Journal of Statistical Physics, Vol. 62, Nos. 1/2, 1991

Book Review: *The Nonequilibrium Statistical Mechanics of Open and Closed Systems*

The Nonequilibrium Statistical Mechanics of Open and Closed Systems. Katja Lindenberg and Bruce J. West, VCH Publishers, New York, 1990.

The theory of stochastic processes is widely used in nonequilibrium statistical mechanics and nonlinear dynamics. Many books and review articles have been devoted to this subject with a broad range of different physical applications. This book is not intended to provide a comprehensive survey of the field, but to cover some selected topics. This limited goal is achieved very successfully. Linear and nonlinear Langevin equations and the corresponding Fokker–Planck equations are discussed and applied to problems ranging from laser physics, hydrodynamics, and spectral line shapes, to phase transitions. The discussion and comparison of additive and multiplicative processes and their detailed analysis are very well made. The presentation is clear, the number of equations is kept to a minimum, and the notation is helpful. The book can be used as a supplement to a graduate-level course, but it is too specialized to serve as a main text. For example, precise definitions of elementary concepts such as "dissipative forces" are not given.

Applications in the book are divided into two broad categories of "closed systems" and "open systems." The authors refer to models involving only random forces as "open" and models with random forces and dissipation as "closed." This terminology is unfortunate, since it refers to the *derivation* of the equations. Once derived, they both represent an open system, since both cases result in stochastic equations for reduced dynamics. A better approach would have been to separate the presentation into two basic problems: (i) the derivation of the stochastic equations and (ii) the methods of solution. At the derivation stage one can make the distinction, but the actual methodology of solution is very similar. An example of this ambiguity is Chapter V, entitled "Non-Hamiltonian Systems," which covers fluctuating hydrodynamics. Hydrodynamic systems are, of course, Hamiltonian systems. It is the starting point for the derivation which is macroscopic and not fully micoscopic. Throughout the book the term

0022-4715/91/0100-0497$06.50/0

"phase space" is misused to denote a probability space rather than the joint space of momenta and coordinates.

Overall, I find the book easy to read and it contains a wealth of information and methods in a concise form. A notable stength is the broad range of very different examples presented in this book using a unified terminology. Researchers active in this field will find the book a handy source and reference to various methods and applications and to the current literature.

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