

Mark Huber | Curriculum Vitae

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Specialist in computational probability, with a focus on Monte Carlo simulation for statistical applications, approximation algorithms, and numerical integration in high dimensions.

Education

Harvey Mudd College <i>Bachelors of Science</i> Mathematics	1994
Cornell University <i>Masters</i> Operations Research and Industrial Engineering	1997
Cornell University <i>PhD</i> Operations Research and Industrial Engineering	1999

Experience

Chemistry Animation Project <i>Computer Animator</i> Created computer animated instructional videos for college chemistry.	California Inst. of Technology 1991, 1992
ONR Graduate Fellowship <i>Visiting Researcher</i> Developed optimization algorithms for finite element analysis output.	Naval Undersea Warfare Center 1995
Data Mining Group <i>Visiting Researcher</i> Programmer in data mining group.	IBM Almaden 1996
School of Operations Research and Industrial Engineering <i>Teaching Assistant</i> Conducted lab sessions for introductory undergraduate course in operations research.	Cornell University 1999
Department of Statistics <i>NSF Postdoc in the Mathematical Sciences</i> Researched Markov chain Monte Carlo methods under Persi Diaconis.	Stanford University 1999-2001
Joint appointment in Mathematics and Statistical Science <i>Assistant Professor</i>	Duke University 2001-2009
Department of Mathematical Sciences <i>Associate Professor</i>	Claremont McKenna College 2009-2012
Department of Mathematical Sciences <i>Fletcher Jones Foundation Associate Professor of Mathematics and Statistics and George R. Roberts Fellow</i>	Claremont McKenna College 2012-2018
Department of Mathematical Sciences <i>Chair</i>	Claremont McKenna College 2016-2019
Computer Science Sequence <i>Director</i>	Claremont McKenna College 2016-present

Data Science Sequence

Director

Department of Mathematical Sciences

Fletcher Jones Foundation Professor of Mathematics and Statistics
and George R. Roberts Fellow

Claremont McKenna College

2018-present

Claremont McKenna College

2018-present

Publications

Book length works.....

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

Published and accepted articles.....

- [3] M. Huber. Adaptive Markov chain Monte Carlo. In *Wiley StatsRef-Statistics Reference Online*. Wiley, to appear.
- [4] M. Huber. Halving the bounds for the Markov, Chebyshev, and Chernoff inequalities through smoothing. *American Mathematical Monthly*. arXiv:1803.06361. To appear.
- [5] M. Huber. An optimal (ϵ, δ) -approximation scheme for the mean of random variables with bounded relative variance. *Random Structures Algorithms*. To appear.
- [6] M. Huber and B. Jones. Faster estimates of the mean of bounded random variables. *Mathematics and Computers in Simulation*, 161:93–101, 2019.
- [7] M. Huber and Nevena Marić. Admissible bernoulli correlations. *Journal of Statistical Distributions and Applications*, 6(2), 2019.
- [8] J. Banks, S. Garrabrant, M. Huber, and A. Perizzolo. Using TPA for approximating the number of linear extensions. *J. Discrete Algorithms*, 51:1–11, 2018. arXiv:1010.4981.
- [9] M. Huber. Adaptive Monte Carlo integration. In *Wiley StatsRef-Statistics Reference Online*. Wiley, 2018. doi:10.1002/9781118445112.stat08070.
- [10] J. Feng, M. Huber, and Y. Ruan. Monte Carlo with user-specified relative error. In P. W. Glynn and A. Owen, editors, *Proceedings in Mathematics & Statistics: Monte Carlo and Quasi-Monte Carlo methods*, volume 241, chapter 12. Springer, 2018.
- [11] M. Huber. Optimal linear Bernoulli factories for small mean problems. *Methodology and Computing in Applied Probability*, 19:631–645, 2017. arXiv:1507.00843. doi:10.1007/s11009-016-9518-3.
- [12] K. Cloud and M. Huber. Fast perfect simulation of Vervaat perpetuities. *J. Complexity*, 42:19–30, 2017. arXiv:1510.01780.
- [13] M. Huber. A Bernoulli mean estimate with known relative error distribution. *Random Structures Algorithms*, 50:173–182, 2017. arXiv:1309.5413.
- [14] M. Huber. Nearly optimal Bernoulli factories for linear functions. *Combin. Probab. Comput.*, 25(4):577–591, 2016. arXiv:1308.1562.
- [15] M. Huber and N. Marić. Simulation of multivariate distributions with fixed marginals and correlations. *J. Appl. Probab.*, 52(2):602–608, 2015. arXiv:1311.2002.
- [16] M. Huber. Approximation algorithms for the normalizing constant of Gibbs distributions. *Ann. Appl. Probab.*, 51(1):92–105, 2015. arXiv:1206.2689.
- [17] 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.

- [18] Mark Huber. Near-linear time simulation of linear extensions of a height-2 poset with bounded interaction. *Chic. J. Theoret. Comput. Sci.*, 2014.
- [19] 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.
- [20] M. Huber, E. Vilella, 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.
- [21] M. Huber. Spatial birth-death swap chains. *Bernoulli*, 18(3):1031–1041, 2012. arXiv:1006.5934.
- [22] 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.
- [23] M. L. Huber. Simulation reductions for the Ising model. *J. Stat. Theory Pract.*, 5(3):413–424, 2011. arXiv:0908.2151v1.
- [24] Faheem Mitha and Mark L. Huber. Monotonic multigamma coupling for perfect sampling. *Journal of Statistical Computation and Simulation*, 82(4):603–622, 2012.
- [25] 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.
- [26] 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.
- [27] M. L. Huber and S. Schott. Using TPA for Bayesian inference. *Bayesian Statistics 9*, pages 257–282, 2010.
- [28] J. A. Fill and M. L. Huber. Perfect simulation of Vervaat perpetuities. *Electron. J. Probab.*, 15:96–109, 2010.
- [29] D. B. Woodward, S. C. Schmidler, and M. Huber. Conditions for rapid mixing of parallel and simulated tempering on multimodel distributions. *Ann. of Appl. Probab.*, 19(2):617–640, 2009.
- [30] 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.
- [31] M. L. Huber and R. L. Wolpert. Likelihood-based inference for Matérn type-III repulsive point processes. *Adv. Appl. Probab.*, 41(4):958–977, 2009.
- [32] M. Huber. Perfect simulation with exponential tails. *Random Structures Algorithms*, 33(1):29–43, 2008.
- [33] 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.
- [34] M. Huber. Perfect simulation for image restoration. *Stochastic Models*, 23(3):475–487, 2007.
- [35] 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.
- [36] M. Huber, Y. Chen, I. Dinwoodie, A. Dobra, and M. Nicholas. Monte Carlo algorithms for Hardy-Weinberg proportions. *Biometrics*, 62:49–53, Mar 2006.
- [37] M. Huber. Fast perfect sampling from linear extensions. *Discrete Mathematics*, 306:420–428, 2006.
- [38] M. Huber. Exact sampling from perfect matchings of dense regular bipartite graphs. *Algorithmica*, 44:183–193, 2006.
- [39] B.P. Tighe, J.E.S. Socolar, D.G. Schaeffer, W.G. Mitchener, and M.L. Huber. Force distributions in a trigonal lattice of rigid bars. *Physical Review E*, 72(031306), 2005.

- [40] Y. Chen, I. Dinwoodie, A. Dobra, and M. Huber. Lattice points, contingency tables, and sampling. *Contemporary Mathematics*, 374:65–78, 2005.
- [41] 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.
- [42] M. Huber. Perfect sampling using bounding chains. *Annals of Applied Probability*, 14(2):734–753, 2004.
- [43] M. L. Huber. A bounding chain for Swendsen-Wang. *Random Structures Algorithms*, 22(1):43–59, 2003.
- [44] 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.
- [45] 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.
- [46] 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.
- [47] M. L. Huber. A faster method for sampling independent sets. In *Proc. 11th ACM-SIAM Sympos. on Discrete Algorithms*, pages 625–626, 2000.
- [48] M. L. Huber. Exact sampling and approximate counting techniques. In *Proc. 30th Sympos. on the Theory of Computing*, pages 31–40, 1998.
- [49] M. L. Huber. Exact sampling using Swendsen-Wang. In *Proc. 10th Sympos. on Discrete Algorithms*, pages 921–922, 1999.

Preprints and Technical Reports.....

- [50] S. R. Garcia, M. Huber, and B. Lutz. Algebraic properties of Heilbronn's exponential sum: supercharacters, Fermat congruences, and Heath-Brown's bound. arXiv:1312.1034v2, 2015.
- [51] M. Huber. Partially recursive acceptance rejection. arXiv:1701.00821, 2016.
- [52] M. Huber. An estimator for Poisson means whose relative error distribution is known. arXiv:1605.09445., 2016.
- [53] M. Huber. The Fundamental Theorem of perfect simulation. arXiv:1704.03561., 2017.
- [54] C. Evans, J. Hardin, M. Huber, D. Stoebel, and G. Wong. Differential expression analysis for multiple conditions. arXiv:1410.3370., 2014.

External funding and awards

Postdoctoral Fellow in the Mathematical Sciences

National Science Foundation 1999–2001
 Perfect simulation techniques

CAREER award

National Science Foundation 2005–2011
 Perfect sampling techniques for high-dimensional integration

DMS grant

National Science Foundation 2014–2018
 Improved Monte Carlo methods for high dimensional sums and integrals

Book Reviews

- Ten great ideas about chance** P. Diaconis and B. Skyrms
M. Huber, AMS Notices, to appear
- An Introduction to Optimization (3rd ed.)** E. K. P. Chong and S. H. Zak
M. Huber, JASA, 104:421, 2009
- Introduction to Stochastic Calculus Applied to Finance (2nd ed.)** D. Lamberton and B. Lapeyre
M. Huber, JASA, 104:1726, 2009
- Monte Carlo and Quasi-Monte Carlo Sampling** C. Lemieux
M. Huber, JASA, 105:876, 2010
- Probability Theory: An Analytic View (2nd ed.)** D. W. Stroock
M. Huber, JASA, 107:853, 2012

Selected Videos

- The Alternating Series Test** https://www.youtube.com/watch?v=svPB4L__EC8&t=85s
M. Huber Dec 2016
- Properties of expected value** <https://www.youtube.com/watch?v=XuAzQZ66TpM&t=21s>
M. Huber Oct 2016
- Convergence of random variables** <https://www.youtube.com/watch?v=XuAzQZ66TpM&t=21s>
M. Huber Oct 2016
- Swapping limits and expectation** <https://www.youtube.com/watch?v=jpxBJITM9i4&t=2s>
M. Huber Oct 2016
- Rigorous limits** <https://www.youtube.com/watch?v=vmSyC33jRbE>
M. Huber Oct 2016
- Sets, logic, and proofs** https://www.youtube.com/watch?v=0ya83f_kfRU&t=21s
M. Huber Oct 2016
- Antidifferentiation of Linear Over Quadratic** <https://www.youtube.com/watch?v=7FSsUZJ4xVY>
M. Huber Apr 2014
- Factorials** <https://www.youtube.com/watch?v=BuaUQrRH0Tc>
M. Huber Apr 2014
- Exponential Growth and Separation of Variables** <https://www.youtube.com/watch?v=KB2iHuoqpB8>
M. Huber Feb 2014
- For all and there exists** <https://www.youtube.com/watch?v=qni0TKd0DgU>
M. Huber Feb 2014
- Supremum and Infimum** <https://www.youtube.com/watch?v=B12G6ZGsBvk&t=1s>
M. Huber Feb 2014
- Six Derivatives to Memorize** <https://www.youtube.com/watch?v=1RyrewyC2xs>
M. Huber Mar 2013
- Antidifferentiation of a function of a line** <https://www.youtube.com/watch?v=qm-tXwmQpKQ>
M. Huber Mar 2013
- Probability for continuous random variables** <https://www.youtube.com/watch?v=rBRkEuU4SNI>
M. Huber Feb 2013
- Indicator Functions** <https://www.youtube.com/watch?v=V3pnr5gmJC8&t=35s>
M. Huber Feb 2013
- Antidifferentiation with the Chain Rule** <https://www.youtube.com/watch?v=9-ftis8vrXg>
M. Huber Dec 2012

Integration by Parts
M. Huber

<https://www.youtube.com/watch?v=NkAkVWtbRZw>
Nov 2012

Selected invited and contributed talks

13th International Conference on Monte Carlo and Quasi Monte Carlo Methods <i>Improved light tailed sample averages for robust estimation of the mean</i>	Rennes, France July 2018
LMS Invited Lecture Series on Computational Statistics <i>Perfect Simulation Short course</i>	University of Warwick, UK July 2018
The 2017 IISA International Conference on Statistics <i>Estimates for Monte Carlo data with user-specified error bounds</i>	Hyderabad, India Dec 2017
LMS-EPSRC Symp. on Markov Processes, Mixing Times, and Cutoff <i>Cutoff phenomena in perfect simulation</i>	University of Durham, UK Aug 2017
International Statistical Institute World Congress <i>Linear time perfect simulation for Markov random fields</i>	Marrakech, Morocco Jul 2017
Monte Carlo Methods and Applications (MCM 2017) <i>Faster estimates with user-specified error for $[0, 1]$ random variables</i>	Montréal, Canada Jul 2017
Southern California Applied Mathematics Symposium <i>Faster Monte Carlo with fewer samples (Plenary Speaker)</i>	UC Irvine, USA Jun 2017
Statistics Seminar Duke University <i>Fast user-specified relative error estimates</i>	Durham, USA Mar 2017
Atul Vyas Memorial Lecture <i>How to roll a five sided die</i>	Claremont, USA Nov 2016
Monte Carlo and Quasi-Monte Carlo Methods in Scientific Computing <i>Monte Carlo with user-specified error</i>	Stanford University, USA Aug 2016
Retrospective Monte Carlo Workshop <i>A Bernoulli Factory using the Fundamental Theorem of Perfect Simulation</i>	University of Warwick, UK Jul 2016
Statistics Seminar <i>The Fundamental Theorem of Perfect Simulation</i>	Technische Universität Dortmund, Germany Jun 2016
CPET Landscape of Educational Technology for Liberal Arts Education <i>Using video for classes</i>	Claremont, USA Feb 2016
Claremont Colleges Library Discourse Series <i>Humanistic Mathematics: A Philosophy, a Journal, and a Community</i>	Claremont, USA Nov 2015
George Mason University Statistics Colloquium <i>Bounded variance Monte Carlo estimates</i>	Fairfax, USA Oct 2015
AMS Fall Western Sectional Meeting <i>Fast approximation algorithms for partition functions of Gibbs distributions</i>	Fullerton, USA Oct 2015
Stochastic Processes and their Applications <i>Better rigorous tail bounds for general Monte Carlo estimation</i>	Oxford, UK Jul 2015
CRISM Seminar <i>Optimal linear Bernoulli factories for small mean problems</i>	University of Warwick, UK Jul 2015
Statistics Seminar <i>Bounding relative error of Monte Carlo estimates</i>	University of Minnesota, USA Mar 2015
Mathematics Seminar <i>Understanding relative error in Monte Carlo simulations</i>	University of Wisconsin, USA Mar 2015
UFL Statistics Colloquium <i>Obtaining relative error of estimates without the Central Limit Theorem</i>	Gainesville, USA Oct 2014

USC Mathematics Colloquium <i>Building a better Bernoulli Factory</i>	Los Angeles, USA Sep 2014
Strategic Educational Technology Summit <i>Using Instructional Videos in and out of the classroom</i>	Claremont, USA Apr 2014
Fifth IMS-ISBA joint meeting: MCMSki IV <i>Perfect simulation for image analysis</i>	Chamonix, France Jan 2014
Gateways to Exploring Mathematical Sciences (GEMS) <i>The Monty Hall Problem</i>	Claremont, USA Nov 2013
AMS Western Sectional Meeting <i>Fast approximation algorithms for partition functions of Gibbs distributions</i>	Riverside, USA Nov 2013
Statistics Seminar <i>An unbiased estimator heads with relative error independent of p</i>	University of Kentucky, USA Oct 2013
JSM 2013 Annual Meeting <i>Controlling error for combinatorial structures</i>	Montreal, Canada Aug 2013
ISBA 2012 World Meeting <i>Fast approximation algorithms for partition functions of Gibbs distributions</i>	Kyoto, Japan June 2012
Department of Statistics Seminar <i>Fast approximation algorithms for Gibbs partition functions</i>	The Ohio State University USA May 2012
Statistics Speakers Series <i>Perfect Simulation of Repulsive Point Processes</i>	UCLA Department of Statistics Nov 2011
Mathematical and Computer Science Colloquium <i>Partially Recursive Acceptance Rejection</i>	University of Missouri-St. Louis Oct 2011
Greek stochastics γ <i>The Paired Product Estimator for normalizing constants of Gibbs distributions</i>	Crete, Greece June 2011
Natural Science Colloquium <i>Adaptive Monte Carlo Methods for Numerical Integration</i>	Pepperdine University Mar 2011
Fall Western Sectional AMS meeting <i>Near linear time perfect simulation of corrugated surfaces</i>	UCLA Oct 2010
Monte Carlo and Quasi-Monte Carlo Methods <i>Using TPA for Monte Carlo Integration</i>	Warsaw, Poland Aug 2010
9th Valencia International Meeting on Bayesian Statistics, (invited talk) <i>Using TPA for Bayesian Inference</i>	Alicante, Spain Jun 2010
Applied Mathematics and Statistics Department Seminar <i>Approximation of Normalizing Constants Using Random Cooling Schedules</i>	UC Santa Cruz Apr 2010
Statistics Department Seminar <i>Approximation of Normalizing Constants Using Random Cooling Schedules</i>	UC Riverside, CA, USA Feb 2010
Joint Mathematics Meetings <i>Spatial Birth-Death-Swap Chains</i>	San Francisco, CA, USA Jan 2010
Claremont Colleges Mathematics Colloquium <i>Better numerical integration through randomness</i>	Claremont, CA, USA Nov 2009
AMS Fall Western Meeting (invited talk) <i>Simulation reductions for the Ising model</i>	UC Riverside, CA, USA Nov 2009
Joint Statistical Meetings (invited talk) <i>Speeding up the product estimator using random temperatures</i>	Washington D.C. Aug 2009
Department of Statistics Colloquium <i>Perfect simulation of repulsive point processes</i>	University of Aalborg, Denmark May 2009

EPSRC Symposium Workshop on Markov Chain-Monte Carlo <i>Perfect simulation of Matérn type III processes</i>	Warwick, UK Mar 2009
Computational Algebraic Statistics, Theories and Applications <i>Sampling linear extensions for inference</i>	Kyoto, Japan Dec 2008
Department of Applied Mathematics and Statistics Seminar <i>Perfect simulation of Matérn type III point processes</i>	The Johns Hopkins University Oct 2008
Department of Mathematics Probability Seminar <i>Conditions for Parallel and Simulated Tempering to be fast or slow</i>	Duke University Oct 2008
Stochastics Seminar, School of Mathematics <i>Perfect simulation of Matérn type III point processes</i>	Georgia Institute of Technology, USA Oct 2008
School of Operations Research and Industrial Engineering Colloquium <i>Dealing with Matérn type III point processes</i>	Cornell University Sep 2008
Advances in Analysis of Monte Carlo Methods workshop (invited talk) <i>An Overview of Perfect Sampling Methods</i>	Harvard University Dec 2007
School of Statistics Seminar <i>Perfect simulation of repulsive point processes</i>	University of Minnesota Oct 2007
New Developments in MCMC (invited talk) <i>Perfect simulation with the Randomness Recycler for arbitrary state spaces</i>	Warwick, UK Aug 2006
Department of Mathematics <i>Advanced Acceptance/Rejection Methods for Monte Carlo Algorithms</i>	UC Davis Mar 2006
Joint Statistical Meetings (contributed talk) <i>Time Dependent Update Functions for Perfect Sampling</i>	Toronto, Canada Aug 2004
IMS meeting (invited talk) <i>Time dependent update functions for perfect sampling</i>	Singapore Mar 2004
Mathematics Colloquium <i>Perfect Sampling: techniques and challenges</i>	University of Ulm, Germany Dec 2003
Mathematisches Forschungsinstitut Oberwolfach (plenary lecture) <i>Perfect sampling</i>	Oberwolfach, Germany Dec 2003
Opening conference Stochastic Computation program SAMSI (contributed talk) <i>Perfect sampling for some mixtures of distributions</i>	Durham, NC Sep 2003
Electrical and Computer Engineering Seminar <i>Bounding chain techniques for perfect sampling</i>	NC State Feb 2003
Undergraduate workshop in the Stochastic Computation Program, SAMSI <i>Stochastic Computation Techniques</i>	Durham, NC Feb 2003
First Cape Cod workshop on Monte Carlo methods (invited talk) <i>Introduction to the Randomness Recycler</i>	Cape Cod, MA Sep 2002
Statistics Colloquium <i>Using the Randomness Recycler</i>	University of North Carolina at Chapel Hill Feb 2002
53rd Annual Meeting of the International Statistical Institute (invited talk) <i>The Randomness Recycler approach to perfect simulation</i>	Seoul, South Korea Aug 2001
Seminar <i>A new approach to perfect sampling from nasty distributions</i>	IBM Research-Almaden Sep 2000
Department of Statistics Colloquium <i>A new approach to perfect sampling from nasty distributions</i>	Stanford University Jul 2000