Sanket S. Kalamkar

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Google Scholar

Profile

- Modeling and analyzing wireless networks such as cellular, D2D, and vehicular networks
- Designing and simulating wireless algorithms
- PHY simulation using MATLAB
- Author of 27 technical papers published in reputed journals and conferences

Technical Skills

- Physical layer architecture and design: Multiple antenna systems, WiFi standards, 3GPP standards (3G, 4G, 5G NR), V2X standards
- Wireless communications, digital communications, information theory, stochastic processes
- Mathematical tools: Stochastic geometry, probability, linear algebra
- Programming skills: MATLAB, Link- and system-level simulations

Education

Indian Institute of Technology Kanpur (IIT Kanpur) Kanpur, India
Doctor of Philosophy (PhD) in Electrical Engineering *July 2009 – May 2016*
Thesis title: On Cooperation, Energy Harvesting, and Security in Cognitive Radio Networks
Advisor: Prof. Adrish Banerjee

College of Engineering Pune Pune, India
Bachelor of Technology (BTech) in Electronics and Telecommunications *July 2005 – May 2009*

Research Experience

INRIA Paris & The University of Texas at Austin Paris, France & Austin, USA
Postdoctoral Researcher (Host: Prof. François Baccelli) *October 2018 - Present*

- *Responsibility*: Modeling and analysis of large wireless networks including cellular and D2D networks.
- *Key achievement*: Proposed a first mathematical optimization framework to analyze the system-level performance of beam management in 5G NR. Taking into account several key aspects of 5G network such as beamforming, network geometry, user mobility and associated handover costs, and blockages, the proposed optimization yields the number of beams at the base station and the user that maximizes the effective rate of downlink transmissions to the directional user. The model complements and helps guide complex and time-consuming system-level simulations.

  Proposed an analytical model for bandwidth allocation for heterogeneous D2D users inspired by bandwidth part in wireless networks — a new adaptive feature in 5G NR. The analysis helps understand the key dependencies between network parameters and also provides insights into the reliability and delay performance of wireless networks. For example, we showed that the bandwidth part could be useful to both users and service providers (leading to higher revenue).

University of Notre Dame Notre Dame, IN, USA
Postdoctoral Research Associate (Host: Prof. Martin Haenggi) *August 2016 - September 2018*

- *Responsibility*: Modeling and analysis of a wide range of wireless networks such as 5G, cellular, and vehicular networks. Provide guidelines for system-level simulations that can help reduce the cost of performing simulations.

- *Key achievement*: Proposed a fundamental performance metric called the *spatial outage capacity*, which answers a practically relevant question: "What is the maximum user-capacity of a wireless network given a certain reliability constraint?" The metric has applications in 5G, ad hoc, and vehicular networks.

Indian Institute of Technology Kanpur (IIT Kanpur) Kanpur, India
Doctoral Research *July 2009 - May 2016*

- Blended intra- and inter-network cooperation with energy harvesting techniques to improve energy and spectrum efficiency in cognitive radio networks.
- Answered questions on the trade-off between cooperation in heterogeneous networks and security under the constraint of energy efficiency.
- Proposed resource allocation schemes to optimally use energy, time, and cooperating users across different networks.

Giant Metrewave Radio Telescope (GMRT) Pune, India
Undergraduate Research *July 2008 - May 2009*

- Designed a low-cost noise detector and clipper to detect and mitigate radio frequency (RF) interference due to high voltage power lines passing near GMRT.
- Built hardware such as AM detector, filters, and noise clipper, all working at 70 MHz, for onsite deployment.

Teaching Experience

Indian Institute of Technology Kanpur Kanpur, India
Tutor and Teaching Assistant *July 2009 - May 2014*

- **Tutor**: Took one lecture per week to teach different numerical examples that helped undergraduate students understand the theory taught in the class. Graded final exams
  - Introduction to Electronics; number of students: 40
  - Principles of Communication; number of students: 20
- **Teaching Assistant (Courses)**: Prepared assignments and graded quizzes
  - Information and Coding Theory (Graduate course); number of students: 16
  - Applied Game Theory (Graduate course); number of students: 53
  - Photonics Networks and Switching (Graduate course); number of students: 21
- **Teaching Assistant (Laboratory)**: Designed experiments and conducted laboratories
  - Developed Brihaspati laboratory, a web-based E-learning system at IIT Kanpur
  - Taught basic Electronics experiments to sophomores
  - Designed new experiments for the instrumentation laboratory

Awards

Best Paper Award in IEEE GLOBECOM	2020
Simons Postdoctoral Fellowship	2018
Tata Consultancy Services (TCS) Research Fellowship	2013 - 2016
Government of India PhD Scholarship	2009 - 2012
Dhirubhai Ambani Undergraduate Scholarship	2005 - 2009
All India Rank 151 out of 41,945 students in Graduate Aptitude Test in Engineering	2009
Ranked 13th among 200,000 candidates in Higher Secondary Examination	2005
Top 1% in National Chemistry Olympiad	2005
IEEE ComSoc Student Travel Grant for IEEE GLOBECOM	2015
International Travel Grant from the Government of India for IEEE GLOBECOM	2015

Publications

Journal papers:

1. **S. S. Kalamkar** and M. Haenggi, "Per-link reliability and rate control: Two facets of the SIR meta distribution," *IEEE Wireless Communications Letters*, vol. 8, no. 4, pp. 1244-1247, August 2019.
2. **S. S. Kalamkar** and M. Haenggi, "Simple approximations of the SIR meta distribution in general cellular networks," *IEEE Transactions on Communications*, vol. 67, no. 6, pp. 4393-4406, June 2019.
3. K. Pathak, **S. S. Kalamkar**, and A. Banerjee, "Optimal user scheduling in energy harvesting wireless networks," *IEEE Transactions on Communications*, vol. 66, no. 10, pp. 4622-4636, October 2018.
4. **S. S. Kalamkar** and M. Haenggi, "The spatial outage capacity of wireless networks," *IEEE Transactions on Wireless Communications*, vol. 17, no. 6, pp. 3709-3722, June 2018.
5. **S. S. Kalamkar** and A. Banerjee, "Interference-aided energy harvesting: Cognitive relaying with multiple primary transceivers," *IEEE Transactions on Cognitive Communications and Networking*, vol. 3, no. 3, pp. 313-327, September 2017.
6. **S. S. Kalamkar** and A. Banerjee, "Secure communication via a wireless energy harvesting untrusted relay," *IEEE Transactions on Vehicular Technology*, vol. 66, no. 3, pp. 2199-2213, March 2017.
7. **S. S. Kalamkar**, J. P. Jeyaraj, A. Banerjee, and K. Rajawat, "Resource allocation and fairness in wireless powered cooperative cognitive radio networks," *IEEE Transactions on Communications*, vol. 64, no. 8, pp. 3246-3261, August 2016.
8. **S. S. Kalamkar**, A. K. Gupta, and A. Banerjee, "Impact of antenna correlation on optimum improved energy detector in cognitive radio," *IEICE Transactions on Communications*, vol. E98-B, no. 8, pp. 1690-1699, August 2015.
9. H. Pradhan, **S. S. Kalamkar**, and A. Banerjee, "Sensing-throughput tradeoff in cognitive radio with random arrivals and departures of multiple primary users," *IEEE Communications Letters*, vol. 19, no. 3, pp. 415-418, March 2015.
10. J. P. Jeyaraj, **S. S. Kalamkar**, and A. Banerjee, "Energy harvesting cognitive radio with channel-aware sensing strategy," *IEEE Communications Letters*, vol. 18, no. 7, pp. 1171-1174, July 2014.
11. **S. S. Kalamkar** and A. Banerjee, "Improved double threshold energy detection for cooperative spectrum sensing in cognitive Radio," *Defence Science Journal (Special Issue on Communication Systems and Image Processing Technologies)*, vol. 63, no.1, pp. 34-40, January 2013.

Papers (under review/to be submitted):

1. **S. S. Kalamkar**, F. Baccelli, F. M. Abinader Jr., A. S. Marcano Fani, and L. G. Uzeda Garcia, "Beam Management in 5G: A Stochastic Geometry Analysis," *IEEE Transactions on Wireless Communications.*
2. F. Baccelli and **S. S. Kalamkar**, "On point processes defined by angular conditions on Delaunay neighbors in the Poisson-Voronoi tessellation," *Journal of Applied Probability.*
3. K. Pathak, **S. S. Kalamkar**, and A. Banerjee, "Energy-efficient user scheduling in energy harvesting wireless networks."

Conference papers:

1. **S. S. Kalamkar**, F. M. Abinader Jr., F. Baccelli, A. S. Marcano Fani, and L. G. Uzeda Garcia, "Stochastic geometry-based modeling and analysis of beam management in 5G," in 2020 *IEEE Global Communications Conference* (GLOBECOM'20), (Taipei, Taiwan), December 2020. (**Best paper award**)

2. F. Baccelli and **S. S. Kalamkar**, "Bandwidth allocation and service differentiation in D2D wireless networks," in 2020 *IEEE International Conference on Computer Communications* (INFOCOM'20) (Virtual conference), July 2020.
3. **S. S. Kalamkar**, "Reliability and local delay in wireless networks: Does bandwidth partitioning help?," in 2019 *IEEE Global Communications Conference* (GLOBECOM'19), (Waikoloa, HI), December 2019.
4. **S. S. Kalamkar** and M. Haenggi, "A simple approximation of the meta distribution for non-Poisson cellular networks," in 2018 *IEEE International Conference on Communications* (ICC'18), (Kansas City, MO), May 2018.
5. **S. S. Kalamkar** and M. Haenggi, "Distributed rate control for high reliability in Poisson bipolar networks," in 2017 *IEEE Global Communications Conference* (GLOBECOM'17), (Singapore), December 2017.
6. V. Gupta, **S. S. Kalamkar**, and A. Banerjee, "On secure communication using RF energy harvesting two-way untrusted relay," in 2017 *IEEE Global Communications Conference* (GLOBECOM'17), (Singapore), December 2017.
7. **S. S. Kalamkar** and M. Haenggi, "Spatial outage capacity of Poisson bipolar networks," in 2017 *IEEE International Conference on Communications* (ICC'17), (Paris, France), May 2017.
8. **S. S. Kalamkar** and A. Banerjee, "Interference-assisted wireless energy harvesting in cognitive relay network with multiple primary transceivers," in 2015 *IEEE Global Communications Conference* (GLOBECOM'15), (San Diego, CA), December 2015.
9. **S. S. Kalamkar**, S. Majhi, and A. Banerjee, "Outage analysis of spectrum sharing energy harvesting cognitive relays in Nakagami-m channels," in 2015 *IEEE Global Communications Conference* (GLOBECOM'15), (San Diego, CA), December 2015.
10. J. P. Jeyaraj, **S. S. Kalamkar**, and A. Banerjee, "On information and energy cooperation in energy harvesting cognitive radio," in 2015 *IEEE International Symposium on Personal, Indoor and Mobile Radio Communications* (PIMRC'15), (Hong Kong), August 2015.
11. S. Majhi, **S. S. Kalamkar**, and A. Banerjee, "Secondary outage analysis of amplify-and-forward cognitive relays with direct link and primary interference," in 2015 *National Conference on Communications* (NCC'15), (Mumbai, India), February 2015.
12. **S. S. Kalamkar** and A. Banerjee, "On the effect of primary user traffic on secondary throughput and outage probability under Rayleigh flat fading channel," in 2014 *International Conference on Signal Processing and Communications* (SPCOM'14), (Bangalore, India), July 2014.
13. **S. S. Kalamkar**, P. K. Singh, and A. Banerjee, "Block outlier methods for malicious user detection in cooperative spectrum sensing," in 2014 *IEEE Vehicular Technology Conference* (VTC-Spring'14), (Seoul, South Korea), May 2014.
14. **S. S. Kalamkar**, A. Banerjee, and A. K. Gupta, "SNR wall for generalized energy detection under noise uncertainty in cognitive radio," in 2013 *Asia-Pacific Conference on Communications* (APCC'13), (Bali, Indonesia), August 2013.
15. **S. S. Kalamkar** and A. Banerjee, "On the performance of generalized energy detector under noise uncertainty in cognitive radio," in 2013 *National Conference on Communications* (NCC'13), (New Delhi, India), February 2013.
16. **S. S. Kalamkar**, A. Banerjee, and A. Roychowdhury, "Malicious user suppression for cooperative spectrum sensing in cognitive radio networks using Dixon's outlier detection method," in 2012 *National Conference on Communications* (NCC'12), (Kharagpur, India), February 2012.

Papers (under review):

1. G. Ghatak, **S. S. Kalamkar**, Y. Gupta, and S. Sharma, "A fine-grained analysis of radar detection in vehicular networks," in 2021 *IEEE International Conference on Communications* (ICC'21), (Montreal, Canada), June 2021.

Talks

1. "Beam management in 5G." Laboratory of Information, Networking and Communication Sciences (LINCS), Paris, France, May 2020.
2. "Fine-grained analysis of wireless networks: Spatial outage capacity and rate control." Laboratory of Information, Networking and Communication Sciences (LINCS), Paris, France, June 2019.
3. "Fine-grained analysis of wireless networks: Spatial outage capacity and rate control." IIT Madras, Chennai, India, February 2019.

Student Mentoring

- Student: Jeya Pradha Jeyaraj - Mentored Jeya on her Master's thesis at IIT Kanpur, which resulted in a journal paper and a conference paper.
- Student: Hrusikesha Pradhan - Mentored Hrusikesha on his Master's thesis at IIT Kanpur, which resulted in a journal paper.
- Student: Praveen Kumar Singh - Mentored Praveen on his Master's thesis at IIT Kanpur, which resulted in a conference paper.
- Student: Vipul Gupta - Mentored Vipul on his Master's thesis at IIT Kanpur, which resulted in a conference paper.
- Student: Sudhakar Reddy Sirigireddy - Mentored Sudhakar on his Master's thesis at IIT Kanpur. The work is to be submitted to a journal.
- Student: Ananya Roychowdhury - Mentored Ananya's internship at IIT Kanpur, which resulted in a conference paper.

Professional Activities

Editor:

- Sensors — Topic editor
- Sensors — Editor for special issue on "Energy-Efficient Communications for beyond 5G Green Networks"

Technical Program Committee (TPC) Member:

- IEEE Global Communications Conference (GLOBECOM) — 2017, 2018, 2019, 2020
- IEEE Wireless Communications and Networking Conference (WCNC) — 2021
- IEEE Vehicular Technology Conference (VTC-Fall) — 2018, 2019
- IEEE Vehicular Technology Conference (VTC-Spring) — 2018
- The Workshop on Spatial Stochastic Models for Wireless Networks (SPASWIN) — 2020
- International Conference on Wireless Personal Multimedia Communications (WPMC) — 2017, 2019
- IEEE International Conference on Advanced Networks and Telecommunications Systems (ANTS) — 2020
- IEEE 5G World Forum (WF-5G) — 2018, 2019, 2020

Reviewer (Journals):

• IEEE Journal on Selected Areas in Communications • IEEE Transactions on Wireless Communications • IEEE Transactions on Communications • IEEE Transactions on Signal Processing • IEEE Transactions on Cognitive Communications and Networking • IEEE Transactions on Vehicular Technology • IEEE Transactions on Information Forensics and Security • IEEE Wireless Communications Letters • IEEE Communications Letters • IEEE Signal Processing Letters • IET Communications • Physical Communication • Transactions on Emerging Telecommunications Technologies • Wireless

Communications and Mobile Computing • Wireless Networks • Performance Evaluation • Frontiers in Communications and Networks

Reviewer (Conferences):

• IEEE GLOBECOM • IEEE ICC • IEEE ISIT • IEEE WCNC • IEEE MILCOM • IEEE PIMRC • SPCOM • National Conference on Communications

Languages

• English • Hindi • Marathi