



The Transition to Chaos: Conservative Classical Systems and Quantum Manifestations (Institute for Nonlinear Science)

By Linda Reichl

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Based on courses given at the universities of Texas and California, this book treats an active field of research that touches upon the foundations of physics and chemistry. It presents, in as simple a manner as possible, the basic mechanisms that determine the dynamical evolution of both classical and quantum systems in sufficient generality to include quantum phenomena. The book begins with a discussion of Noether's theorem, integrability, KAM theory, and a definition of chaotic behavior; continues with a detailed discussion of area-preserving maps, integrable quantum systems, spectral properties, path integrals, and periodically driven systems; and concludes by showing how to apply the ideas to stochastic systems. The presentation is complete and self-contained; appendices provide much of the needed mathematical background, and there are extensive references to the current literature; while problems at the ends of chapters help students clarify their understanding. This new edition has an updated presentation throughout, and a new chapter on open quantum systems.

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Editorial Review

Review

From the reviews of the second edition:

"This book is an expanded and updated version ... from a previous edition and reviews results on the manifestation of chaos in classical and quantum mechanics. ... A very wide range of topics is covered in the book, which thus can be used as preliminary reading for research areas The book can also be considered as a helpful companion both for mathematicians and for physicists. ... Many technical details and background notions can be found in a rich complement of appendices." (Guido Gentile, *Mathematical Reviews*, Issue 2006 c)

From the Back Cover

This book provides a thorough and comprehensive discussion of classical and quantum chaos theory for bounded systems and for scattering processes. Specific discussions include:

- Noether's theorem, integrability, KAM theory, and a definition of chaotic behavior.
- Area-preserving maps, quantum billiards, semiclassical quantization, chaotic scattering, scaling in classical and quantum dynamics, dynamic localization, dynamic tunneling, effects of chaos in periodically driven systems and stochastic systems.
- Random matrix theory and supersymmetry.

The book is divided into several parts. Chapters 2 through 4 deal with the dynamics of nonlinear conservative classical systems. Chapter 5 and several appendices give a thorough grounding in random matrix theory and supersymmetry techniques. Chapters 6 and 7 discuss the manifestations of chaos in bounded quantum systems and open quantum systems respectively. Chapter 8 focuses on the semiclassical description of quantum systems with underlying classical chaos, and Chapter 9 discusses the quantum mechanics of systems driven by time-periodic forces. Chapter 10 reviews some recent work on the stochastic manifestations of chaos.

The presentation is complete and self-contained; appendices provide much of the needed mathematical background, and there are extensive references to the current literature. End of chapter problems help students clarify their understanding. In this new edition, the presentation has been brought up to date throughout, and a new chapter on open quantum systems has been added.

About the author:

Linda E. Reichl, Ph.D., is a Professor of Physics at the University of Texas at Austin and has served as Acting Director of the Ilya Prigogine Center for Statistical Mechanics and Complex Systems since 1974. She is a Fellow of the American Physical Society and currently is U.S. Editor of the journal Chaos, Solitons, and Fractals.

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