

ANKUR A. KULKARNI

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Systems and Control Engineering
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ACADEMIC AND PROFESSIONAL CAREER

Associate Professor, Systems and Control Engineering, May 2018 – present
Indian Institute of Technology Bombay.

Assistant Professor, Systems and Control Engineering, Jan 2013 – May 2018
Indian Institute of Technology Bombay.

Post-doctoral Research Associate, Coordinated Science Laboratory, Jan 2011 – Dec 2012
University of Illinois at Urbana-Champaign
Supervisors: P.R. Kumar and Todd P. Coleman (topic: stochastic control); Negar Kiyavash (topic: information and coding theory).

Instructor, University of Illinois at Urbana-Champaign
Undergraduate course: *Introduction to Operations Research* Fall 2010
Undergraduate course: *Engineering Economy* Fall 2011

Ph.D., Industrial Engineering, University of Illinois at Urbana-Champaign. Dec 2010
Thesis – *Generalized Nash Games with Shared Constraints: Existence, Efficiency, Refinement and Equilibrium Constraints*. Advisor – Uday V. Shanbhag

M.S., General Engineering, University of Illinois at Urbana-Champaign. May 2008
Thesis – *Topics in Stochastic Optimization and Equilibrium Problems*.
Advisor – Uday V. Shanbhag

B.Tech., Aerospace Engineering, Indian Institute of Technology Bombay. May 2006

AWARDS AND HONOURS

- **Associate** of the Indian Academy of Sciences, Bangalore (2015–2018)
- **INSPIRE Faculty Award** by the Department of Science and Technology, India, 2013.
- **Excellence in Teaching Award** 2018, IIT Bombay.
- **Best paper award** at the Indian Control Conference, Kanpur, 2018.
- **Runner-up best paper award** at the International Conference on Signal Processing and Communications (SPCOM), 2018.
- **Best paper award** at the National Conference on Communications, Chennai, 2017.
- **William A. Chittenden Award** for an Outstanding Master of Science Graduate in General Engineering.
- Listed on **The Incomplete List of Teachers Ranked as Excellent** by their Students, Spring 2007.
- **University of Illinois Fellowship**, 2010.
- **NSF Travel Grant** for the International Conference on Continuous Optimization, Hamilton, Canada, 2007. **IEEE CSS Student Travel Support Award** for the Conference on Decision and Control, Shanghai, China, 2009.

VISITS

Visitor

May 2018

Visiting Prof Sanjoy Mitter

Laboratory for Information and Decision Systems, Massachusetts Institute of Technology, Cambridge, USA.

Visitor

June 2014 – July 2014

Visiting Prof Karl Henrik Johansson

Department of Automatic Control, KTH Royal Institute of Technology, Stockholm, Sweden.

Visiting Scholar

May 2008 – Aug 2008

Visiting Prof Vivek S. Borkar

School of Technology and Computer Science, Tata Institute of Fundamental Research

Short visits

2012 – 2017

Indian Institute of Science, Bangalore, University of Illinois at Urbana-Champaign, Pennsylvania State University.

RESEARCH INTERESTS

My research interest lies in game theory, stochastic control, information theory, and in general in decision problems involving multiple decision makers in a dynamic, stochastic environment. My current thrust is on using principles of convex optimization to understand and solve problems in network information theory, networked control, combinatorial coding theory, stochastic teams and dynamic games.

PUBLICATIONS

Journal

1. Sharu Theresa Jose and Ankur A. Kulkarni, “*Improved Finite Blocklength Converses for Slepian-Wolf Coding via Linear Programming*”, accepted (in press) IEEE Transactions on Information Theory, (2018).
2. Mathew Abraham and Ankur A. Kulkarni, “*An ADMM-Based Algorithm for Solving DC-OPF in a Large Electricity Network Considering Transmission Losses*”, accepted (in press) IET Generation, Transmission and Distribution, (2018).
3. Mathew P. Abraham and Ankur A. Kulkarni, “*New Results on the Existence of Open Loop Nash Equilibria in Discrete Time Dynamic Games via Generalized Nash Games*”, (in press, published online) Mathematical Methods of Operations Research, (2017).
4. Ankur A. Kulkarni, “*Local and Networked Mean-Square Estimation with High Dimensional Log-concave Noise*”, IEEE Transactions on Information Theory, Vol 64, Issue 4, pp 2759 - 2773 (2018).
5. Parthe Pandit and Ankur A. Kulkarni, “*A linear complementarity based characterization of the weighted independence number and the independent domination number in graphs*”, Discrete Applied Mathematics, Vol 244, pp 155–169 (2018).
6. Parthe Pandit and Ankur A. Kulkarni, “*Refinement of the Equilibrium of Public Goods Games over Networks: Efficiency and Effort of Specialized Equilibria*”, in press, Journal of Mathematical Economics, (2018).
7. Sharu Theresa Jose and Ankur A. Kulkarni, “*Linear Programming based Converses for Finite Blocklength Lossy Joint Source-Channel Coding*”, IEEE Transactions on Information Theory, Vol 63, Issue 11, pp 7066–7094 (2017).
8. Mathew P. Abraham and Ankur A. Kulkarni, “*An Approach Based on Generalized Nash Games and Shared Constraints for Discrete Time Dynamic Games*”, Dynamic Games and Applications, Vol 8, Issue 4, pp 641–670 (2018).

9. Ankur A. Kulkarni, “*Near-Optimality of Linear Strategies for Static Teams with ‘Big’ Non-Gaussian Noise*”, accepted subject to minor modifications by the IEEE Transactions on Automatic Control, (2017).
10. Ankur A. Kulkarni, “*Games and Teams With Shared Constraints*” Philosophical Transactions of the Royal Society, Vol 375, Issue 2100, (2017) (**invited paper**).
11. Daniel Cullina, Negar Kiyavash and Ankur A. Kulkarni “*Restricted Composition Deletion Correcting Codes*”, IEEE Transactions on Information Theory, Vol 62, Issue 9, pp 4819–4832 (2016).
12. Ankur A. Kulkarni and Uday V. Shanbhag, “*An Existence Result for Hierarchical Stackelberg v/s Stackelberg Games*”, IEEE Transactions on Automatic Control, Vol 60, No 12, pp 3379–3384 (2015).
13. Ankur A. Kulkarni and Todd P. Coleman, “*An Optimizer’s Approach to Stochastic Control Problems with Nonclassical Information Structures*”, IEEE Transactions on Automatic Control, Vol 60, No 4, pp 937–949 (2015).
14. Ankur A. Kulkarni and Uday V. Shanbhag, “*A Shared-Constraint Approach to Multi-leader Multi-follower Games*, Set Valued and Variational Analysis, 22(4), pp 691–720, (2014).
15. Ankur A. Kulkarni, Negar Kiyavash and R. Sreenivas, “*On the Varshamov-Tenengolts Construction on Binary Strings*”, Vol 317, Discrete Mathematics, pp 79–90, (2014).
16. Ankur A. Kulkarni and Negar Kiyavash, “*Non-asymptotic Upper Bounds for Deletion Correcting Codes*”, IEEE Transactions on Information Theory, 59(8), pp 5115–5130, (2013).
17. Ankur A. Kulkarni and Uday V. Shanbhag, “*Revisiting Generalized Nash Games and Variational Inequalities*”, Journal of Optimization Theory and Applications 154(1), (2012).
18. Ankur A. Kulkarni and Uday V. Shanbhag, “*On the Variational Equilibrium as a Refinement of the Generalized Nash Equilibrium*”, Automatica 48(1), pp. 45–55, (2012).
19. Ankur A. Kulkarni and Uday V. Shanbhag, “*Recourse-based Stochastic Nonlinear Programming: Properties and Benders-SQP Algorithms*”, Computational Optimization and Applications (2010).
20. Ankur A. Kulkarni and Vivek S. Borkar “*Finite Dimensional Approximation and Newton-based Algorithm for Stochastic Approximation in Hilbert Space*”, Automatica 45(12), pp. 2815-2822, (2009).

Conference

1. Anuj S. Vora and Ankur A. Kulkarni, “*A Minimax Theorem for Finite Blocklength Joint Source-Channel Coding over an AVC*”, accepted by the National Conference on Communications, 2019.
2. Mansi Sood, Sharayu Moharir and Ankur A. Kulkarni, “*Pricing and Commission in Two-Sided Markets with Free Upgrades*”, accepted by Lecture Notes in Computer Science, 2018.
3. Sharu Theresa Jose and Ankur A. Kulkarni, “*On a Game Between a Delay-constrained Communication System and a Finite State Jammer*”, to appear in the Proceedings of the IEEE Conference on Decision and Control (2018).
4. Sharu Theresa Jose and Ankur A. Kulkarni, “*A Linear Programming Based Finite Blocklength Converse for Asymmetric Multiple Access Channels*”, to appear in the Proceedings of SPCOM, (2018) (**Runner best paper award**).
5. Mansi Sood, Ankur A. Kulkarni, Sharayu Moharir, “*Platform Competition for Throughput in Two-sided Freelance Markets*”, to appear in the Proceedings of SPCOM, (2018).
6. Mansi Sood, Sharayu Moharir and Ankur A. Kulkarni “*Pricing in Two-Sided Markets in the Presence of Free Upgrades*”, to appear in the Proceedings of COMSNETS (2018).
7. Mathew P. Abraham and Ankur A. Kulkarni, “*On the Existence of Equilibria in Price-Coupling Games*”, to appear in the Proceedings of the Indian Control Conference, (2018) (**Best student paper award**).
8. Sharu Theresa Jose and Ankur A. Kulkarni, “*Linear programming based converses for some network-like problems.*”, to appear in the Proceedings of the IEEE Information Theory Workshop, (2017).

9. Smita Solanki and Ankur A. Kulkarni, “*Separating the Good from the Bad in Rating Systems: A Framework and Numerical Evidence*”, 2017 IEEE International Conference on Signal Processing, Informatics, Communication and Energy Systems (SPICES), (2017).
10. Sharu Theresa Jose and Ankur A. Kulkarni, “*A Linear Programming Based Channel Coding Strong Converse for the BSC and BEC*”, Proceedings of the Twenty-third National Conference on Communications, Chennai, India (2017) (**Best paper award**).
11. Parthe Pandit and Ankur A. Kulkarni, “*Non-constructive Lower Bounds for Binary Asymmetric Error Correcting Codes*”, Proceedings of the Twenty-third National Conference on Communications, Chennai, India (2017).
12. Ankur A. Kulkarni, “*Mean-square estimation with high dimensional log-concave noise*” Proceedings of the the IEEE Conference on Decision and Control, pp 2029–2034, Las Vegas, USA (2016).
13. Ankur A. Kulkarni, “*Approximately Optimal Linear Strategies for Static Teams with ‘Big’ Non-Gaussian Noise*”, Proceedings of the IEEE Conference on Decision and Control, Osaka, Japan, pp 7177–7182 (2015).
14. Sharu Theresa Jose and Ankur A. Kulkarni, “*A Linear Programming Relaxation for Stochastic Control Problems with Non-Classical Information Patterns*”, Proceedings of the IEEE Conference on Decision and Control, Osaka, Japan, pp 5743–5748 (2015).
15. Bharat Prabhakar and Ankur A. Kulkarni, “*Dimensionality Reduction of Affine Variational Inequalities Using Random Projections*” Proceedings the Allerton Conference, Monticello, USA, pp 256–263 (2014).
16. Ankur A. Kulkarni, “*Insertion and Deletion Errors with a Forbidden Symbol*” Proceedings of the IEEE Information Theory Workshop, Hobart, Australia, pp 596–560 (2014).
17. Ankur A. Kulkarni and Uday V. Shanbhag, “*On the Consistency of Leaders’ Conjectures in Hierarchical Games*”, Proceedings of the IEEE Conference on Decision and Control, Florence, Italy, pp 1180–1185 (2013).
18. Ankur A. Kulkarni and Todd P. Coleman, “*An Optimizer’s approach to Stochastic Control Problems with Nonclassical Information Structure*”, Proceedings of the IEEE Conference on Decision and Control, Maui, USA, pp 154-159 (2012)..
19. Daniel Cullina, Ankur A. Kulkarni, and Negar Kiyavash, “*A Coloring Approach to Constructing Deletion Correcting Codes from Constant Weight Subgraphs*”, Proceedings of IEEE International Symposium on Information Theory, Boston, USA, pp 513–517 (2012).
20. Ankur A. Kulkarni and Uday V. Shanbhag, “*New Insights on Generalized Nash Games with Shared Constraints: Constrained and Variational Equilibria*”, Proceedings of the IEEE Conference on Decision and Control, Shanghai, China, pp 151-156 (2009).
21. Wei Chen, Dayu Huang, Ankur A. Kulkarni, Jayakrishnan Unnikrishnan, Quanyan Zhu, Prashant Mehta, Sean Meyn, Adam Wierman, “*Approximate Dynamic Programming using Fluid and Diffusion Approximations with Applications to Power Management*”, Proceedings of the IEEE Conference on Decision and Control, Shanghai, China, pp 3575–3580 (2009).
22. Ankur A. Kulkarni, Albert Rossi, Jay Alameda and Uday V. Shanbhag, “*A Grid-Computing Framework for Quadratic Programming Under Uncertainty*”, Proceedings of the TeraGrid, pp 4–8, 2007.

PAPERS UNDER REVIEW

- J2 Sharu Theresa Jose and Ankur A. Kulkarni, “Shannon meets von Neumann: A Minimax Theorem for Channel Coding in the Presence of a Jammer”, under review with the IEEE Transactions on Information Theory, 2018.
- J1 Karan N. Chadha and Ankur A. Kulkarni, “On Independent Cliques and Linear Complementarity Problems”, under review with Mathematics of Operations Research, 2018.
- C3 Vivek Deulkar, Jayakrishnan Nair and Ankur A. Kulkarni, “Sizing Storage for Reliable Renewable Integration”, under review for PowerTech 2019.

- C2 Ankur A. Kulkarni and Anupama Kowli, "Addressing the Free-rider Problem in Voluntary Demand Response Programs", under review for PowerTech 2019.
- C1 Indu Yadav, Ankur A. Kulkarni and Abhay Karandikar, "Strategy-proof Spectrum Allocation among Multiple Operators", under review with the IEEE Wireless Communications and Networking Conference, 2019.

SELECTED INVITED TALKS

- Bombay Information Theory Seminars, 2018.
- Indo-UK workshop on Energy Management: Flexibility, Risk and Optimisation, Edinburgh, Scotland, UK, 2016.
- NMI-IFCAM Summer school on Large Scale Optimization, IISc Bangalore, 2016.
- NMI Workshop on Game Theory and Mechanism Design, IISc Bangalore, 2016.
- Workshop on Analysis and Applications of Stochastic Systems (as part of SVAN 2016), Rio de Janeiro, Brazil, 2016.
- TEQIP School on Systems and Control, IIT Kanpur, 2015.
- Pennsylvania State University, 2015.
- Indo-French Summer School on Applied Mathematics, Indian Institute of Science, Bangalore, 2015.
- Joint Telematics Group workshop, Indian Institute of Science, Bangalore, 2015.
- International Conference on Signal Processing and Communication (SPCOM), 2014.
- University of Illinois at Urbana-Champaign, 2014.
- KTH Royal Institute of Technology, 2014.
- IBM India Research Lab, Bangalore, 2013.
- Midwest Workshop on Control and Game Theory, 2012.

STUDENT GUIDANCE

- 1 Ph.D. student guided, 2 ongoing (sole guide)
- Presently mentoring 1 post-doc
- 2 M.Tech. students guided, 2 ongoing (sole guide)
- 1 B.Tech. project, 2 Dual Degree project (co)-guided, 1 Dual Degree project (EE student) presently co-guiding.

TEACHING RELATED ACTIVITIES

Course development

- *Designed* the popular and unique course 'SC 631: Games and Information' at IIT Bombay.
- *Designed* the advanced course 'SC 632: Variational Analysis and Polyhedral Geometry' at IIT Bombay.
- *Revamped* the course 'SC 607: Optimization' at IIT Bombay.

Course feedback scores at IIT Bombay

Course	SC 631 Games and Information			SC 607 Optimization		SC 202 Signals and Feedback Systems		SC 632 Variational Analysis and Polyhedral Geometry
Year	2017-18	2016-17	2015-16	2017-18	2016-17	2014-15	2013-14	2013-14
Score	92.50	94.90	94.40	90.37	86.70	94.00	89.35	98.67
Year	2014-15	2013-14		2015-16	2014-15			
Score	93.91	94.99		85.71	92.33			

QIP/CEP

- *Designed* and offered a course under the Quality Improvement/Continuing Education Programme, IIT Bombay on ‘Optimization and Game Theory’, 2015. Total registration 50.

FUNDED PROJECTS

#	Title and PI/co-PI	Funding agency	Amount	Duration
1	Games, Control and Optimization with Shared Constraints (INSPIRE Faculty Award). Sole PI.	Department of Science and Technology	35 lakhs	2013-18
2	Towards a Convex-Analytic view of Information Structures. Sole PI.	IRCC, IIT Bombay	20 lakhs	2013-18
3	Approximation of High-Dimensional Optimization and Control Problems. Co-PI Vivek S. Borkar.	Science and Engineering Research Board	30 lakhs	2015-18
4	Equilibria of Dynamic Games: An Optimization-based Approach. Sole PI.	Science and Engineering Research Board	17 lakhs	2015-18
5	SPORES: SMART Planning and Operations of Grids with Renewables and Storage. One of the main investigators in a consortium led by IITB.	Department of Science and Technology	2.56 crores	2018-21
6	Modeling Electricity Value Chain Agents. IITB Co-PI Anupama S. Kowli	under review with Tata Consultancy Services	26 lakhs	–
7	Agent Based Modeling of Smart Citizens in a Smart City Ecosystem. Sole IITB PI.	approved in principle by Tata Consultancy Services	25 lakhs	–
8	Convex Analytic Approaches for the Finite Blocklength Information Theory of Networks. Sole PI	under review with Science and Engineering Research Board	6 lakhs	–

CONSULTANCY

#	Title and PI/co-PI	Funding agency	Amount	Duration
1	Analysis related to Algorithmic Trading, HFT & Colocation in Indian securities market. Sole PI. <i>Consultant to the Technical Advisory Committee of the Securities and Exchange Board of India on devising regulatory strategies for high frequency trading. Designed a quantitative framework based on game theory and queuing theory for analyzing and devising scheduling rules (randomization, speed bumps, resting time etc) and information flows (tick-by-tick data feed, colocation access) to ensure a level playing field for all market participants and to control price volatility in the Indian securities market, in the face of high frequency algorithmic trading.</i>	Securities and Exchange Board of India (SEBI)	20 lakhs	2016-17

OTHER PROFESSIONAL ACTIVITIES

Technical programme committee

- Member, TPC of American Control Conference, 2019.
- Member, TPC of Indian Control Conference, 2018, 2019.
- Member, TPC of International Conference on Control, Decision and Information Technologies, 2019.
- Member, TPC of 25th International Joint Conference on Artificial Intelligence, 2016.
- Member, TPC for International Conference on Signal Processing and Communication (SPCOM), 2018.
- Member, TPC for National Conference on Communications, 2015, 2016, 2017, 2018, 2019.
- Member, TPC for Xerox Research Centre India Open, 2015, 2016.

Session chair at international conferences

- *Session co-chair* and *session organizer* for session on “50 Years of Witsenhausen’s Counterexample” at the IEEE Conference on Decision and Control, Miami, USA 2018 (forthcoming).
- *Session chair* for session “Information Theory” at the International Conference on Signal Processing and Communication (SPCOM), Bangalore, India, 2018.
- *Session co-chair* for session on “Estimation” at the IEEE Conference on Decision and Control, Las Vegas, USA 2016.
- *Session co-chair* for sessions on “Information Theory and Control” and “Stochastic Optimal Control” at the IEEE Conference on Decision and Control, Osaka, Japan 2015.
- *Session chair* for session on “Online Optimization” at International Symposium on Mathematical Programming, Pittsburgh, USA, 2015.
- *Session chair* for session on “Coding for Distributed Storage” at SPCOM 2014.
- *Session co-chair* for session on “Optimization Theory” at the Allerton Conference, Monticello, USA 2014.
- *Session chair* For session on “Stochastic Programming” at the INFORMS Annual meeting, Seattle, USA 2007.

Organisation

- Workshop on “Optimization” for the National Centre for Mathematics, 2016
- Steering committee for the National Mathematics Initiative year on Optimization and Game Theory, 2015-16.
- *Organized* the Third IIT Bombay Winter School on Optimization and Control, 2014.

Reviewer for

- IEEE Transactions on Information Theory, Automatica, IEEE Transactions on Automatic Control, IEEE Journal on Selected Areas in Communications (*Game theory in Wireless Communications*), IEEE Transactions on Communications, Mathematical Programming, European Journal of Operations Research, Mathematical Methods of Operations Research, SIAM Journal on Optimization, IEEE Transactions on Signal Processing, Journal of Optimization Theory and Applications, Optimal Control, Applications and Methods, International Game Theory Review, Indian Journal of Pure and Applied Mathematics

Other

- Member, IEEE.
- President of *SPICMACAY* at UIUC, 2008-2009. Managed a fully-volunteer \$20000/annum organization.