

Curriculum Vitae

Timothy M. Garoni

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Education

- 2003 • **Ph.D.** The University of Melbourne.
- 2000 • **B.Sc.(Hons)** The University of Melbourne.

Employment

- July 2024 – • **Professor** in the School of Mathematics at Monash University.
- Jan 2016 – June 2024 • **Associate Professor** in the School of Mathematics at Monash University.
- Jan 2015 – Dec 2015 • **Senior Lecturer** in the School of Mathematics at Monash University.
- May 2011 – Dec 2014 • **ARC Future Fellow** in the School of Mathematics at Monash University.
- Jan 2011 – May 2011 • **ARC Future Fellow** in the Department of Mathematics and Statistics at the University of Melbourne.
- Jan 2008 – Dec 2010 • **Research Fellow** at the ARC Centre of Excellence for Mathematics and Statistics of Complex Systems (**MASCOS**), in the Department of Mathematics and Statistics at the University of Melbourne.
- Sept 2005 – Dec 2007 • **Postdoctoral Research Fellow** in the Physics Department at New York University.
- Sept 2003 – Sept 2005 • **Postdoctoral Research Fellow** at the Institute for Mathematics and its Applications (**IMA**), at the University of Minnesota.

Professional Associations

- 2015 – 2018 • Chair of the Australian and New Zealand Association of Mathematical Physics (ANZAMP), a Division of AustMS. Consequently served on the AustMS Council and Steering Committee.
- 2011 – 2015 • Secretary of ANZAMP.
- 2011 – present • Member of ANZAMP.
- 2008 – present • Member of AustMS.

Research Interests

- My chief area of interest is discrete models in classical statistical mechanics. The study of such models lies at the intersection of mathematical physics, probability theory, combinatorics and computer science. I am interested in both equilibrium models, including the Ising model, self-avoiding walk, percolation, and the Fortuin-Kasteleyn random-cluster model, and also non-equilibrium models such as exclusion processes. I am particularly interested in the behaviour of equilibrium models in high dimensions. One aspect of my work involves studying the properties of Markov chains which arise in applications of the Monte Carlo method to discrete statistical mechanics. This includes questions such as the speed of mixing of finite Markov chains. I have also collaborated with traffic engineers, applying methods from non-equilibrium statistical mechanics and probability theory to the study of transportation.

Supervision

- I have supervised 4 postdoctoral research fellows. I have served as main supervisor for 4 successfully completed PhD students (2016, 2018, 2020, 2022), and associate supervisor for an additional 4 successfully completed PhD students (2009, 2017, 2019, 2020). I am currently Main Supervisor of two PhD students, and associate supervisor of another. I have further supervised 12 honours research projects, 9 third-year research projects, and 10 summer vacation research projects.

Research Grants & Fellowships

- Awarded Nov 2022 • **ARC Discovery Project**, *Self-Interacting Random Walks*. Project ID: DP230102209.
Andrea Collecchio (Chief Investigator), Timothy M. Garoni (Chief Investigator), Kais Hamza (Chief Investigator).
- Awarded Nov 2017 • **ARC Discovery Project**, *Random walks with long memory*. Project ID: DP180100613.
Andrea Collecchio (Chief Investigator), Timothy M. Garoni (Chief Investigator), Kais Hamza (Chief Investigator).
- Awarded April 2015 • **ARC Centre of Excellence**, *ARC Centre of Excellence for Mathematical & Statistical Frontiers*. Project ID: CE140100049.
I was one of 19 Chief Investigators.
- Awarded Nov 2013 • **ARC Discovery Project**, *Finite Markov chains in statistical mechanics and combinatorics*. Project ID: DP140100559.
Timothy M. Garoni (Chief Investigator), Greg Markowsky (Chief Investigator), and Andrea Collecchio (Chief Investigator).
- Awarded Nov 2011 • **ARC Linkage Project**, *Modelling large urban transport networks using stochastic cellular automata*. Project ID: LP120100258.
Timothy M. Garoni (Chief Investigator), Jan de Gier (Chief Investigator), Andreas Schadschneider (Partner Investigator), and VicRoads (Partner Organization).
- Awarded Nov 2010 • **ARC Future Fellowship**, *Design, analysis and application of Monte Carlo methods in statistical mechanics*. Project ID: FT100100494.

Research Grants & Fellowships (continued)

- Awarded Oct 2010
- **ARC Discovery Project**, *Design, analysis and application of Monte Carlo algorithms in statistical mechanics*. Project ID: DP110101141. Timothy M. Garoni (Chief Investigator), Alan Sokal (Partner Investigator) and Youjin Deng (Partner Investigator).

Service

- Chair of the local organising committee for the 46th Conference on Stochastic Processes and their Applications, to be held in Melbourne in July 2027.
- Chair of the B. H. Neumann Prize Committee for the Australian Mathematical Society, (2020 – 2022).
- Deputy Director (Outreach) of the ARC Centre of Excellence for Mathematical & Statistical Frontiers (ACEMS) (January 2021 – December 2021). Interim Deputy Director of ACEMS (July 2019 – November 2019). I also served as ACEMS Node Leader (Monash node) and Theme Leader (Multiscale Models theme).
- Organiser for the MATRIX program, **Monte Carlo Algorithms in Statistical Mechanics**, held 26 June 2023 – 7 July 2023.
- Organiser for the ANZAMP/Mathematical Physics session at the 8th Australia-New Zealand Mathematics Convention (2014).
- Organiser for the **AMSI Workshop on Mathematics of Transportation Networks**, held at Monash University, 19–21 June 2013, as part of the International Year for the **Mathematics of Planet Earth**.
- Organiser for the Inaugural Australian and New Zealand Association of Mathematical Physics (ANZAMP) Conference, held in Lorne, 2–5 December 2012.
- Organiser for the Workshop on Mesoscopic Modelling of Traffic Networks, held at the University of Melbourne, 18 July 2011.
- Organiser for the Mathematical Physics sessions at the 54th, 56th and 57th Annual Meetings of the Australian Mathematical Society (2010, 2012, 2013).
- Organiser for the international conference **Monte Carlo Algorithms in Statistical Physics**, held in Melbourne, 26–28 July 2010. This was a satellite meeting of **Statphys 24**.

Teaching Experience

- 2015 –
- **Unit Coordinator** for *Mixing of finite Markov chains*, in the School of Mathematics at Monash University.
- 2015 –
- **Unit Coordinator** for *Linear Algebra (Advanced)*, in the School of Mathematics at Monash University.
- 2012 –
- **Unit Coordinator** for *Linear Algebra with Applications*, in the School of Mathematics at Monash University.

Teaching Experience (continued)

- 2017 – 2018 • **Lecturer** for *Engineering mathematics*, in the School of Mathematics at Monash University.
- 2014 • **Lecturer** for *Applied Mathematical Modelling*, in the School of Mathematics at Monash University.
- 2011 • **Lecturer** for *Analysis of change*, in the School of Mathematics at Monash University.
- 2009 • **Lecturer** for *Calculus 2*, in the Department of Mathematics and Statistics at the University of Melbourne.
- 2006 • Taught the recitations for the course *Mathematical Physics*, in the Physics Department of New York University.
- 2004 • **Primary instructor** for the course *Methods of Applied Mathematics*, in the School of Mathematics at the University of Minnesota.

Publications

Non-referred Articles

- Tim Garoni, Peaker Guo and Zongzheng Zhou, *How hard is it to scramble Rubik's Cube?*, The Conversation (31 January 2020).

Preprints

- Eren Metin Elci and Timothy M Garoni, *Critical speeding-up in dynamical percolation*, arXiv:2402.08927.

Refereed Journal Articles

- Youjin Deng, Timothy M Garoni, Jens Grimm and Zongzheng Zhou, *Two-point functions of random-length random walk on high-dimensional boxes*, Journal of Statistical Mechanics, 023203 (2024).
- Youjin Deng, Timothy M Garoni, Jens Grimm and Zongzheng Zhou, *Unwrapped two-point functions on high-dimensional tori*, Journal of Statistical Mechanics, 053208 (2022).
- Reza Mohajerpoor, Meead Saberi, Hai L. Vu, Timothy M. Garoni and Mohsen Ramezani, *H_∞ robust perimeter flow control in urban networks with partial information feedback*, Transportation Research Part B **137**, 47-73 (2020).
- Youjin Deng, Timothy M Garoni, Jens Grimm, Abraham Nasrawi and Zongzheng Zhou, *The length of self-avoiding walks on the complete graph*, Journal of Statistical Mechanics, 103206 (2019).
- Zongzheng Zhou, Jens Grimm, Sheng Fang, Youjin Deng and Timothy M. Garoni, *Random-Length Random Walks and Finite-Size Scaling in High Dimensions*, Physical Review Letters **121**, 185701 (2018).
- Eren Metin Elçi, Jens Grimm, Lijie Ding, Abraham Nasrawi, Timothy M. Garoni and Youjin Deng, *Lifted worm algorithm for the Ising model*, Physical Review E **97**, 042126 (2018).
- Lele Zhang, Caley Finn, Timothy M. Garoni and Jan de Gier, *Behaviour of traffic on a link with traffic light boundaries*, Physica A **503**, 116-138 (2018).
- Andrea Collecchio, Eren Metin Elçi, Timothy M. Garoni and Martin Weigel, *On the Coupling Time of the Heat-Bath Process for the Fortuin-Kasteleyn Random-Cluster Model*, Journal of Statistical Physics **170**, 22-61 (2018).
- Jens Grimm, Eren Metin Elci, Zongzheng Zhou, Timothy M. Garoni and Youjin Deng, *Geometric explanation of anomalous finite-size scaling in high dimensions*, Physical Review Letters **118**, 115701 (2017).
- Lele Zhang, Callum Stuart, Samithree Rajapaksha, Gentry White and Timothy M. Garoni, *Study of Cross-Correlations in Traffic Networks with Applications to Perimeter Control*, Transportation Research Record **2623**, 108-116 (2017).
- Andrea Collecchio, Timothy M. Garoni, Timothy Hyndman and Daniel Tokarev, *The worm process for the Ising model is rapidly mixing*, Journal of Statistical Physics **164**, 1082-1102 (2016).
- Long T. Truong, Majid Sarvi, Graham Currie and Timothy M. Garoni, *Required traffic micro-simulation runs for reliable multivariate performance estimates*, Journal of Advanced Transportation **50**, 296-314 (2016).

Publications (continued)

- Ronny Kutadinata, Will Moase, Chris Manzie, Lele Zhang, and Tim Garoni, *Enhancing the performance of existing urban traffic light control through extremum-seeking*, Transportation Research Part C **62** 1-20 (2016).
- Zongzheng Zhou, Xiao Xu, Timothy M. Garoni, and Youjin Deng, *Leaf-excluded percolation in two and three dimensions*, Physical Review E **91**, 022140 (2015).
- Lele Zhang, Jan de Gier, and Timothy M. Garoni, *Traffic disruption and recovery in road networks*, Physica A **401**, 82-102 (2014).
- Xiao Xu, Junfeng Wang, Zongzheng Zhou, Timothy M. Garoni, and Youjin Deng, *Geometric structure of percolation clusters*, Physical Review E **89**, 012120 (2014).
- Junfeng Wang, Zongzheng Zhou, Wei Zhang, Timothy M. Garoni, and Youjin Deng, *Bond and Site Percolation in Three Dimensions*, Physical Review E **87**, 052107 (2013).
- Junfeng Wang, Zongzheng Zhou, Qingquan Liu, Timothy M. Garoni, Youjin Deng, *High-precision Monte Carlo study of directed percolation in $(d + 1)$ dimensions*, Physical Review E **88**, 042102 (2013).
- Lele Zhang, Timothy M. Garoni, and Jan de Gier, *A comparative study of Macroscopic Fundamental Diagrams of arterial road networks governed by adaptive traffic signal systems*, Transportation Research Part B **49**, 1-23 (2013).
- Jian-Ping Lv, Timothy M. Garoni, and Youjin Deng, *Phase transitions in XY antiferromagnets on plane triangulations*, Physical Review B **87**, 024108 (2013).
- Nicholas R. Beaton, Philippe Flajolet, Timothy M. Garoni, and Anthony J. Guttmann, *Some New Self-avoiding Walk and Polygon Models*, Fundamenta Informaticae **117**, 19-33 (2012).
- Qingquan Liu, Youjin Deng, Timothy M Garoni, and Henk W J Blöte, *The $O(n)$ loop model on a three-dimensional lattice*, Nuclear Physics B **859**, 107-128 (2012).
- Timothy M. Garoni, Giovanni Ossola, Marco Polin, and Alan D. Sokal, *Dynamic Critical Behavior of the Chayes-Machta Algorithm for the Random-Cluster Model. I. Two Dimensions*. Journal of Statistical Physics **144**, 459-518 (2011).
- Jan de Gier, Timothy M. Garoni, and Omar Rojas, *Traffic flow on realistic road networks with adaptive traffic lights*, Journal of Statistical Mechanics P04008 (2011).
- Qingquan Liu, Youjin Deng, and Timothy M. Garoni, *Worm Monte Carlo study of the honeycomb-lattice loop model*, Nuclear Physics B **846**, 283-315 (2011).
- Jan de Gier, Timothy M. Garoni, and Zongzheng Zhou, *Autocorrelations in the totally asymmetric simple exclusion process and Nagel-Schreckenberg model*, Physical Review E **82**, 021107 (2010).
- Youjin Deng, Wei Zhang, Timothy M. Garoni, Alan D. Sokal, and Andrea Sportiello, *Some geometric critical exponents for percolation and the random-cluster model*, Physical Review E **81**, 020102(R) (2010).
- Wei Zhang, Timothy M. Garoni, and Youjin Deng, *A worm algorithm for the fully-packed loop model*, Nuclear Physics B **814**, 461-484 (2009).

Publications (continued)

- Timothy M. Garoni, Anthony J. Guttmann, Iwan Jensen, and John C. Dethridge, *Prudent walks and polygons*, Journal of Physics A: Mathematical and Theoretical **42**, 095205 (2009).
- Youjin Deng, Timothy M. Garoni, and Alan D. Sokal, *Dynamic critical behavior of the worm algorithm for the Ising model*, Physical Review Letters **99**, 110601 (2007).
- Youjin Deng, Timothy M. Garoni, Jonathan Machta, Giovanni Ossola, Marco Polin, and Alan D. Sokal, *Critical Behavior of the Chayes-Machta-Swendsen-Wang Dynamics*, Physical Review Letters **99**, 055701 (2007).
- Youjin Deng, Timothy M. Garoni, and Alan D. Sokal, *Critical Speeding-Up in the Local Dynamics of the Random-Cluster Model*, Physical Review Letters **98**, 230602 (2007).
- Youjin Deng, Timothy M. Garoni, Wenan Guo, Henk W. J. Blöte, and Alan D. Sokal, *Cluster Simulations of Loop Models on Two-Dimensional Lattices*, Physical Review Letters **98**, 120601 (2007).
- Youjin Deng, Timothy M. Garoni, and Alan D. Sokal, *Ferromagnetic Phase Transition for the Spanning-Forest Model ($q \rightarrow 0$ Limit of the Potts Model) in Three or More Dimensions*, Physical Review Letters **98**, 030602 (2007).
- P. J. Forrester, N. E. Frankel, and T. M. Garoni, *Asymptotic form of the density profile for Gaussian and Laguerre random matrix ensembles with orthogonal and symplectic symmetry*, Journal of Mathematical Physics **47**, 023301 (2006).
- T. M. Garoni, P. J. Forrester, and N. E. Frankel, *Asymptotic corrections to the eigenvalue density of the GUE and LUE*, Journal of Mathematical Physics **46**, 103301 (2005).
- T. M. Garoni, *On the asymptotics of some large Hankel determinants generated by Fisher-Hartwig symbols defined on the real line*, Journal of Mathematical Physics **46**, 043516 (2005).
- P. J. Forrester, N. E. Frankel, and T. M. Garoni, *Random matrix averages and the impenetrable Bose gas in Dirichlet and Neumann boundary conditions*, Journal of Mathematical Physics **44**, 4157 (2003).
- P. J. Forrester, N. E. Frankel, T. M. Garoni, and N. S. Witte, *Finite one-dimensional impenetrable Bose systems: Occupation numbers*, Physical Review A **67**, 043607 (2003).
- P. J. Forrester, N. E. Frankel, T. M. Garoni, and N. S. Witte, *Painlevé Transcendent Evaluations of Finite System Density Matrices for 1d Impenetrable Bosons*, Communications in Mathematical Physics **238**, 257 (2003).
- T. M. Garoni and N. E. Frankel, *On the ubiquity of the Lévy integral – its relationship with the generalized Euler-Jacobi series and their asymptotics beyond all orders*, Fractals **11**, 93 (2003).
- T. M. Garoni and N. E. Frankel, *d-dimensional Lévy flights: Exact and asymptotic*, Journal of Mathematical Physics **43**, 5090 (2002).
- T. M. Garoni and N. E. Frankel, *Lévy flights: Exact results and asymptotics beyond all orders*, Journal of Mathematical Physics **43**, 2670 (2002).
- T. M. Garoni, N. E. Frankel, and M. L. Glasser, *Complete asymptotic expansions of the Fermi-Dirac integrals*, Journal of Mathematical Physics **42**, 1860 (2001).

Publications (continued)

Refereed Conference Proceedings

- Andrea Bedini, Lele Zhang and Timothy M. Garoni, *A Case Study of a Continuous Flow Intersection and Its Impact on Public Transport*, 2017 IEEE 20th International Conference on Intelligent Transportation Systems (ITSC): Workshop, 959-964 (2018).
- Long T. Truong, Majid Sarvi, Graham Currie and Timothy M. Garoni, *How Many Simulation Runs are Required to Achieve Statistically Confident Results? A case study of simulation-based surrogate safety measures*, Proceedings of the 2015 IEEE 18th International Conference on Intelligent Transportation Systems (2015).
- Lele Zhang, Somayeh Shiri and Timothy Garoni, *A Study of Aggregated Speed in Road Networks Using Cellular Automata*, ACRI 2014, In Lecture Notes in Computer Science **8751**, 596. Springer, (2014).
- Lele Zhang and Timothy Garoni, *Modeling disruption and recovery of traffic in road networks*, ACRI 2014, In Lecture Notes in Computer Science **8751**, 640. Springer, (2014).
- Ronny Kutadinata, Will Moase, Chris Manzie, Lele Zhang and Tim Garoni, *Extremum-Seeking for Adaptation of Urban Traffic Signal Control*, Proceedings of the IFAC World Congress, Cape Town, South Africa (2014).