

MATHAV MURUGAN

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Education

2010-2015 Ph.D. in Applied Mathematics, Cornell University
Advisor: Laurent Saloff-Coste

2004-2009 B.Tech. and **M.Tech.** in Electrical engineering, Indian Institute of Technology, Kharagpur.

Employment

2019- Assistant Professor, University of British Columbia

2015-2018 PIMS postdoctoral fellow in stochastics, University of British Columbia

2010-2015 Graduate Teaching Assistant, Cornell University

2009-2010 Quantitative Analyst, Morgan Stanley

Research Interests

I am interested in probability theory and analysis. My current research focus is on the relationship between the long-term behavior of Markov processes and the geometry of the underlying state space. I am also interested in Sandpile models, potential theory, boundary theory, quasiconformal mappings, and metric geometry.

Publications and Preprints (Preprints are available at my [homepage](#)).

- M. T. Barlow, Z.-Q. Chen, M. Murugan Stability of EHI and regularity of MMD spaces (submitted)
- T. Jaschek, M. Murugan, Geometric implications of fast volume growth and capacity estimates (submitted)
- G. Liu, M. Murugan, Parabolic Harnack inequality implies the existence of jump kernel (submitted).
- M. Murugan, On the length of chains in a metric space, *J. Funct. Anal.* **279** (2020), no. 6, 108627, 18 pp.
- N. Kajino, M. Murugan, On singularity of energy measures for symmetric diffusions with full off-diagonal heat kernel estimates, *Ann. Probab.* (in press).
- M. Murugan, Quasisymmetric uniformization and heat kernel estimates, *Trans. Amer. Math. Soc.* **372** (2019), 4177–4209.
- M.T. Barlow, M. Murugan. Boundary Harnack principle and elliptic Harnack inequality, *J. Math. Soc. Japan*, **71**, no. 2 (2019), 383–412.
- M. Murugan, L. Saloff-Coste. Heat kernel estimates for anomalous heavy-tailed random walks, *Ann. Inst. Henri Poincaré Probab. Stat.* **55** (2019), no. 2, 697–719.
- M. Murugan, A note on heat kernel estimates, resistance bounds and Poincaré inequality, (submitted) (2018).
- M.T. Barlow, M. Murugan. Stability of the elliptic Harnack inequality, *Ann. of Math.* (2) **187** (2018), no. 3, 777–823.
- M. Murugan, L. Saloff-Coste, Harnack inequalities and Gaussian estimates for random walks on metric measure spaces, [arXiv:1506.07539](#) (submitted).

- M. Murugan, L. Saloff-Coste. Davies' method for anomalous diffusions, *Proc. Amer. Math. Soc.* **145** (2017), no. 4, 1793–1804.
- L. Levine, M. Murugan, Y. Peres, B. Ugurcan. Divisible sandpile at critical density, *Ann. Henri Poincaré* **17** (2016), no. 7, 1677–1711.
- M. Murugan, L. Saloff-Coste. Transition probability estimates for long range random walks, *New York J. Math.* **21** (2015), 723–757.
- M. Murugan, L. Saloff-Coste. Anomalous threshold behavior of long range random walks, *Electron. J. Probab.* **20** (2015), no. **74**, 21 pp.
- T. Faver, K. Kochalski, M. K. Murugan, H. Verheggen, E. Wesson, A. Weston. Roundness properties of ultrametric spaces. *Glasg. Math. J.* **56** (2014), no. 3, 519–535.
- M. K. Murugan. Supremal p -negative type of vertex transitive graphs. *J. Math. Anal. Appl.* **391** (2012), no. 2, 376–381.
- S. S. Adams, M. K. Murugan. Hurwitz-Radon inspired maximal three-dimensional real orthogonal designs. *Australas. J. Combin.* **54** (2012), 151–162.
- S. S. Adams, J. Davis, N. Karst, M. K. Murugan, B. Lee, M. Crawford, C. Greeley. Novel classes of minimal delay and low PAPR rate $\frac{1}{2}$ complex orthogonal designs. *IEEE Trans. Inform. Theory* **57** (2011), no. 4, 2254–2262.
- S. S. Adams, N. Karst, M. K. Murugan. The final case of the decoding delay problem for maximum rate complex orthogonal designs. *IEEE Trans. Inform. Theory* **56** (2010), no. 1, 103–112.
- S. S. Adams, M. Crawford, C. Greeley, B. Lee, M. K. Murugan. Multilevel and multidimensional Hadamard matrices. *Des. Codes Cryptogr.* **51** (2009), no. 3, 245–252.

Grants and Awards

- 2019–2024 Canada Research Chair in Probability (Tier 2)
- 2019–2024 NSERC Discovery grant, \$24,000 per year.
- 2019–2022 NSERC Discovery Accelerator grant, \$40,000 per year.
- 2019 NSERC Discovery launch supplement, \$12,500.
- 2019–2024 Canada Research Chair Tier 2 stipend, \$20,000 per year.
- 2015–2017 PIMS postdoctoral fellowship

Seminar and Conference Talks

- Probability seminar, University of Washington (December 2019)
- Oberwolfach workshop on Heat Kernels, Stochastic Processes, and Functional Inequalities (November 2019)
- Oberseminar Geometric Analysis, Bielefeld University (June 2019)
- Analysis Seminar, University of California, Los Angeles (May 2019)
- Kobe Workshop on Probabilistic Potential Theory and Related Fields, Kobe University (May 2019)
- Kansai Probability Seminar, Kyoto University (April 2019).
- Workshop on Analysis and Geometry of Random Shapes, Institute for Pure and Applied Mathematics, University of California, Los Angeles (January 2019).
- 9th International Conference on Stochastic Analysis and Its Applications, Universität Bielefeld (September 2018)
- 2018 Spring Probability Workshop, Institute of Mathematics, Academia Sinica, Taiwan. (June 2018)
- Rainwater seminar, University of Washington (March 2018)
- Probability seminar, Research Institute for Mathematical Sciences, Kyoto University (February 2018).

The 3rd KTGU Mathematics Workshop for Young Researchers, Kyoto University. (February 2018)
 Mathematics Colloquium, University of British Columbia (January 2017)
 Oberwolfach workshop on Heat Kernels, Stochastic Processes and Functional Inequalities (November 2016).
 Retreat for Young researchers in Stochastics, Banff International Research Station (September 2016)
 8th International Conference on Stochastic Analysis and Its Applications, Beijing Institute of Technology (June 2016)
 17th Pacific Northwest probability seminar, University of Washington (October 2015)
 Postdoctoral retreat in Stochastics, Banff International Research Station (September 2015)
 Probability Seminar, University of British Columbia (November 2014, December 2015, February 2016, January 2017, January 2018, November 2018, October 2019)
 Probability Seminar, University of Washington (November 2014)
 MSR Theory seminar, Microsoft Research (November 2014)
 Probability Seminar, Cornell University (May 2014 and May 2016)

Teaching experience

Instructor, Calculus I (MATH 1110; Fall 2014) , Multivariable Calculus (MATH 253, Fall 2015 and Fall 2016), Functional Analysis (MATH 421/510, Spring 2016), Multivariable Calculus (MATH 200, Spring 2017), Continuous Time Stochastic Processes (MATH 546, Fall 2017), Probability with Physical Applications (MATH 318, Spring 2018). Complex Analysis (MATH 440/508, Fall 2018), Probability II (MATH 419/545, Spring 2019).

- lectured, worked with students in office hours, supervised grader, graded exams

Teaching Assistant (Fall 2010-Spring 2014)

- Taught discussion sections, worked with students in office hours, graded exams and homework, maintained course webpage and grade data
- Undergraduate Courses assisted: Multivariable Calculus (MATH 1920), Linear Algebra (MATH 2940), Introduction to Differential Equations (MATH 3230), Basic Probability (MATH 4710), Stochastic Processes (MATH 4740), Computational Algebra (MATH 4370)
- Graduate courses assisted: Probability Theory I (MATH 6710), Probability Theory II (MATH 6720), Introduction to Mathematical Statistics (MATH 6740)

Teaching Assistant, Research Experiences for Undergraduates program, Cornell University (Summer 2014)

- Undergraduate research projects on Chip firing games on graphs, supervise practice presentations, organize social activities.

Teaching Assistant, Summer Mathematics Institute, Cornell University (Summer 2012)

- Real Analysis course, graded homework, worked with students in office hours.

Teaching Assistant, Summer Mathematics Institute, Cornell University (Summer 2011)

- Undergraduate research projects on non-linear geometry (negative-type) of metric spaces and embedding problems, supervise practice presentations, help the students prepare posters, wrote research papers with undergraduates.

Service

PIMS Postdoctoral fellowship panel (December 2019 –)

Organizer for Probability seminar: September 2015 – June 2017

Co-organizer for Online Open Probability School (OOPS) 2020.

Co-organizer for PIMS-CRM Summer School in Probability 2017 with Omer Angel, Edwin Perkins and Gordon Slade.

Referee for Journal of the European Mathematical Society, Lecture Notes in Mathematics, International Mathematical Research Notices, Mathematische Annalen, Journal of Functional Analysis, Potential Analysis, Electronic Journal of Probability, Journal of Theoretical Probability, and Annales de l'Institut Henri Poincaré (B) Probabilités et Statistiques.

Teaching assistant for 'Sandpile Models' at Cornell Probability Summer School 2013.

Assisted for K-12 education and outreach program, Mathematics for Secondary School Teachers (December 2012).