1. Record Nr. UNINA9910300558303321

Autore	Gupta Shamik
Titolo	Statistical Physics of Synchronization / / by Shamik Gupta, Alessandro Campa, Stefano Ruffo
Pubbl/distr/stampa	Cham : , : Springer International Publishing : , : Imprint : Springer, , 2018
ISBN	3-319-96664-2
Edizione	[1st ed. 2018.]
Descrizione fisica	1 online resource (135 pages)
Collana	SpringerBriefs in Complexity, , 2191-5334
Disciplina	530.13
Soggetti	Mathematical physics Dynamics Nonlinear theories Theoretical, Mathematical and Computational Physics Applied Dynamical Systems Mathematical Physics
Lingua di pubblicazione	Inglese
Formato	Materiale a stampa
Livello bibliografico	Monografia
Nota di contenuto	Synchronizing systems -- Introduction -- The oscillators and their interaction: A qualitative discussion -- Oscillators as limit cycles -- Interacting limit-cycle oscillators -- Synchronizing systems as statistical mechanical systems -- The features of a statistical physical description -- Some results for noiseless interacting oscillators -- The oscillators with inertia -- Appendix 1: A two-dimensional dynamics with a limit-cycle attractor -- Appendix 2: The Lyapunov exponents -- Appendix 3: The one-body distribution function in an N-body system -- Oscillators with first-order dynamics -- The oscillators with distributed natural frequencies -- The Kuramoto model -- Unimodal symmetric g(w) -- Nonunimodal g(w) -- Appendix 1: An H-theorem for a particular simple case -- Appendix 2: Form of the function r(K) for symmetric and unimodal frequency distributions in the Kuramoto model -- Appendix 3: The numerical solution of Eq. (2.34) -- Oscillators with second-order dynamics -- Generalized Kuramoto model with inertia and noise -- Nonequilibrium first-order synchronization phase transition: Simulation results -- Analysis in the

continuum limit: The Kramers equation -- Phase diagram: Comparison with numeric -- Appendix 1: The noiseless Kuramoto model with inertia: Connection with electrical power distribution models -- Appendix 2: Proof that the dynamics (3.9) does not satisfy detailed balance -- Appendix 3: Simulation details for the dynamics (3.9) -- Appendix 4: Derivation of the Kramers equation -- Appendix 5: Nature of solutions of Eq. (3.32) -- Appendix 6: Solution of the system of equations (3.39) -- Appendix 7: Convergence properties of the expansion (3.38).

Sommario/riassunto

This book introduces and discusses the analysis of interacting many-body complex systems exhibiting spontaneous synchronization from the perspective of nonequilibrium statistical physics. While such systems have been mostly studied using dynamical system theory, the book underlines the usefulness of the statistical physics approach to obtain insightful results in a number of representative dynamical settings. Although it is intractable to follow the dynamics of a particular initial condition, statistical physics allows to derive exact analytical results in the limit of an infinite number of interacting units. Chapter one discusses dynamical characterization of individual units of synchronizing systems as well as of their interaction and summarizes the relevant tools of statistical physics. The latter are then used in chapters two and three to discuss respectively synchronizing systems with either a first- or a second-order evolution in time. This book provides a timely introduction to the subject and is meant for the uninitiated as well as for experienced researchers working in areas of nonlinear dynamics and chaos, statistical physics, and complex systems.