Whittle, Peter

Systems in stochastic equilibrium. (English) Zbl 0665.60107

Wiley Series in Probability and Mathematical Statistics: Applied Probability and Statistics. Chichester etc.: John Wiley & Sons Ltd. X, 460 p.; $ 64.95 (1986).

"This book provides a study of statistical equilibrium in systems of interacting components. The integrating theme of the work is the interaction termed "weak coupling". This approach gives a unified treatment of models in statistical mechanics, chemical kinetics, ecological competition, the processor networks of computers, communication and job-shop contexts, and systems of socio-economic interaction and role formation."

Such is the blurb on the dust cover of this book, an individualistic view of the many-facetted topic of stochastic networks, unified in another highly original text of Peter Whittle. The central features of the work are perhaps the ideas of reversibility and weak coupling, and the target is to describe the equilibrium theory of stochastic systems with interacting components.

After an introduction to Markov processes and other basic notions, the author describes the associated theory arising in statistical mechanics and chemical kinetics, before moving on to Jackson networks and the fundamental notion of weak coupling; this is a form of interaction induced by the passage of units of some kind between the components of a system. Formally, we say that there is a weak coupling in a network if (in equilibrium) the probability distribution of the system state, conditional upon the distribution of units over the components of the system, does not depend on the parameters which describe the routing of units.

The author moves on to "bonding models", and in particular to polymerization and random graph processes, before terminating with 50 pages of less central material about random fields.

This book is not easy going, the originality of view being a continuous challenge to the reader. It is crammed full of ideas and insights, and will become a classic of its sort.

MSC:

60K35	Interacting random processes; statistical mechanics type models; percolation theory
60-02	Research exposition (monographs, survey articles) pertaining to probability theory
60K20	Applications of Markov renewal processes (reliability, queueing networks, etc.)
82B05	Classical equilibrium statistical mechanics (general)

Keywords:

statistical equilibrium in systems of interacting components; statistical mechanics; chemical kinetics; reversibility; weak coupling; Jackson networks; random graph processes