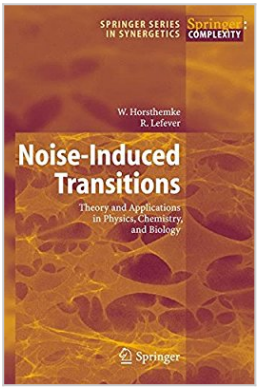

Noise-Induced Transitions: Theory and Applications in Physics, Chemistry, and Biology (Springer Series in Synergetics)

By W. Horsthemke, R. Lefever

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The study of phase transitions is among the most fascinating fields in physics. Originally limited to transition phenomena in equilibrium systems, this field has outgrown its classical confines during the last two decades. The behavior of far from equilibrium systems has received more and more attention and has been an extremely active and productive subject of research for physicists, chemists and biologists. Their studies have brought about a more unified vision of the laws which govern self-organization processes of physico-chemical and biological sys tems. A major achievement has been the extension of the notion of phase transi tion to instabilities which occur only in open nonlinear systems. The notion of phase transition has been proven fruitful in apphcation to nonequilibrium ins- bihties known for about eight decades, like certain hydrodynamic instabilities, as well as in the case of the more recently discovered instabilities in quantum optical systems such as the laser, in chemical systems such as the Belousov-Zhabotinskii reaction and in biological systems. Even outside the realm of natural sciences, this notion is now used in economics and sociology. In this monograph we show that the notion of phase transition can be extend ed even further. It apphes also to a new class of transition phenomena which occur only in nonequilibrium systems subjected to a randomly fluctuating en vironment.

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Editorial Review

From the Back Cover

This classic text, an often-requested reprint, develops and explains the foundations of noise-induced processes. At its core is a self-contained, textbook-style presentation of the elements of probability theory, of the theory of Markovian diffusion processes and of the theory of stochastic differential equations, on which the modeling of fluctuating natural and artificial environments is based. Following an introduction to the mathematical tools, the occurrence and the properties of noise-induced transitions are then analyzed for rapidly fluctuating environments describable by the white-noise idealization. Subsequently, more realistic and general types of colored noises are considered. Appropriate practical methods for dealing with these situations are developed. The latter part of the book contains applications and experimental studies illustrating the many facets of noise-induced transitions. The following applications are considered in Noise-Induced Transitions: population dynamics, electrical circuits, chemical and photochemical reactions, non-linear optics, and hydrodynamical systems.

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