

# Dominique Guillot

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**Research interests:** analysis on networks, combinatorial matrix theory, linear algebra, mathematical statistics, matrix analysis, missing data problems, applications of data science in sciences and engineering.

## Appointments

June 2021 – present

Associate Professor. University of Delaware.

August 2015 – May 2021

Tenure-track Assistant Professor. University of Delaware.

## Education and Training

July 2012 – July 2015

Postdoctoral Research Associate. Stanford University.

Mentor: Bala Rajaratnam.

August 2010 – July 2012

Postdoctoral Research Associate. University of Southern California and Stanford University.

Mentors: Julien Emile-Geay (USC) and Bala Rajaratnam (Stanford).

Jan 2007 – June 2010

Ph.D. in Mathematics (distinction recommendation)

Laval University, Québec, Canada

Thesis: Boundary behavior in Dirichlet spaces with harmonic weights and de Branges–Rovnyak spaces.

Thesis advisor: Thomas J. Ransford.

Sep 2005 – Jan 2007

M.Sc. in Mathematics (with honors)

Laval University, Québec, Canada

Thesis: Visibility of the spectrum in Banach algebras and the problem of controlled inversion.

Advisor: Thomas J. Ransford.

Sep 2005 – June 2006

Academic Visitor

University of Oxford, United Kingdom.

Sep 2002 – Jun 2005

B.Sc. in Mathematics (with honors)

Laval University, Québec, Canada.

Sep 2000 – June 2002

D.E.C. in Natural Sciences

Collège François-Xavier-Garneau, Québec, Canada.

## Honors and Awards

- 2019 Inducted in the Honors Society of Phi Kappa Phi, U. Delaware chapter.
- 2017 Excellence in Teaching Award Nomination, U. Delaware.
- 2016 International Linear Algebra Society minisymposium award to invite early career speaker.
- 2015 Research-in-groups award, International Centre for Mathematical Sciences, Edinburgh, UK.
- 2015 Travel grant award to participate to the workshop *Challenges in Functional Connectivity Modeling and Analysis Workshop* at SAMSI.
- 2014 Selection and invitation by American Institute of Mathematics to organize international workshop (with full funding), Palo Alto, United States.
- 2012 Natural Sciences and Engineering Research Council of Canada Postdoctoral Fellowship.
- 2012 Postdoctoral Fellowship, Stanford University.
- 2012 National Science Foundation Travel Grant Award.
- 2011 Society for Industrial and Applied Mathematics Travel Grant Award.
- 2010 Postdoctoral Fellowship, University of Southern California and Stanford University.
- 2010 Fonds Québécois de la Recherche sur la Nature et les Technologies Postdoctoral Fellowship (University of Leeds, United Kingdom).
- 2010 Doctoral thesis ranked “excellent” by each of the four members of the thesis committee.
- 2009 *Star Professor* Prize for Excellence in Teaching, Laval University.
- 2008 *Star Professor* Prize for Excellence in Teaching, Laval University.
- 2007 Natural Sciences and Engineering Research Council of Canada Alexander-Graham-Bell Scholarship.
- 2007 Natural Sciences and Engineering Research Council of Canada Postgraduate Scholarship.
- 2007 Fonds Québécois de la Recherche sur la Nature et les Technologies Postgraduate Scholarship.
- 2007 Honors from the faculty of graduate studies for master studies.
- 2006 Natural Sciences and Engineering Research Council of Canada Postgraduate Scholarship (master).
- 2006 Grant for Abroad Studies (Oxford, UK).
- 2005 Natural Sciences and Engineering Research Council of Canada Postgraduate Scholarship (master).
- 2005 Fonds Québécois de la Recherche sur la Nature et les Technologies Postgraduate Scholarship (master).
- 2005 Natural Sciences and Engineering Research Council of Canada Undergraduate Scholarship, Summer 2005.
- 2005 Honors for undergraduate studies.
- 2005 Honors from the department of mathematics and statistics for the academic year 2005.
- 2005 Prize from the director of the department of mathematics and statistics of Laval University for the quality of the final-year project.
- 2004 Tembec Scholarship.
- 2004 Natural Sciences and Engineering Research Council of Canada Undergraduate Scholarship, Summer 2004.
- 2004 Honors from the department of mathematics and statistics for the academic year 2004.
- 2003 Natural Sciences and Engineering Research Council of Canada Undergraduate Scholarship, Summer 2003.
- 2003 Honors from the department of mathematics and statistics for the academic year 2003.
- 2002 Hydro-Québec Scholarship, 2002.

# Publications

## Peer-Reviewed

*Theoretical mathematics.*

1. A. Belton, D. Guillot, A. Khare, M. Putinar, *Preservers of totally positive kernels and Pólya frequency functions*, to appear in Mathematics Research Reports, 2022, arXiv: 2110.08206, 20 pages.
2. A. Belton, D. Guillot, A. Khare, M. Putinar, *Hirschman–Widder densities*, to appear in Applied and Computational Harmonic Analysis, 2022, arXiv: 2101.02129, 26 pages.
3. A. Belton, D. Guillot, A. Khare, M. Putinar, *Matrix compression along isogenic blocks*, to appear in Acta Scientiarum Mathematicarum, 2022, arXiv: 2010.14429, 29 pages.
4. A. Belton, D. Guillot, A. Khare, M. Putinar, *Totally positive kernels, Polya frequency functions, and their transforms*, to appear in Journal d’Analyse Mathématique, 2021, arXiv: 2006.16213, 63 pages.
5. A. Belton, D. Guillot, A. Khare, M. Putinar, *Moment-sequence transforms*, to appear in Journal of the European Mathematical Society, 2021, arXiv:1610.05740, 48 pages.
6. M. Ghandehari, D. Guillot, K. Hollingsworth, *Gabor-type frames for signal processing on graphs*, to appear in Journal of Fourier Analysis and Applications, 2020, arXiv:2009.06058, 19 pages.
7. A. Belton, D. Guillot, A. Khare, M. Putinar, *A panorama of positivity. II: Fixed dimension*, Complex Analysis and Spectral Theory. Proceedings of the CRM Workshop held at Laval University, QC, May 21-25, 2018. Contemporary Mathematics. CRM Proceedings. American Mathematical Society, Providence, RI, 2020. arXiv:1812.05482.
8. D. Guillot and J. Wu, *Total nonnegativity of GCD matrices and kernels*, Linear Algebra and its Applications, 578:446–461, 2019. arXiv:1901.01947.
9. A. Belton, D. Guillot, A. Khare, M. Putinar, *A panorama of positivity. I: Dimension free*, in Analysis of Operators on Function Spaces (The Serguei Shimorin Memorial Volume), A. Aleman, H. Hedenmalm, D. Khavinson, M. Putinar, Eds., pages 117–165, Trends in Mathematics, Birkhauser, 2019, arXiv:1812.05482.
10. M. Ghandehari, D. Guillot, K. Hollingsworth, *A non-commutative viewpoint on graph signal processing*, 13th International Conference on Sampling Theory and Applications (SampTA), Bordeaux, France, 2019.
11. A. Belton, D. Guillot, A. Khare, M. Putinar, *Simultaneous kernels of matrix Hadamard powers*, Linear Algebra and its Applications, 576:142–157, 2019, arXiv:1709.03280.
12. D. Guillot, A. Khare, B. Rajaratnam, *The critical exponent: a novel graph invariant*, 29th International Conference on Formal Power Series and Algebraic Combinatorics (FPSAC ’17), Séminaire Lotharingien de Combinatoire 78B, article #62, 2017, arXiv:1802.06976.
13. D. Guillot, A. Khare, B. Rajaratnam, *Preserving positivity for rank-constrained matrices*, Trans. Amer. Math. Soc., 369:6105–6145, 2017, arXiv:1406.0042.
14. A. Belton, D. Guillot, A. Khare, M. Putinar, *Matrix positivity preservers in fixed dimension. I.*, Advances in Mathematics, 298, 325-368, 2016, arXiv:1504.07674.

15. A. Belton, D. Guillot, A. Khare, M. Putinar, *Schur polynomials and matrix positivity preservers*, FPSAC '16 Proceedings (DMTCS proc. BC), 155–166, 2016.
16. A. Belton, D. Guillot, A. Khare, M. Putinar, *Matrix positivity preservers in fixed dimension*, C. R. Acad. Sci. Paris, Volume 354, Issue 2, 2016, Pages 143–148.
17. D. Guillot, A. Khare, B. Rajaratnam, *Critical exponents of graphs*, J. Combin. Theory Ser. A, Volume 139, 2016, Pages 30–58, arXiv:1504.04069.
18. D. Guillot, A. Khare, B. Rajaratnam, *Preserving positivity for matrices with sparsity constraints*, Trans. Amer. Math. Soc. 368:8929–8953, 2016 arXiv:1406.3408.
19. P. Diao, D. Guillot, A. Khare, B. Rajaratnam, *Differential calculus on graphon space*, J. Combin. Theory Ser. A, Volume 133, 2015, Pages 183–227, arXiv:1403.3736.
20. D. Guillot, B. Rajaratnam, *Functions preserving positive definiteness for sparse matrices*, Trans. Amer. Math. Soc. 367 (2015), 627–649, arXiv:1210.3894.
21. D. Guillot, A. Khare, B. Rajaratnam, *Complete characterization of Hadamard powers preserving Loewner positivity, monotonicity, and convexity*, Journal of Mathematical Analysis and Applications, 425 no. 1, pages 489–507, 2015, arXiv:1311.1581.
22. D. Guillot, A. Khare, B. Rajaratnam, *The critical exponent conjecture for powers of doubly nonnegative matrices*, Linear Algebra and its Applications, Volume 439, Issue 8, 2013, Pages 2422–2427 arXiv:1303.4701.
23. D. Guillot, B. Rajaratnam, *Retaining positive definiteness in thresholded matrices*, Linear Algebra and its Applications, Volume 436, Issue 11, 1 June 2012, Pages 4143–4160, arXiv:1108.3325.
24. D. Guillot, N. Chevrot, T. J. Ransford, *De Branges-Rovnyak spaces and Dirichlet spaces*, J. Funct. Anal., 259 (2010), 2366–2383.
25. D. Guillot, *Blaschke condition and zero sets in weighted Dirichlet spaces*, Arkiv för Matematik, Volume 50, Issue 2 (2012), 269–278.
26. D. Guillot, *Fine boundary behavior and invariant subspaces of harmonically weighted Dirichlet spaces*, Complex Analysis and Operator Theory, 2012, Volume 6, Issue 6, 1211–1230.
27. D. Guillot, *Comportement au bord dans les espaces de Dirichlet avec poids harmoniques et espaces de de Branges-Rovnyak* [Boundary behavior in Dirichlet spaces with harmonic weights and de Branges–Rovnyak spaces], Doctoral dissertation, Laval University, 2010.
28. D. Guillot, *La visibilité du spectre des algèbres de Banach et le problème de l'inversion contrôlée* [Visibility of the spectrum in Banach algebras and the problem of controlled inversion], Master thesis, Laval University, 2007.
29. D. Guillot, T.J. Ransford, *Bloch's theorem for algebroid multifunctions II*, Math. Proc. R. Ir. Acad., 105A(2) (2005), 103–109.

1. J. Florez-Ospina, D. Lau, D. Guillot, K. Barner, G. Arce, *Smoothness on Rank-Order Path Graphs and its Use in Compressive Spectral Imaging with Side Information*, to appear in Signal Processing, 2022.
2. I. Balogun, M. Leadingham II, D. Guillot, and N. Attoh-Okine, *Deep Learning Approach Towards Squat Isolation in a Multi-Embedded Track Geometry Defects*, accepted in IEEE BigData workshop, 2021.
3. A. Vaccaro, J. Emile-Geay, D. Guillot, R. Verna, C. Morice, J. Kennedy, B. Rajaratnam, *Climate field completion via Markov random fields – Application to the HadCRUT4.6 temperature dataset*, Journal of Climate, Volume 34(10), 4169–4188, 2021.
4. D. Guillot, A. Parada, S. Cioaba, G. Arce, *Optimal sampling sets in cographs*, IEEE Data Science workshop, Minneapolis, USA, 2019.
5. A. Lasisi, E. N. Martey, D. Guillot, N. Attoh-Okine, *A three-step agglomerated Machine Learning: An alternative to Weibull Defect Analysis of Rail Infrastructure*, IEEE International Conference on Big Data, Seattle, USA, 2018.
6. J. Wang, J. Emile-Geay, D. Guillot, N. McKay, B. Rajaratnam, *Fragility of reconstructed temperature patterns over the Common Era: Implications for model evaluation*, Geophysical Research Letters, Volume 42, Issue 17, 2015, Pages 7162–7170.
7. D. Guillot, B. Rajaratnam, J. Emile-Geay, *Statistical paleoclimate reconstructions via Markov random fields*, Ann. Appl. Stat., Volume 9, Number 1 (2015), 324–352. arXiv:1309.6702.
8. J. Wang, J. Emile-Geay, D. Guillot, J. E. Smerdon, and B. Rajaratnam, *Evaluating climate field reconstruction techniques using improved emulations of real-world conditions*, Clim. Past, 10, 1–19, 2014.
9. J. Wang, J. Emile-Geay, D. Guillot, and B. Rajaratnam, *Spatiotemporal Patterns of low-frequency variability in a 2000-year long global temperature reconstruction*, 4th International Workshop on Climate Informatics, NCAR, Boulder, CO, 2014.
10. D. Guillot, A. Maleki, B. Rajaratnam, B. Rolfs, I. Wong, *Iterative thresholding algorithms for sparse inverse covariance estimation*, NIPS, Lake Tahoe, 2012, arXiv:1211.2532.

## Current and past grants

- American Institute of Mathematics (AIM) workshop grant (full funding to support 20 workshop participants) , Pasadena, CA, 2023.
- Travel grant for plenary speakers, Fields Institute for Research in Mathematical Sciences, Toronto, Canada, \$CAD 1,000.
- Strategic initiative grant, University of Delaware Research Foundation, 2017–2018, \$48,949.00, UDRF-SI GUILLOT, *Efficient design of uniqueness sets for band-limited signals on networks*.
- Research experience for undergraduates (REU) supplement, University of Delaware Research Foundation, 2017, \$3,500.
- Simons collaboration grant for mathematicians, 2017-2022, \$42,000.00, *Matrix positivity preservers, Schur polynomials, and Hankel operators*.

- Research-in-groups grant, International Centre for Mathematical Sciences, Edinburgh, UK, 2016, £10,180 (\$13,300).
- University of Delaware Research Foundation Grant, 2016-2018, \$35,000.00, UDRF GUILLOT 16-18, *Analysis of clustering algorithms via graph limits*.
- American Institute of Mathematics (AIM) workshop grant (full funding to support 20 workshop participants) , Palo Alto, CA, 2014.

## Courses Taught

Date	Institution	Course name
Fall 2022	University of Delaware	MATH450: Mathematical Statistics (30 students)
Spring 2022	University of Delaware	MATH637: Mathematical Techniques in Data Science (23 students)
Winter 2022	University of Delaware	MATH242 Analytic Geometry and Calculus B (29 students)
Fall 2021	University of Delaware	MATH508: Complex Analysis (29 students)
Fall 2021	University of Delaware	MATH450: Mathematical Statistics (30 students)
Summer 2021	University of Delaware	MATH349: Elementary Linear Algebra (30 students)
Spring 2021	University of Delaware	MATH450: Mathematical Statistics (25 students)
Spring 2021	University of Delaware	MATH450: Mathematical Statistics (18 students)
Winter 2021	University of Delaware	MATH242: Analytic Geometry and Calculus B (30 students)
Fall 2020	University of Delaware	MATH350: Probability Theory and Simulation Methods (35 students)
Summer 2020	University of Delaware	MATH350: Probability Theory and Simulation Methods (23 students)
Spring 2020	University of Delaware	MATH637: Mathematical Techniques in Data Science (16 students)
Spring 2020	University of Delaware	MATH401: Introduction to Real Analysis (27 students)
Winter 2020	University of Delaware	MATH242: Analytic Geometry and Calculus B (21 students)
Fall 2019	University of Delaware	MATH 350: Probability Theory and Simulation Methods (38 students)
Fall 2019	University of Delaware	MATH 350: Probability Theory and Simulation Methods (39 students)
Spring 2019	University of Delaware	MATH 350: Probability Theory and Simulation Methods (30 students)
Fall 2018	University of Delaware	MATH 350: Probability Theory and Simulation Methods (38 students)
Fall 2018	University of Delaware	MATH 451: Abstract Algebra I (25 students)
Fall 2017	University of Delaware	MATH 245: Introduction to Proof (23 students)
Spring 2017	University of Delaware	MATH 567: Mathematical Techniques in Data Science (16 students)
Fall 2016	University of Delaware	MATH 450: Mathematical Statistics (25 students)
Fall 2016	University of Delaware	MATH 349: Elementary Linear Algebra (20 students)
Spring 2016	University of Delaware	MATH 829: Introduction to data mining and analysis (21 students)
Fall 2015	University of Delaware	MATH 349: Elementary Linear Algebra (21 students)
Summer 2014	Stanford University	STATS 116: Theory of Probability (50 students)
Spring 2014	Stanford University	STATS 116: Theory of Probability (85 students)
Spring 2013	Stanford University	STATS 116: Theory of Probability (85 students)
Fall 2009*	Laval University	MAT-1900: Mathematics for Engineers I (105 students)
Fall 2008	Laval University	MAT-1500: Geometry (80 students)
Winter 2008*	Laval University	MAT-1910: Mathematics for Engineers II (150 students)

\* *Star professor* prize for excellence in teaching awarded for this course.

## Mentoring Experience

### Ph.D. Students.

- Kristopher Hollingsworth, University of Delaware, 2016–2020.  
Co-supervision with M. Ghandehari.  
Now tenure-track assistant professor at Minnesota State University–Mankato  
Previously a postdoctoral fellow at U. Minnesota.  
Dissertation: *Discrete frames for high-dimensional data: constructions on regular and irregular domains*.

### Graduate Summer Projects.

- Thang Xuan Nguyen, University of Delaware, Summer 2021.
- Yikun Bai, University of Delaware, Summer 2017.
- Abhijit Kumar Baruah, University of Delaware, Summer 2017.

### Undergraduate Projects.

- Logan Hallee, U. Delaware, Fall 2021.
- Emily Goldfarb, U. Delaware, Fall 2021.
- Brandon Myers, U. Delaware, Summer and Fall 2021.
- Yunpeng Wang, U. Delaware, Spring 2021.
- Lucas Wu, U. Delaware, Summer 2018.
- Kyle Wang, U. Delaware, Summer 2017.
- Tina Torkaman, U. Delaware (visiting from Sharif University of Technology), Summer 2016.
- Kyle Wang, U. Delaware, Summer 2016.

## Recent and Upcoming Talks

- SIAM conference on Applied Linear Algebra, online, May 2021.
- Hilbert spaces of analytic functions (Plenary speaker), Fields Institute, Toronto, Canada, November 2021.
- University of Nevada, Reno Colloquium, April 2020.
- 36th Southeastern Analysis Meeting (Plenary speaker), Virginia, USA, March 2020.
- AMS Fall Western Sectional Meeting, UC Riverside, California, USA, November 2019.
- International Linear Algebra Society Meeting (Matrix Inequalities and Matrix Equations session), Rio, Brazil, 2019.
- International Linear Algebra Society Meeting (Spectral graph theory session), Rio, Brazil, 2019.
- Workshop on Positivity (Plenary speaker, Mini-course lecture series on positivity preservers), University of New Mexico, May 2019.
- IIT Bombay mathematics seminar, Mumbai, India, 2019.
- IISc Bangalore mathematics seminar, Bangalore, India, 2019.
- University of Richmond Colloquium, 2018.
- Virginia Operator Theory and Complex Analysis Meeting (Plenary Speaker), 2018.

- Complex Analysis and Spectral Theory, Laval University, 2018.
- U. Delaware Signal Processing and Communications Seminar Series, 2017.
- Joint Mathematics Meetings, Atlanta, 2017.
- Recent Advances in Linear Algebra and Graph Theory, Chattanooga, 2016.
- U. Delaware Inverse Problems and Analysis Seminar, 2016.
- SIAM Conference on Applied Linear Algebra, Atlanta, 2015.
- Discrete Mathematics Day at Worcester Polytechnic Institute, 2015.
- University of Oregon Seminar, 2015.
- San Jose State University Colloquium, 2015.
- Joint Mathematics Meetings, San Antonio, 2015.
- American Institute of Mathematics (AIM), Palo Alto, 2014.
- American Geophysical Union Meeting, San Francisco, 2014.
- International Linear Algebra Society Meeting, Providence, 2013.
- Joint Mathematics Meetings, San Diego, 2013.
- American Geophysical Union Meeting, San Francisco, 2013.
- European Geophysical Union Meeting, Vienna, 2012.
- American Geophysical Union Meeting, San Francisco, 2012.
- American Geophysical Union Meeting, San Francisco, 2011.
- International Congress on Industrial and Applied Mathematics (ICIAM), Vancouver, 2011.

## Recent Professional Activities

- Director of Undergraduate Studies, U. Delaware, 2022–present.
- President of the Honor Society of Phi Kappa Phi, U. Delaware Chapter, 2022–2023.
- Manager of the ILAS website, International Linear Algebra Society, 2021–present.
- U. Delaware Math Club advisor, 2021.
- Senator, College of Arts and Sciences, University of Delaware, 2020–2022.
- Referee for: Advances in Operator Theory, American Mathematical Monthly, Bulletin of the London Mathematical Society, Canadian Journal of Mathematics, Colloquium Mathematicum, Computational Statistics and Data Analysis, Concrete Operators, Electronic Linear Algebra, Indian Journal of Pure and Applied Mathematics, Journal of Combinatorial Theory Series A, Journal of Fourier Analysis and Applications, Linear Algebra Appl., Linear and Multilinear Algebra, MathSciNet, Mediterranean Journal of Mathematics, Proc. Amer. Math. Soc., Publicationes Mathematicae Debrecen, SampTA, SIAM Journal on Mathematics of Data Science, SIGMA, Special Matrices, Studia Mathematica, and Trans. Amer. Math. Soc.
- Co-organizer of the invited ILAS 2022 minisymposium on “Matrix positivity: theory and applications”, Galway, Ireland, 2022.
- Co-organizer of the mini-symposium *Matrix equations, matrix inequalities, and applications* at the SIAG/LA conference, New Orleans, May 17–21, 2021.



- Co-organizer of a special session on *Interplay between Analysis and Combinatorics* at the AMS Fall Eastern Sectional Meeting 2018.
- U. Delaware Undergraduate Research Coordinator 2018–2019.
- Co-organizer of the ILAS 2017 invited mini-symposium on “Linear Algebra and Positivity with Applications to Data Science”, Iowa State University, Ames, IA, 2017.
- Co-organizer of an AMS Special Session on *Positivity and Matrix Inequalities*, Joint Mathematics Meetings, San Antonio, 2015.
- Co-organizer of an AMS Special Session on *Limits of Discrete Structures*, Joint Mathematics Meetings, San Antonio, 2015.
- Co-organizer of the workshop “Positivity, graphical models, and modeling of complex multivariate dependencies” at the American Institute of Mathematics (AIM), Palo Alto, United States, 2014.
- Putnam supervisor, University of Delaware, December 2019.

## Professional Organization Memberships

- Member of the Honors Society of Phi Kappa Phi.
- Member of the International Linear Algebra Society

## Computer Literacy

Matlab, Python, C/C++, R, Fortran, Java, HTML

LaTeX, Maple, GeoGebra

Linux, Mac OS, Windows

## Languages

English: fluent

French: native

Spanish: professional working proficiency

## References

Letters of recommendation available upon request.