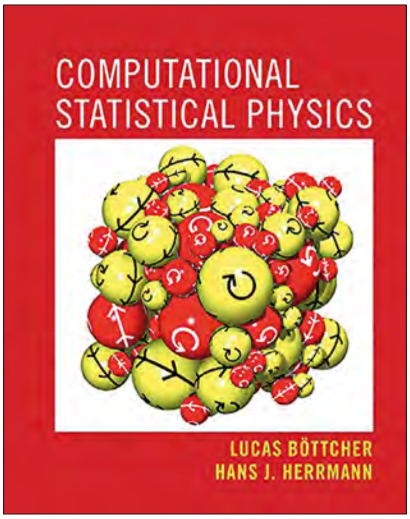
Computational Statistical Physics

By Lucas Böttcher and Hans J. Herrmann

DOI: https://doi.org/10.1051/epn/2022306



"Computational Statistical Physics" by Lucas Böttcher and Hans J. Herrmann is a textbook for physics students taking a Bachelor or Master course in computational physics and focuses on teaching them stochastic and molecular dynamics methods used in Statistical Physics. The part on stochastic methods covers random numbers, introduces various standard models like percolation or the Ising model, then phase transitions and finite size scaling and finally discusses various methods: Monte Carlo methods, Cluster algorithms, histogram methods, numerical renormalization group, parallelization, and the Gillespie algorithm.

The part on molecular dynamics covers various standard integration algorithms and the cell index method, and then discusses the algorithmic solutions to the specific problems that arise in connection with composed particles, long-range interactions, thermostats, inelastic collisions, and event-driven dynamics as they occur for instance in the simulation of granular matter.

Finally discrete fluid models like the lattice Boltzmann method are briefly touched as well as a short discussion of quantum mechanical ab initio simulations. Apart from the latter two each chapter contains exercises, which ask the reader to implement the discussed algorithm.

The organization and content of the book is very similar to my own lecture on computational physics, and it could very well serve as a textbook for it. It covers a lot of material but has only 250 pages, so a lecturer might have to add additional material or refer to more extensive textbooks on Monte Carlo or molecular dynamics simulations. And she/he would have to add basics of quantum Monte Carlo methods used in computational statistical physics, which is not contained in the book although it could have been straightforwardly integrated into the chapter on the Ising model.

For lecturers as well as students it would have been very useful to provide solutions and computer codes for the exercises, which are unfortunately not included in the book. Very appealing is the layout of the text, the Cambridge University Press textbook style: with blue boxes for highlighted information, grey boxes for additional information, and green boxes for the exercises.

Moreover, many pages display on their marginal column pictures, plus some personal data, of the researcher who made an important contribution to the topic of the chapter. For this reason, it is also fun to scroll through the book and learn about the historic evolution of stochastic methods and molecular dynamics in statistical physics. Therefore, I enjoyed reading it and I can recommend it. ■

■ **Heiko Rieger,** *Saarland University*

europhysicsnews
2022 • Volume 53 • number 3

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ISSN 0531-7479 • ISSN 1432-1092 (electronic edition)

Printer: Fabrègue • Saint-Yrieix-la-Perche, France

Legal deposit: July 2022