

## **Book Review: *The Langevin Equation with Applications in Physics, Chemistry and Electrical Engineering***

**The Langevin Equation with Applications in Physics, Chemistry and Electrical Engineering.** W. T. Coffey, Yu. P. Kalmykov, and J. T. Waldron, World Scientific, Singapore, 1996.

This book presents a phenomenological treatment of the Langevin equation with special emphasis on rotational Brownian motion. Chapter 1 contains an interesting historical background. Chapter 2 describes methods of solution of the Langevin equation. Chapters 3 and 4 discuss the Brownian motion of a free particle and oscillators. Chapters 5–10 involve rotational Brownian motion and its applications, a subject the authors have contributed to in a vast number of publications. These applications involve both linear and nonlinear Langevin equations. These chapters provide the most important and illuminating parts of this book. Finally, Chapter 11 contains an extremely brief discussion of linear response theory and the Fokker–Planck operator.

There is a lot of valuable material in this book but, since the approach is phenomenological, there is little insight into when a Langevin equation, even with multiplicative noise, is a valid description of a physical process. There are many situations in which a molecular treatment is necessary, particularly when there are boundary conditions that must be taken into account. There is an overeagerness to disregard the Fokker–Planck equation in favor of the Langevin equation. To quote from the preface: “This approach to the subject enables one to completely dispense with the underlying probability density diffusion equation—the Fokker Planck equation with all its attendant mathematical complications.” To be sure the appropriate Fokker–Planck and Langevin equations are equivalent but there are cases in which the Fokker–Planck approach is considerably simpler.

Despite these quibbles, I found this book a valuable addition to my library. It will be of interest to researchers and advanced students and

the material could be used as the text for a course for advanced undergraduates and graduate students.

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