijit Bhattacharya and Anurag Kumar, "An Approximation to the QoS Aware Throughput Region of a Tree Network under IEEE 802.15.4 CSMA/CA with Application to Wireless Sensor Network Design," *Ad Hoc Networks*, (an Elsevier Journal), vol. 33, pages 35-54, 2015.
- J13. K.P. Naveen and Anurag Kumar, "Relay Selection with Channel Probing in Sleep-Wake Cycling Wireless Sensor Networks," *ACM Transactions on Sensor Networks (TOSN)*, Vol. 11, No. 3, Article 52, 38 pages, May 2015.
- J14. Manoj Panda and Anurag Kumar, "Cell-Level Modeling of 802.11 WLANs," *Ad Hoc Networks*, (an Elsevier Journal), vol. 25, pages 84-101, 2015.
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• **Refereed Papers in Conferences/Workshops with Published Proceedings**

- C1. K. P. Naveen and Anurag Kumar, "Coverage Properties of One-Dimensional Infrastructure-Based Wireless Networks," *The 19th ACM International Conference on Modeling, Analysis and Simulation of Wireless and Mobile Systems (ACM MSWIM)*, Malta, November 2016. **Shortlisted among four papers for the best paper award**
- C2. Avinash Mohan, Arpan Chattopadhyay, and Anurag Kumar, "Hybrid MAC Protocols for Low-Delay Scheduling," *Proceedings 13th IEEE International Conference on Mobile Ad Hoc and Sensor Systems (IEEE MASS)*, Brasilia, Brazil, 10-13 October 2016.
- C3. Abhijit Bhattacharya and Anurag Kumar, "Mean Delay Analysis of Cache Assisted File Transfers Over the Internet," *Proceedings of the Conference on Signal Processing, Communications, and Networking (SPCOM 2016)*, Bangalore, 2016.
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- C5. Samrat Mukhopadhyay, Pramod M.J., Anurag Kumar, "An Approach for Analysis of Mean Delay at a Signalized Intersection with Indisciplined Traffic," Workshop on Intelligent Transportation Systems, COMSNETS 2015, Bangalore, January 2015.
- C6. Arpan Chattopadhyay, Avishek Ghosh, Akhila S. Rao, Bharat Dwivedi, S.V.R. Anand, Marceau Coupechoux, and Anurag Kumar, "Impromptu Deployment of Wireless Relay Networks: Experiences Along a Forest Trail," in *MASS 2014, IEEE International Conference on Mobile Ad hoc and Sensor Systems*, Philadelphia, Pennsylvania, USA, October 2014.
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- C13. K.P. Naveen and Anurag Kumar, “Relay Selection with Channel Probing for Geographical Forwarding in Wireless Sensor Networks,” *WiOpt’12: 10th Symposium on Modeling and Optimization in Mobile, Ad Hoc and Wireless Networks*, Paderborn, Germany, May 2012. **Best Student Paper Award**
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