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 engineeering, 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

Publications

M. Murugan, Heat kernel for reflected diffusion and extension property on uniform domains. *Probab. Theory Related Fields.* (accepted).

M. Murugan, A note on heat kernel estimates, resistance bounds and Poincaré inequality *Asian J. Math.* (accepted).

G. Liu, M. Murugan, On the comparison between jump processes and subordinated diffusions *ALEA Lat. Am. J. Probab. Math. Stat.* (accepted).

M. Murugan, Conformal Assouad dimension as the critical exponent for combinatorial modulus, *Ann. Fenn. Math.* **48**, 2023, 453–491

M. Murugan, L. Saloff-Coste, Harnack inequalities and Gaussian estimates for random walks on metric measure spaces, *Electron. J. Probab.*, **28** 1-81 (2023).

N. Kajino, M. Murugan, On the conformal walk dimension: Quasisymmetric uniformizition for symmetric diffusions, *Invent. Math.* **231** (2023), no. 1, 263–405.

V. Guan, M. Murugan, J. C. Wei, Helmholtz solution for fractional Laplacian and other related operators, *Commun. Contemp. Math.* **25** (2023), no.2, Paper No. 2250016, 18 pp.

T. Jaschek, M. Murugan, Geometric implications of fast volume growth and capacity estimates, *Analysis and partial differential equations on manifolds, fractals and graphs*, 183–199, *Adv. Anal. Geom.*, **3**, De Gruyter, Berlin, 2021

G. Liu, M. Murugan, Parabolic Harnack inequality implies the existence of jump kernel. *Potential Anal.* **57** (2022), no. 1, 155–166

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.* **48** (2020), no. 6, 2920–2951.

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.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. 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.

Preprints

M. T. Barlow, Z.-Q. Chen, M. Murugan, Stability of EHI and regularity of MMD spaces, revision requested by *Advances in Math.*.

J. Malmquist, M. Murugan, Counterexamples to Harnack inequality for isotropic unimodal Lévy processes (submitted)

Grants and Awards

2019–2024	Canada Research Chair in Probability (Tier 2)
2019–2024	NSERC Discovery grant, $24,000 per year.
2022	Research member, Mathematical Sciences Research Institute, Berkeley.
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

Conference on Fractal Geometry and Related Topics, Chinese University of Hong Kong (December 2023).

Joint Probability seminar and Geometric analysis seminar, Courant Institute of Mathematical Sciences, New York University. (October 2023)

Conference on Stochastic Processes and Related Fields, Kyoto University. (September 2023)

Quasiworld workshop, Helsinki University. (August 2023)

Minicourse (**4 lectures**) on Stability and characterization of the Harnack inequalities and heat kernel estimates. Workshop and summer school on Processes and heat kernels with symmetries, Le Centre Henri Lebesgue, Angers (June 2023)

Minicourse (**3 lectures**) on Stability results for symmetric random walks and diffusions. OIST workshop on Potential theory and random walks in metric spaces, Okinawa (May-June 2023)

Kansai Probability seminar, Kyoto University (May 2023)

Special session on "Interactions between analysis, PDE, and probability in non-smooth spaces" at AMS Sectional Meeting at the University of Cincinnati (April 2023)

Conference on Analysis and geometry of fractals and metric spaces, Okinawa (March 2023)

Special session on Analysis of PDEs at the Canadian Mathematical Society Winter meeting 2022, Toronto (December 2022)

BIRS workshop on Smooth Functions on Rough Spaces and Fractals with Connections to Curvature Functional Inequalities, Banff (November 2022)

Research seminar series at Mathematical Sciences Research Institute (February 2022)

10th International Conference on Stochastic Analysis and Its Applications, Kyoto University (September 2021)

Non-local operators, probability and singularities (online seminar) (October 2021)

Probability seminar, Stanford University (April 2021)

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 Washington (November 2014)

MSR Theory seminar, Microsoft Research (November 2014)

Service

PIMS Postdoctoral fellowship selection committee (December 2019 – December 2020)

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 (in 2017, 2022, 2025) and for CRM-PIMS Summer School in Probability (in 2021, 2024).

External reviewer for Killiam prize and Banff International Research Station.

Referee for a number of journals/monographs including: Journal of the European Mathematical Society, Memoirs of European Mathematical Society, Lecture Notes in Mathematics (Springer), Annals of Probability, Journal de Mathématiques Pures et Appliquées, Journal de l'École polytechnique — Mathématiques, Journal of Fractal Geometry, International Mathematical Research Notices, Mathematische Annalen, Asian Journal of Mathematics, Israel Journal of Mathematics, Journal of Functional Analysis, Potential Analysis, Annales Fennici Mathematici, Electronic Journal of Probability, Journal of Theoretical Probability, and Annales de l'Institut Henri Poincaré (B) Probabilités et Statistiques.

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