

Mark Huber

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Education

- 1994 **BS**, *Harvey Mudd College*.
Mathematics
- 1997 **Masters**, *Cornell University*.
Operations Research and Industrial Engineering
- 1999 **PhD**, *Cornell University*.
Operations Research and Industrial Engineering

Thesis

- title *Perfect Sampling Using Bounding Chains*
- advisor Prof. David Shmoys
- department School of Operations Research and Industrial Engineering

Research Area

Monte Carlo simulation for statistical applications, approximation algorithms, and numerical integration. Design and analysis of new sampling methods that draw variates exactly from high-dimensional target distributions, and more efficient methods for utilizing these samples.

Experience

- 1991, 1992 **Computer Animator**, *Chemistry Animation Project*, California Inst. of Technology.
Created computer animated instructional videos for college chemistry.
- 1995 **Visiting Researcher**, Naval Undersea Warfare Center.
Developed optimization algorithms for finite element analysis output.
- 1996 **Visiting Researcher**, IBM Almaden.
Programmer in data mining group.
- 1999 **Teaching Assistant**, *Cornell University*.
Conducted lab sessions for introductory undergraduate course in operations research.
- 1999-2001 **NSF Postdoc in the Mathematical Sciences**, *Dept. of Statistics*, Stanford U.
Researched Markov chain Monte Carlo methods under Persi Diaconis.

- 2001-2009 **Assistant Professor**, *Joint appointment: Dept. of Mathematics and Dept. of Statistical Science*, Duke University.
- 2009-2012 **Associate Professor**, *Dept. of Mathematical Sciences*, Claremont McKenna College.
- 2012-present **Fletcher Jones Foundation Associate Professor of Mathematics and Statistics and George R. Roberts Fellow**, *Dept. of Mathematical Sciences*, Claremont McKenna College.

Courses taught

Undergraduate courses

Integral Calculus, Monte Carlo Methods, Multivariable Calculus, Probability, Statistical Inference (probability required), Vector Calculus (linear algebra required), Honors Multivariable Calculus, Mathematical Finance, Mathematical Modeling, Deterministic Operations Research, Stochastic Operations Research, Stochastic Processes.

Graduate courses

Brownian Motion, Real Analysis (measure theory), Stochastic Processes, Advanced Monte Carlo Markov chain Methods, Spatial Point Processes, Basic Monte Carlo Markov chain Methods, Probability (measure theory required).

Publications

Submitted papers

- [1] A. Cloud and M. Huber. Fast perfect simulation of Vervaat perpetuities. 2015. arXiv:1510.01780.
- [2] M. Huber. Optimal linear Bernoulli factories for small mean problems. 2015. arXiv:1507.00843.
- [3] C. Evans, J. Hardin, M. Huber, D. Stoebel, and G. Wong. Differential expression analysis for multiple conditions. 2014. arXiv:1410.3370. Submitted.
- [4] J. Banks, S. Garrabrant, M. Huber, and A. Perizzolo. Using TPA for approximating the number of linear extensions, 2010. arXiv:1010.4981. Submitted.

Book length works

- [5] M. L. Huber. *Perfect Simulation*. Number 148 in Chapman & Hall/CRC Monographs on Statistics & Applied Probability. CRC Press, 2015.
- [6] M. L. Huber. *Perfect Sampling with Bounding Chains*. Ph.D. thesis, Cornell University, 1999.

Published articles

- [7] M. Huber. A Bernoulli mean estimate with known relative error distribution. *Random Structures Algorithms*. arXiv:1309.5413. To appear.
- [8] M. Huber. Nearly optimal Bernoulli factories for linear functions. *Combin. Probab. Comput.* arXiv:1308.1562. To appear.
- [9] M. Huber and N. Marić. Simulation of multivariate distributions with fixed marginals and correlations. *J. Appl. Probab.* arXiv:1311.2002. To appear.
- [10] M. Huber. Approximation algorithms for the normalized constant of Gibbs distributions. *Ann. Appl. Probab.*, 51(1):92–105, 2015. arXiv:1206.2689.

- [11] M. Huber. Near-linear time simulation of linear extensions of a height-2 poset with bounded interaction. *Chic. J. Theoret. Comput. Sci.*, 2014.
- [12] M. Huber and N. Marić. Minimum correlation for any bivariate Geometric distribution. *ALEA Lat. Am. J. Probab. Math. Stat.*, pages 459–470, 2014. arXiv:1406.1779.
- [13] M. L. Huber and S. Schott. Random construction of interpolating sets for high dimensional integration. *Journal of Applied Probability*, 51(1):92–105, 2014. arXiv:1112.3692.
- [14] M. Huber. Spatial birth-death swap chains. *Bernoulli*, 18(3):1031–1041, 2012.
- [15] M. Huber, E. Villella, D. Rozenfeld, and J. Xu. Bounds on the artificial phase transition for perfect simulation of the hard core Gibbs processes. *Involve*, 5(3):247–255, 2012.
- [16] M. L. Huber and J. Law. Simulation reduction of the Ising model to general matchings. *Electronic Journal of Probability*, 17:1–15, 2012. Article 33, arXiv:0907.0477v1.
- [17] F. Mitha and M. L. Huber. Monotonic multigamma coupling for perfect sampling. *Journal of Statistical Computation and Simulation*, 82(4):603–622, 2012. doi:10.1080/00949655.2010.548065.
- [18] M. Huber. Spatial point processes. In S. Brooks, A. Gelman, G. Jones, and X. Meng, editors, *Handbook of MCMC*, pages 227–252. Chapman & Hall/CRC Press, 2011.
- [19] M. L. Huber. Simulation reductions for the Ising model. *J. Stat. Theory Pract.*, 5(3):413–424, 2011. arXiv:0908.2151v1.
- [20] J. A. Fill and M. L. Huber. Perfect simulation of Vervaat perpetuities. *Electron. J. Probab.*, 15:96–109, 2010.
- [21] M. L. Huber and S. Schott. Using TPA for Bayesian inference. *Bayesian Statistics 9*, pages 257–282, 2010.
- [22] J. Møller, M. L. Huber, and R. L. Wolpert. The stationary Matérn hard core process of type III. *Stochastic Process. Appl.*, 120:2142–2158, 2010.
- [23] M. L. Huber and R. L. Wolpert. Likelihood-based inference for Matérn type-III repulsive point processes. *Adv. Appl. Prob.*, 41(4):958–977, 2009.
- [24] D. B. Woodward, S. C. Schmidler, and M. Huber. Conditions for rapid mixing of parallel and simulated tempering on multimodel distributions. *Ann. of Appl. Prob.*, 19(2):617–640, 2009.
- [25] D. B. Woodward, S. C. Schmidler, and M. Huber. Sufficient conditions for torpid mixing of parallel and simulated tempering. *Electron. J. Probab.*, 14:780–804, 2009.
- [26] M. Huber. Perfect simulation with exponential tails. *Random Structures Algorithms*, 33(1):29–43, 2008.
- [27] M. Huber and J. Law. Fast approximation of the permanent for very dense problems. In *Proc. of 19th ACM-SIAM Symp. on Discrete Alg.*, pages 681–689. 2008.
- [28] M. Huber. Perfect simulation for image restoration. *Stochastic Models*, 23(3):475–487, 2007.
- [29] D. Hearn and M. Huber. The ancestral distance test: A topdown approach to detect correlated evolution in large lineages with missing character data and incomplete phylogenies. *Systematic Biology*, 55(5):803–817, 2006.
- [30] M. Huber. Exact sampling from perfect matchings of dense regular bipartite graphs. *Algorithmica*, 44:183–193, 2006.
- [31] M. Huber. Fast perfect sampling from linear extensions. *Discrete Mathematics*, 306:420–428, 2006.

- [32] M. Huber, Y. Chen, I. Dinwoodie, A. Dobra, and M. Nicholas. Monte Carlo algorithms for Hardy-Weinberg proportions. *Biometrics*, 62:49–53, Mar 2006.
- [33] Y. Chen, I. Dinwoodie, A. Dobra, and M. Huber. Lattice points, contingency tables, and sampling. *Contemporary Mathematics*, 374:65–78, 2005.
- [34] B. Tighe, J. Socolar, D. Schaeffer, W. Mitchener, and M. Huber. Force distributions in a trigonal lattice of rigid bars. *Physical Review E*, 72(031306), 2005.
- [35] M. Huber. Perfect sampling using bounding chains. *Annals of Applied Probability*, 14(2):734–753, 2004.
- [36] M. Huber and G. Reinert. The stationary distribution in the Antivoter model: exact sampling and approximations. In *Stein's Method: Expository Lectures and Applications*, pages 79–94. IMS Lecture Notes 46, 2004.
- [37] M. L. Huber. A bounding chain for Swendsen-Wang. *Random Structures Algorithms*, 22(1):43–59, 2003.
- [38] A. T. Benjamin, M. T. Fluet, and M. L. Huber. Optimal token allocations in Solitaire Knock 'm Down. *The Electronic Journal of Combinatorics*, 8(2):1–8, 2001.
- [39] J. A. Fill and M. L. Huber. The Randomness Recycler approach to perfect sampling. In *Proc. 53rd Session of the ISI*, pages 69–72. 2001.
- [40] J. A. Fill and M. L. Huber. The Randomness Recycler: A new approach to perfect sampling. In *Proc. 41st Sympos. on Foundations of Comp. Sci.*, pages 503–511. 2000.
- [41] M. L. Huber. A faster method for sampling independent sets. In *Proc. 11th ACM-SIAM Sympos. on Discrete Algorithms*, pages 625–626. 2000.
- [42] M. L. Huber. Exact sampling using Swendsen-Wang. In *Proc. 10th Sympos. on Discrete Algorithms*, pages 921–922. 1999.
- [43] M. L. Huber. Exact sampling and approximate counting techniques. In *Proc. 30th Sympos. on the Theory of Computing*, pages 31–40. 1998.

External funding and awards

- 1999–2001 **National Science Foundation**, *Postdoctoral Fellow in the Mathematical Sciences*.
Perfect simulation techniques
- 2005–2011 **National Science Foundation**, *CAREER award*.
Perfect sampling techniques for high-dimensional integration
- 2014–2017 **National Science Foundation**, *DMS grant*.
Improved Monte Carlo methods for high dimensional sums and integrals

Selected talks

- Oct 2015 *Bounded variance Monte Carlo estimates*, George Mason University Statistics Colloquium, Fairfax, USA.
- Oct 2015 *Fast approximation algorithms for partition functions of Gibbs distributions*, AMS Fall Western Sectional Meeting, Fullerton, USA.
- Jul 2015 *Better rigorous tail bounds for general Monte Carlo estimation*, Stochastic Processes and their Applications, Oxford, UK.
- Jul 2015 *Optimal linear Bernoulli factories for small mean problems*, University of Warwick, UK.

- Mar 2015 *Bounding relative error of Monte Carlo estimates*, University of Minnesota, USA.
- Mar 2015 *Understanding relative error in Monte Carlo simulations*, University of Wisconsin, USA.
- Oct 2014 *Obtaining relative error of estimates without the Central Limit Theorem*, UFL Statistics Colloquium, Gainesville, USA.
- Sep 2014 *Building a better Bernoulli Factory*, USC Mathematics Colloquium, Los Angeles, USA.
- Apr 2014 *Using Instructional Videos in and out of the classroom*, Strategic Educational Technology Summit, Claremont, USA.
- Jan 2014 *Perfect simulation for image analysis*, Fifth IMS-ISBA joint meeting: MCMSki IV, Chamonix, France.
- Nov 2013 *The Monty Hall Problem*, Gateways to Exploring Mathematical Sciences (GEMS), Claremont, USA.
- Nov 2013 *Fast approximation algorithms for partition functions of Gibbs distributions*, AMS Western Sectional Meeting, Riverside, USA.
- Oct 2013 *An unbiased estimator for the probability of heads with relative error independent of p* , Statistics Seminar, University of Kentucky, Lexington, USA.
- Aug 2013 *Controlling error for combinatorial structures*, JSM 2013 Annual Meeting, Montreal, Canada.
- June 2012 *Fast approximation algorithms for partition functions of Gibbs distributions*, ISBA 2012 World Meeting, Kyoto, Japan.
- May 2012 *Fast approximation algorithms for partition functions of Gibbs distributions*, Seminar, The Ohio State University Department of Statistics, Columbus, USA.
- Nov 2011 *Perfect Simulation of Repulsive Point Processes*, Statistics Speakers Series, UCLA Department of Statistics.
- Oct 2011 *Partially Recursive Acceptance Rejection*, Mathematical and Computer Science Colloquium, University of Missouri-St. Louis.
- June 2011 *The Paired Product Estimator for normalizing constants of Gibbs distributions*, Greek stochastics γ , Crete, Greece.
- Mar 2011 *Adaptive Monte Carlo Methods for Numerical Integration*, Natural Science Colloquium, Pepperdine University.
- Oct 2010 *Near linear time perfect simulation of corrugated surfaces*, Fall Western Sectional AMS meeting, UCLA.
- Aug 2010 *Using TPA for Monte Carlo Integration*, 9th International Conference on Monte Carlo and Quasi-Monte Carlo Methods, (invited talk), Warsaw, Poland.
- Jun 2010 *Using TPA for Bayesian Inference*, 9th Valencia International Meeting on Bayesian Statistics, (invited talk), Alicante, Spain.
- Apr 2010 *Approximation of Normalizing Constants Using Random Cooling Schedules*, Applied Mathematics and Statistics Department Seminar, UC Santa Cruz.
- Feb 2010 *Approximation of Normalizing Constants Using Random Cooling Schedules*, Statistics Department Seminar, UC Riverside.

- Jan 2010 *Spatial Birth-Death-Swap Chains*, AMS Session on Probability and Statistics, Joint Mathematics Meetings, (contributed talk), San Francisco, CA.
- Nov 2009 *Better numerical integration through randomness*, Claremont Colleges Mathematics Colloquium, Claremont, CA.
- Nov 2009 *Simulation reductions for the Ising model*, AMS Fall Western Meeting, UC Riverside, (invited talk).
- Aug 2009 *Speeding up the product estimator using random temperatures*, Joint Statistical Meetings, (invited talk), Washington D.C..
- May 2009 *Perfect simulation of repulsive point processes*, Department of Statistics Colloquium, University of Aalborg, Denmark.
- Mar 2009 *Perfect simulation of Matérn type III processes*, EPSRC Symposium Workshop on Markov Chain-Monte Carlo, (invited talk), Warwick, UK.
- Dec 2008 *Sampling linear extensions for inference*, Computational Algebraic Statistics, Theories and Applications, (invited talk), Kyoto, Japan.
- Oct 2008 *Perfect simulation of Matérn type III point processes*, Department of Applied Mathematics and Statistics Seminar, The Johns Hopkins University.
- Oct 2008 *Conditions for Parallel and Simulated Tempering to be fast or slow*, Probability Seminar, Dept. of Mathematics, Duke University.
- Oct 2008 *Perfect simulation of Matérn type III point processes*, Stochastics Seminar, School of Mathematics, Georgia Institute of Technology.
- Sep 2008 *Dealing with Matérn type III point processes*, School of Operations Research and Industrial Engineering Colloquium, Cornell University.
- Dec 2007 *An Overview of Perfect Sampling Methods*, Advances in Analysis of Monte Carlo Methods workshop, (invited talk), Harvard University.
- Oct 2007 *Perfect simulation of repulsive point processes*, School of Statistics Seminar, University of Minnesota.
- Aug 2006 *Perfect simulation with the Randomness Recycler for arbitrary state spaces*, New Developments in MCMC, (invited talk), Warwick, UK.
- Mar 2006 *Advanced Acceptance/Rejection Methods for Monte Carlo Algorithms*, Department of Mathematics, UC Davis.
- Aug 2004 *Time Dependent Update Functions for Perfect Sampling*, Joint Statistical Meetings, (contributed talk), Toronto, Canada.
- Mar 2004 *Time dependent update functions for perfect sampling*, IMS meeting, (invited talk), Singapore.
- Dec 2003 *Perfect Sampling: techniques and challenges*, Mathematics Colloquium, University of Ulm, Germany.
- Dec 2003 *Perfect sampling*, Mathematisches Forschungsinstitut Oberwolfach, (plenary lecture), Oberwolfach, Germany.
- Sep 2003 *Perfect sampling for some mixtures of distributions*, Opening conference Stochastic Computation program SAMSI, (contributed talk), Durham, NC.

- Feb 2003 *Bounding chain techniques for perfect sampling*, Electrical and Computer Engineering Seminar, NC State.
- Feb 2003 *Stochastic Computation Techniques*, Undergraduate workshop, Stochastic Computation Program, SAMSI, Durham, NC.
- Sep 2002 *Introduction to the Randomness Recycler*, First Cape Cod workshop on Monte Carlo methods, (invited talk), Cape Cod, MA.
- Feb 2002 *Using the Randomness Recycler*, Statistics Colloquium, University of North Carolina at Chapel Hill.
- Aug 2001 *The Randomness Recycler approach to perfect simulation*, 53rd Annual Meeting of the International Statistical Institute, (invited talk), Seoul, South Korea.
- Sep 2000 *A new approach to perfect sampling from nasty distributions*, IBM Research - Almaden, (invited talk).
- Jul 2000 *A new approach to perfect sampling from nasty distributions*, Department of Statistics Colloquium, Stanford University.

Service to community

- 2008–present **Associate Editor**, *Journal of American Statistical Association Reviews*.
- 2009–present **Editor**, *Journal of Humanistic Mathematics*.
- 1999–present **Referee**, *Partial list*: *College Mathematics J.*, *J. of Multivariate Analysis*, *Theoretical Computer Science*, *Annals of Applied Probability*, *Annals of the Institute of Statistical Mathematics*, *Algorithmica*, *Biometrika*, *European J. of Applied Mathematics*, *J. of Computational and Graphical Statistics*, *Symposium on Theoretical Aspects of Computer Science*, *American Mathematical Monthly*, *Bayesian Analysis*, *J. of American Statistical Association*, *Statistics and Computing*, *Foundations of Computer Science*, *Random Structures and Algorithms*.
- 2002-2003 **Program committee**, *Statistical and Applied Mathematical Sciences Institute*.
Stochastic Computation Program
- 2008-2009 **Program committee**, *Statistical and Applied Mathematical Sciences Institute*.
Sequential Monte Carlo Program