

Curriculum Vitae
Anthony Quas

Nationality	British and American
Present Position	Professor, University of Victoria (2008–)
Previous Positions	Canada Research Chair, University of Victoria (2005–2014) Associate Professor, University of Victoria (2005–2008) Associate Professor, University of Memphis (2001–2004) Assistant Professor, University of Memphis (1997–2001) Research Fellow of King’s College working in the Statistical Laboratory, Cambridge University (1993–1997)
Work Address	University of Victoria, Department of Mathematics and Statistics Victoria, BC Canada V8W 2Y2
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Education	
1986–1989	B.A. in Mathematics (first class) at Cambridge University
1989–1990	Certificate of Advanced Study in Mathematics (with distinction) at Cambridge University
1990–1994	PhD in Mathematics at the University of Warwick under the supervision of Peter Walters

Academic Distinctions

1990	Tyson Medal for performance in Certificate of Advanced study in Mathematics
1992	Cambridge University ‘Smith Prize’ for a research essay
2002	Maitre de Conférences invité for 1 month, Université de Tours
2002–2005	NSF Individual Research Grant
2005	Research Member, MSRI, 5 months
2006–2018	NSERC Individual Research Grant
2007–2009	NSERC Grant Selection Committee Member
2008	NSF Grant Committee Member
2008	Principal organizer, Low Complexity Dynamics, Banff
2008–	Editor, Dynamical Systems: An International Journal
2008	Principal Organizer, Northwest Dynamical Systems Symposium, Victoria
2008	Organizer, MSRI program on Additive Combinatorics and Ergodic Theory
2009	Professeur invité, Aix–Marseille II, 1 month
2010	Professeur invité, Aix–Marseille III, 1 month
2011	Professeur invité, Paris XI, 1 month
2011	Principal Organizer, Ergodic Optimization, Banff
2011–2013	Member, Mathematics NSERC Liaison Committee
2012	Research Member, MSRI, 1 month
2013–2017	Chair, Mathematics NSERC Liaison Committee
2015	IdEx Professeur invité, Bordeaux III, 1 month

Teaching Experience

I have taught a wide variety of courses at the Universities of Victoria, Memphis and Cambridge at a number of levels; from Freshman classes to classes for Doctoral students. These have included Ergodic Theory, Probability, Complex Analysis, Foundations of Mathematics, Abstract Algebra, Calculus, Analytic Geometry in three dimensions, Differential Equations and Linear Algebra. I have used the Maple package as an educational tool in teaching Calculus.

While in Victoria, I have supervised two Ph.D.’s to completion and two post-doctoral Fellows. I supervised a Master’s student, and also co-supervised an additional postdoc and two Masters students. I am currently supervising an additional Ph.D. student.

Administrative Experience

While at the University of Victoria, I have served four times on the Departmental Hiring committee, and twice on the Departmental Tenure and Promotion Committee. I wrote a guide for department members on applying for research funding, and have reviewed the majority of grant applications that are written in the department, applying knowledge obtained through serving on the research council Grant Selection Committee.

While in Memphis, I served as Colloquium Organizer.

Professional Service

I write reviews of papers for *Mathematical Reviews* and *Zentralblatt für Mathematik*, and have refereed papers for a number of journals, including *International Mathematical Research Notices*, *Journal of Theoretical Probability*, *Indagationes Mathematicae*, *American Mathematical Monthly*, *Nonlinearity*, *Annales de l'Institut Fourier*, *Ergodic Theory and Dynamical Systems*, *Combinatorics Probability and Computing*, *Mathematical Proceedings of the Cambridge Philosophical Society*, *Illinois Journal of Mathematics*, *Random Structures and Algorithms*, *Probability Theory and Related Fields*, *Discrete and Continuous Dynamical Systems*, *Bulletin of the London Mathematical Society*, *IEEE Transactions on Information Theory*, *Israel Journal of Mathematics*, *Journal of the London Mathematical Society*, *Theoretical Computer Science*, *Mathematics Research Letters*, *Discrete Optimization*, *Dynamical Systems: An International Journal*.

I have also been an internal examiner for numerous students at Ph.D. and Master's levels, as well as external examiner for Master's degrees, Ph.D's, and Habilitation theses.

I served on the NSERC Grant Selection committee for 3 years, the NSF Dynamics panel for 1 year; and have written reports on grant proposals for Canadian, Chilean, Mexican, and Israeli funding agencies.

I am an Editor of the research journal, *Dynamical Systems: An International Journal*.

I am frequently asked to write letters for tenure and promotion cases, and have been asked to write four such letters in 2013.

Outreach

I am the Managing Editor of *Pi in the Sky*, a PIMS outreach journal, aimed at High School students. Copies are distributed to all High Schools mathematics departments in Western Canada. I have written articles, solicit articles from others, and oversee the production process of the magazine.

I am the Chair of the Mathematics NSERC Liaison committee, a mathematics community-led initiative to facilitate communication with the Research Council.

I founded the Victoria Math Circle, a venue for gifted High School students to work on Mathematics problems.

I have given public lecture on voting paradoxes, and recently was lectured at a summer camp for middle school children in France on the subject "Comment peut-on mesurer la dimension?"

I have given undergraduate colloquia at Western Washington University, DePaul University and Swarthmore College.

Research Interests

My research interests cover a range of topics in ergodic theory and dynamical systems. In particular, my work has included work on ergodic theorems, symbolic dynamics and the ergodic theory of differentiable dynamical systems, and their connections with stochastic processes.

I am familiar with the C Programming language and have written a number of programs as tools in my research as well as interactive graphical demonstration programs which relate to my research work. In addition, I have experience of Mathematica, which I have used in my research.

Seminars and Conferences

I have given colloquia and seminars at Berkeley, Brest, CalTech, Cambridge, CWI (Amsterdam), DePaul University (Chicago), University of East Anglia (Norwich), Liverpool, Maryland, Ludwig-Maximilians-Universität (Munich), McGill (Montreal), University of Maryland, Marseille, Memphis, University of New South Wales, University of North Texas, Northwestern University, Oregon Sate University, North Dakota State University, Oxford, Paris VI, Porto, Queen Mary Westfield College (London), Rouen (France), University of Southern California, Stanford, Toulouse, São Paulo, Brigham Young, San Francisco State University, University of Sydney, Tours, Victoria, Waikato (New Zealand), Paris XI, Uppsala, Kansas State, Western Washington, Warwick, UBC and Washington.

I recently gave a mini-course in São Paulo and have recently given talks at conferences in Santiago, Maryland, Penn State, Pucon, Banff, Guanajuato, Sydney, Riverside, Crete, Bordeaux, Colorado and Seattle.

Publications

- [1] A. Quas, ‘On representations of Markov chains by random smooth maps’, *Bull. London Math. Soc.* **23**(1991), 487–492.
- [2] A. Quas, ‘Invariant measures for families of circle maps’, *Math. Proc. Camb. Phil. Soc.* **111**(1992), 585–597.
- [3] A. Quas, ‘Representations of Markov chains on tori’, *Random and Computational Dynamics* **1**(1993), 261–276.
- [4] A. Quas, ‘A C^1 expanding map of the circle which is not weak-mixing’, *Israel J. Math.* **93**(1995), 359–372.
- [5] A. Quas, ‘Non-ergodicity for C^1 expanding maps and g -measures’, *Ergodic Theory Dynamical Systems* **16**(1996), 531–543.
- [6] A. Quas, ‘Invariant densities for C^1 maps’, *Stud. Math.* **120**(1996), 83–88.
- [7] A. Quas, ‘Rigidity of continuous coboundaries’, *Bull. London Math. Soc.* **29**(1997), 595–600.
- [8] A. Quas, ‘An entropy estimator for a class of infinite alphabet processes’, *Theor. Probab. Appl.* **43**(1998), 610–621.
- [9] Z. Coelho and A. Quas, ‘Criteria for \bar{d} -continuity’, *Trans. Amer. Math. Soc.* **350**(1998), 3257–3268.
- [10] A. Dooley, I. Klemeš and A. Quas, ‘Product and Markov measures of type III’, *J. Austr. Math. Soc. (Series A)*, **65**(1998), 84–110.
- [11] A. Quas, ‘Infinite paths in a Lorentz lattice gas model’, *Probab. Theory Rel. Fields*, **114**(1999) 229–244.
- [12] G. Cui, Y. Jiang and A. Quas, ‘Scaling functions, g -measures and Teichmüller spaces of circle endomorphisms’, *Discrete Continuous Dynamical Systems*, **5**(1999), 535–552.
- [13] A. Quas, ‘Most expanding maps have no absolutely continuous invariant measure’, *Stud. Math.* **134**(1999) 69–78.
- [14] G. Hernandez, F. Niño and A. Quas, ‘Ergodicity of evolutionary systems’, in *Proceedings of the 5th International Conference on Information Systems, Analysis and Synthesis*(1999), 148–155.
- [15] F. Niño, G. Hernandez, F. Botelho and A. Quas, ‘Random iterated neural networks: Asymptotic behavior’, in *Smart Engineering Systems: Neural Networks, Fuzzy Logic, Evolutionary Programming and Rough Sets*(1999)
- [16] G. Hernandez, F. Niño, A. Quas and D. Dasgupta, ‘Equilibrium states of iterated random maps arising in evolutionary algorithms’, in *Proceedings of the Third International Workshop on Frontiers in Evolutionary Algorithms, Atlantic City, NJ*(2000).
- [17] F. Niño, G. Hernandez, F. Botelho and A. Quas, ‘Random iterated neural networks as universal approximators of dynamical systems’, in *Proceedings of the Fifth International Symposium on Artificial Life and Robotics, Oita, Japan*(2000).
- [18] E. Lesigne, A. Quas, T. de la Rue, and B. Rittaud, ‘Weak disjointness in ergodic theory’, *Proceedings of the Conference on Ergodic Theory and Dynamical Systems, Toruń 2000*.
- [19] A. Quas and P. Trow, ‘Subshifts of multidimensional shifts of finite type’, *Ergodic Theory Dynamical Systems* **20**(2000) 859–874.
- [20] A. Quas and P. Trow, ‘Mappings of group shifts’, *Isr. J. Math.* **124**(2001), 333–365.
- [21] J. Campbell and A. Quas, ‘A generic expanding map has a singular SRB measure’, *Comm. Math. Phys.* **221**(2001), 335–349.
- [22] A. Quas and A. Şahin, ‘Entropy gaps and locally maximal entropy in \mathbb{Z}^d subshifts’, *Ergodic Theory Dynamical Systems* **23**(2003), 1227–1245.
- [23] P. Balister, B. Bollobás and A. Quas, ‘Convexity, random tilings and shifts of finite type’, *Illinois J. Math* **46**(2003), 781–795.
- [24] E. George, G. Narasimhan and A. Quas, ‘Exact sampling of sequence alignments’ (preprint).
- [25] K. Petersen, A. Quas and S. Shin, ‘Measures of maximal relative entropy’, *Ergodic Theory Dynamical Systems* **23**(2003), 207–223.
- [26] E. Lesigne, A. Quas and M. Wierdl, ‘Generic points in the Cartesian powers of the Morse dynamical system’, *Bull. Soc. Math. France* **131**(2003), 435–464.
- [27] A. Quas, ‘Anomalous election outcomes’ *Stochastics and Dynamics* **4**(2004) 95–105.
- [28] A. Quas and L. Zamboni, ‘Periodicity and local complexity’, *Theor. Comp. Sci.* **319**(2004), 229–240.
- [29] C. Demeter and A. Quas, ‘Weak- L^1 estimates and ergodic theorems’, *New York J. Math.* **10**(2004), 169–174.
- [30] P. Balister, B. Bollobás and A. Quas, ‘Percolation in Voronoi tilings’ *Random Structures and Algorithms* **26**(2005) 310–318.

- [31] M. Boshernitzan, G. Kolesnik, A. Quas and M. Wierdl, ‘Ergodic averaging sequences’ *J. d’Analyse Math.* **95**(2005), 63–103.
- [32] A. Dooley and A. Quas, ‘Approximate transitivity for zero entropy systems’, *Ergodic Theory Dynamical Systems* **25**(2005), 443–453.
- [33] A. Quas and M. Wierdl, Appendix to ‘Combinatorial and Diophantine applications of ergodic theory’ in *Handbook of dynamical systems*, Volume 1B, Elsevier (2006).
- [34] X. Bressaud and A. Quas, ‘Rate of approximation of minimizing measures’, *Nonlinearity* **20**(2007), 845–853.
- [35] W. Bahsoun, C. Bose and A. Quas, ‘Deterministic representation for position dependent random maps’, *Discrete Cont. Dyn. Systems* **22**(2008), 529–540.
- [36] Z. Nedev and A. Quas, ‘Balanced sets and the vector game’, *International J. Number Th.* **4**(2008), 339–347.
- [37] R. McCutcheon and A. Quas, ‘Generalized polynomials and mild mixing systems’, *Canad. J. Math.* **61**(2009), 656–673.
- [38] A. Goetz and A. Quas, ‘Global properties of piecewise isometries’, *Ergodic Theory Dynamical Systems* **29**(2009), 545–568.
- [39] A. Quas, ‘Distance in positive density sets’, *J. Comb. Th. A* **116**(2009), 979–987.
- [40] A. Quas, ‘Ergodicity and Mixing Properties’, chapter in *Encyclopedia of Complexity and Systems Science*, Springer 2009.
- [41] G. Froyland, S. Lloyd and A. Quas, ‘Coherent structures and isolated spectrum for Perron–Frobenius cocycles’, *Ergodic Theory Dynamical Systems* **30**(2010), 729–756.
- [42] A. Quas and M. Wierdl, ‘Rates of convergence of non-conventional averages’, *Ergodic Theory Dynamical Systems* **30**(2010), 233–262.
- [43] A. Quas and Y. Peres, ‘Entropy rate for hidden Markov chains with rare transitions’, *Entropy of Hidden Markov Processes and Connections to Dynamical Systems*, Cambridge Univ. Press (2011).
- [44] B. Fernandez and A. Quas, ‘Statistical properties of invariant graphs in piecewise affine discontinuous forced systems’, *Nonlinearity* **24**(2011), 2477–2488.
- [45] A. Quas and J. Siefken, ‘Ergodic optimization of super-continuous functions’, *Ergodic Theory Dynamical Systems* **32**(2012), 2071–2082.
- [46] A. Quas and T. Soo, ‘Weak mixing suspension flows over shifts of finite type are universal’, *J. Mod. Dynam.* **6** (2012), 427–449.
- [47] Y. Cheung, A. Goetz and A. Quas, ‘Piecewise Isometries, Uniform Distribution and $3 \log 2 - \pi^2/8$ ’, *Ergodic Theory Dynamical Systems* **32**(2012), 1862–1888.
- [48] G. Froyland, S. Lloyd and A. Quas, ‘A semi-invertible Oseledets theorem with application to transfer operator cocycles’, *Discrete Contin. Dynam. Sys.* **33**(2013), 3835–3860.
- [49] M. Allahbakhshi and A. Quas, ‘Measures of Relative Maximal Entropy’, *Trans. Amer. Math. Soc.* **365**(2013), 1347–1368.
- [50] C. González-Tokman and A. Quas, ‘A semi-invertible operator Oseledets theorem’, *Ergodic Theory Dynam. Systems* **34** (2014), 1230–1272.
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- [52] G. Froyland, C. González-Tokman and A. Quas, ‘Detecting Isolated Spectrum of Transfer and Koopman Operators with Fourier Analytic Tools’, *J. Comput. Dyn.* **1** (2014), 249–278.
- [53] B. Kra, A. Quas and A. Şahin, ‘Rudolph’s two step coding theorem and Alpern’s lemma for \mathbb{R}^d actions’, *Trans. Amer. Math. Soc.* **367** (2015), 4253–4285.
- [54] C. González-Tokman and A. Quas, ‘A concise proof of the multiplicative ergodic theorem on Banach spaces’ *J. Mod. Dyn.* **9** (2015), 237–255.
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- [57] A. Quas and T. Soo, ‘A monotone Sinai theorem for Bernoulli shifts’, *Ann. Prob.* **44** (2016), 107–130.
- [58] E. Coven, A. Quas and R. Yassawi, ‘Computing automorphism groups of shifts using atypical equivalence classes’ *Discrete Analysis* **2016:3**.

- [59] J. Janssen, A. Quas and R. Yassawi, ‘Bratteli diagrams where random orders are imperfect’, *Proc. Amer. Math. Soc.* **145** (2017), 721–735.
- [60] X. Bressaud and A. Quas, ‘Dynamical analysis of a repeated game with incomplete information’, *Math. Oper. Res.* **42** (2017), 1085–1105.
- [61] C. Bose, J. Horan and A. Quas, ‘On irreducibility of Oseledets subspaces’, *Dyn. Sys.* **33** (2018), 332–347.
- [62] B. Fernandez and A. Quas, ‘The variation of invariant graphs in forced systems’, *Chaos* **083101** (2018).
- [63] G. Froyland, C. González-Tokman and A. Quas, ‘Hilbert space Lyapunov exponent stability’, *Trans. Amer. Math. Soc.* **372** (2019), 2357–2388.
- [64] A. Bonato, J. Janssen and A. Quas, ‘Geometric random graphs and Rado sets in sequence spaces’, *Eur J. Comb.* **79** (2019), 1–14.
- [65] A. Quas, P. Thieullen and M. Zarrabi, ‘Explicit bounds for separation between Oseledets subspaces’, *Dynam. Syst.* **34** (2019), 517–560.
- [66] J. S. Gonschorowski, A. Quas and J. Siefken, ‘Support stability of maximizing measures for shifts of finite type’, *Ergodic Theory Dynam. Syst.* **41** (2021), 869–880.
- [67] C. González-Tokman and A. Quas, ‘Stability and Collapse of the Lyapunov spectrum for Perron-Frobenius Operator cocycles’, *J. Eur. Math. Soc.* **23** (2021), 3419–3457.
- [68] T. Kucherenko, A. Quas and C. Wolf, ‘Multiple phase transitions on compact symbolic systems’, *Adv. Math.* **385** (2021), 107768.
- [69] A. Bonato, J. Janssen and A. Quas, ‘Geometric random graphs and Rado sets of continuous functions’, *Discrete Anal.* (2021), Paper No. 3, 21pp.
- [70] C. Bose, A. Quas and M. Tanzi, ‘Random Composition of L-S-V Maps Sampled Over Large Parameter Ranges’, *Nonlinearity* **34** (2021), 3641–3675.
- [71] C. González-Tokman and A. Quas, ‘Lyapunov exponents for transfer operator cocycles of metastable maps: A quarantine approach’, *Tr. Mosk. Math. Obs.* (Transactions of the Moscow Mathematical Society) [Invited paper in honour of 80th birthday of Valery Oseledets] **82** (2021), 65–76.
- [72] J. Antonioli, S. Hong and A. Quas, ‘A multiplicative ergodic theoretic characterization of relative equilibrium states’, *Ergodic Theory Dynam. Syst.* (to appear) .
- [73] J. Campbell, A. Deane and A. Quas, ‘The Lightning model’, *J. Theor. Prob.* (to appear).
- [74] T. Kucherenko and A. Quas, ‘Flexibility of the Pressure function’, *Commun. Math. Phys.* (to appear).