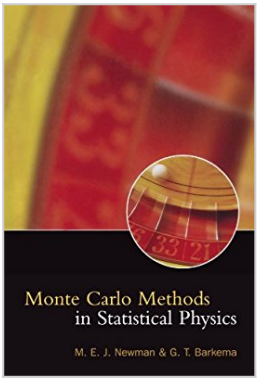

Monte Carlo Methods in Statistical Physics

By M. E. J. Newman, G. T. Barkema

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This book provides an introduction to Monte Carlo simulations in classical statistical physics and is aimed both at students beginning work in the field and at more experienced researchers who wish to learn more about Monte Carlo methods. It includes methods for both equilibrium and out of equilibrium systems, and discusses in detail such common algorithms as the Metropolis and heat-bath algorithms, as well as more sophisticated ones such as continuous time Monte Carlo, cluster algorithms, multigrid methods, entropic sampling and simulated tempering. Data analysis techniques are also explained starting with straightforward measurement and error-estimation techniques and progressing to topics such as the single and multiple histogram methods and finite size scaling. The last few chapters of the book are devoted to implementation issues, including lattice representations, efficient implementation of data structures, multispin coding, parallelization of Monte Carlo algorithms, and random number generation. The book also includes example programs which show how to apply these techniques to a variety of well-known models.

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Editorial Review

Review

"This book is intended for those who are interested in the use of Monte Carlo simulations in classical statistical mechanics. Its primary goal is to explain how to perform such simulations efficiently. To this end, the authors discuss . . . some of the many interesting new algorithms designed to accelerate the simulation of particular classes of problems in statistical physics, such as cluster algorithms, multigrid methods, non-local algorithms for conserved-order-parameter models, entropic sampling, simulated tempering and continuous time Monte Carlo. The book is divided into three parts covering equilibrium (Chapters 1-8) and non-equilibrium (9-12) Monte Carlo simulations, and implementations (13-16). Each algorithm is introduced in the context of a particular model. For example, the Metropolis algorithm is illustrated by its application to the Ising model. A brief outline of the physics behind each model is always given."--*Quarterly of Applied Mathematics*

"In recent years there has been a flurry of activity in the development of new Monte Carlo algorithms that accelerate the dynamics of particular classes of systems in statistical physics. The present text discusses many of these algorithms . . . The book is well written and can be enjoyed at various levels. . . . [T]he primary goal of the book is to explain how to perform Monte Carlo simulations efficiently, and the authors have succeeded admirably in achieving their goal. The authors' discussion of the results of the algorithms was very helpful in understanding the algorithms. . . . In summary, this book belongs in the personal library of all researchers in statistical physics (regardless of whether they write Monte Carlo algorithms or not), computational scientists interested in Monte Carlo methods, and advanced undergraduates and graduate students wishing to learn about recent developments in statistical physics and Monte Carlo methods."--*Journal of Statistical Physics*

"Mark Newman and Gerard Barkema have written a remarkably clear and thorough book on the application of Monte Carlo simulations to classical statistical mechanics. Their writing is excellent throughout, and they cover a wide range of topics. *Monte Carlo Methods in Statistical Physics* is well suited for classroom use and could be valuable as a reference or tool for self-study for both beginning and experienced researchers. ... This book should give newcomers to Monte Carlo methods all the information and advice they need to get useful programs up and running. In addition to a basic presentation of the algorithms, Newman and Barkema discuss various implementation issues at length, give a wide range of programming advice, and discuss random number generators. This book also has an extensive treatment of data analysis techniques."--*Computing in Science and Engineering*

"The authors present a detailed account of Monte Carlo algorithms and techniques for the data analysis of the results of simulation. In my opinion this book can be very useful for both graduate students and experienced researchers. Problems are clearly stated, solutions are accurately discussed and there are problems to solve after every chapter. This book is surely suitable for use as a textbook for a course on simulation methods, or

as a supplementary text in a course on statistical physics. Although the overall technical level is that of a graduate text, I think even experienced researchers in the field would benefit from reading the detailed accounts of the most sophisticated new simulation techniques which have appeared in recent years." -- *Emilio N.M. Cirillo, Mathematical Reviews Clippings 2000m*

About the Author
Mark Newman is at Santa Fe Institute. G. T. Barkema is at Utrecht University.

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