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Book Review: *Statistical Mechanics: Fundamentals and Modern Applications*

Statistical Mechanics: Fundamentals and Modern Applications, R. E. Wilde and S. Singh, Wiley, New York, 1998.

This book is intended to be a text for senior undergraduates and junior graduate students. It is divided into three parts: I. Essentials which includes discussions of the fundamentals of stochastic theory and classical and quantum statistical mechanics; II. Equilibrium statistical mechanics with chapters on phase transitions, liquids and molecular dynamics and Monte Carlo methods, polymers, proteins and spin glass models; III. Nonequilibrium statistical mechanics with discussions of the Boltzmann equation, Brownian Motion, Zwanzig-Mori formalism, barrier crossing problems, oscillating chemical reactions and chaos, and finally cellular automaton models.

The breadth of applications discussed is impressive and a perusal of the table of contents gives one the impression that this will be a valuable text for students since it introduces them to a large number of modern applications and techniques in statistical mechanics. On the whole, the authors succeed in their endeavors, although there are a number of weak points and some incorrect statements. One of the most annoying features of the book is that in the middle of a discussion details are referred to in another text. Perhaps this is necessary to keep the size of the book within bounds.

In Part I, the discussion of ensemble theory is not particularly illuminating and it is not emphasized that all systems in an ensemble are isolated. The decay to equilibrium is glossed over. In Part II, the superposition approximation on p. 126 is incorrectly stated. There is also no discussion of Weeks-Chandler-Andersen theory in the chapter on liquids. In Part III, the notation in the discussion of stochastic processes is extremely confusing and several of the equations on p. 220 are incorrect. The physical basis for the validity of the Langevin equations is not presented. In Chapter 10, linear response theory is given short shrift. The Zwanzig-Mori formalism is presented, but there is no discussion as to when it will be useful or the importance of the existence of a smallness parameter.

Fortunately, the presentation improves when the authors treat subjects which are close to their research interests. Chapters 5 and 6 on molecular dynamics and Monte Carlo methods are nicely done as are Chapter 11 on barrier crossing, Chapter 12 on oscillating reactions and Chapter 13 on cellular automata.

I would recommend this book as a text for an advanced course in statistical mechanics after the fundamentals have been discussed elsewhere.

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