

5634 - Stochastic Methods

Michaelmas Term - 2016-2017

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Topics

- Probability and Statistics
 - Random Variables
 - Central Limit Theorem, Confidence Intervals
 - Error estimation, non-parametric methods (bootstrap, jackknife)
- Generating Random Numbers
 - Linear Congruential
 - ‘Die-hard’ tests
 - Advanced generators: ranlux and the Mersenne twister
 - Generating random variables
- Monte Carlo Integration
 - Importance Sampling
 - Other variance reduction techniques
- Markov chain Monte Carlo
 - equilibrium properties
 - error analysis and autocorrelations
 - Metropolis and the Gibbs Sampler
- Case Studies
 - The Ising Model
 - The Self-avoiding Walk

Grading

- Homework: 40%
 - written
 - Computer programs: C or C++
- Exam: 60%

References

- Sheldon M. Ross, *Simulation*, 3rd edition, Academic Press 2002
- I. Sachs, S. Sen and J. Sexton, *Elements of Statistical Mechanics*, Cambridge University Press (2006)
- Colin Morningstar, *The Monte Carlo Method in Quantum Field Theory*, [arXiv:hep-lat/0702020v1](#)
- Alan Sokal, *Monte Carlo methods in statistical mechanics: Foundations and New Algorithms*, Cours de Troisième Cycle en Suisse Romande, Lausanne, Switzerland, Jun 15-29, 1989
- U. Wolff, *Monte Carlo errors with less errors*, Comput. Phys. Commun. 156 (2004) 143 [Erratum-ibid. 176 (2007) 383], [arXiv:hep-lat/0306017](#)
- David P. Landau and Kurt Binder, *Monte Carlo Simulations in Statistical Physics*, 2nd edition, Cambridge University Press (2005)