



Phase Transitions (Primers in Complex Systems)

By Ricard V. Solé

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Phase transitions--changes between different states of organization in a complex system--have long helped to explain physics concepts, such as why water freezes into a solid or boils to become a gas. How might phase transitions shed light on important problems in biological and ecological complex systems? Exploring the origins and implications of sudden changes in nature and society, *Phase Transitions* examines different dynamical behaviors in a broad range of complex systems. Using a compelling set of examples, from gene networks and ant colonies to human language and the degradation of diverse ecosystems, the book illustrates the power of simple models to reveal how phase transitions occur.

Introductory chapters provide the critical concepts and the simplest mathematical techniques required to study phase transitions. In a series of example-driven chapters, Ricard Solé shows how such concepts and techniques can be applied to the analysis and prediction of complex system behavior, including the origins of life, viral replication, epidemics, language evolution, and the emergence and breakdown of societies.

Written at an undergraduate mathematical level, this book provides the essential theoretical tools and foundations required to develop basic models to explain collective phase transitions for a wide variety of ecosystems.

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Editorial Review

Review

"Solé has compiled an interesting overview of the vast amount of real world systems in which phases play a role. It is a good introduction to the topic and the great variety of applications is inspirational. *Phase Transitions* is a good read for the JASSS audience interested in if, how, and when abrupt changes may occur--either as risks for collapse or as opportunities for salvation."--**Emile Chappin, *Journal of Artificial Societies and Social Simulation***

"Mean-field approaches constitute an elegant and considerable contribution to complex systems studies, and I commend Sole for his rigorous presentation."--**Lael Parrott, *BioScience***

From the Back Cover

"This ambitious book provides an elegant and much-needed synthesis to many of the ideas that have come to define the field of complex systems and their applications to nature and society. It makes an important contribution to the field, especially for researchers and students looking for an overview of the literature and entry points for research."--**Luis Bettencourt, Los Alamos National Laboratory and the Santa Fe Institute**

"This clear and easy-to-follow book is a valuable compilation of systems showing phase transition phenomena that have become more and more important in understanding natural and man-made complex systems. It is a useful addition to the already existing literature."--**Stefan Thurner, Medical University of Vienna**

About the Author

Ricard V. Sole is research professor and head of the Complex Systems Lab at Pompeu Fabra University and external professor at the Santa Fe Institute. He is the coauthor of "Signs of Life" (Basic) and "Self-Organization in Complex Ecosystems" (Princeton).

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