Dynamical Processes On Complex Networks

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Generalized Epidemic Mean Field Model for Spreading Processes Over Multilayer Complex Networks

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Dr. Felipe Abrah ã o on AID and Algorithmic Complex Networks at AUTOMATA 2020 *KDD2020 ResearchTrack Neural Dynamics on Complex Networks Network Dynamics complex systems - why study system dynamics?* **Introduction to Complexity: Small-World Networks Part 1** *Multi-agent models in complex networks (4 o 4)* Temporal Analysis of Complex Networks John Preskill - Quantum Computing and Fundamental Physics Dynamical Processes On Complex Networks

This book is a very well-structured and well-researched book on dynamical processes on complex networks. In chapters 1-5 it covers the basics of dynamical processes (modelling, simulation, phase transitions), and in chapters 6-12 specific areas of application, namely resilience and robustness, synchronization, search, epidemics, collective behaviour, traffic, and biological networks.

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Recent advances have generated a vigorous research effort in understanding the effect of complex connectivity patterns on dynamical phenomena. For example, a vast number of everyday systems, from the brain to ecosystems, power grids and the Internet, can be represented as large complex networks. This new and recent account presents a comprehensive explanation of these effects.

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The availability of large data sets has allowed researchers to uncover complex properties such as large-scale fluctuations and heterogeneities in many networks, leading to the breakdown of standard theoretical frameworks and models. Until recently these systems were considered as haphazard sets of points and connections. Recent advances have generated a vigorous research effort in understanding the effect of complex connectivity patterns on dynamical phenomena. This book presents a comprehensive account of these effects. A vast number of systems, from the brain to ecosystems, power grids and the internet, can be represented as large complex networks. This book will interest graduate students and researchers in many disciplines, from physics and statistical mechanics to mathematical biology and information science. Its modular approach allows readers to readily access the sections of most interest to them, and complicated maths is avoided so the text can be easily followed by non-experts in the subject.

The availability of large data sets have allowed researchers to uncover complex properties such as large scale fluctuations and heterogeneities in many networks which have lead to the breakdown of standard theoretical frameworks and models. Until recently these systems were considered as haphazard sets of points and connections. Recent advances have generated a vigorous research effort in understanding the effect of complex connectivity patterns on dynamical phenomena. For example, a vast number of everyday systems, from the brain to ecosystems, power grids and the Internet, can be represented as large complex networks. This new and recent account presents a comprehensive explanation of these effects.

An in-depth 2008 account on complex connectivity patterns for graduates and researchers in statistical mechanics, mathematical biology and information science.

Examining important results and analytical techniques, this graduate-level textbook is a step-by-step presentation of the structure and function of complex networks. Using a range of examples, from the stability of the internet to efficient methods of immunizing populations, and from epidemic spreading to how one might efficiently search for individuals, this textbook explains the theoretical methods that can be used, and the experimental and analytical results obtained in the study and research of complex networks. Giving detailed derivations of many results in complex networks theory, this is an ideal text to be used by graduate students entering the field. End-of-chapter review questions help students monitor their own understanding of the materials presented.

This book brings together two emerging research areas: synchronization in coupled nonlinear systems and complex networks, and study conditions under which a complex network of dynamical systems synchronizes. While there are many texts that study synchronization in chaotic systems or properties of complex networks, there are few texts that consider the intersection of these two very active and interdisciplinary research areas. The main theme of this book is that synchronization conditions can be related to graph theoretical properties of the underlying coupling topology. The book introduces ideas from systems theory, linear algebra and graph theory and the synergy between them that are necessary to derive synchronization conditions. Many of the results, which have been obtained fairly recently and have until now not appeared in textbook form, are presented with complete proofs. This text is suitable for graduate-level study or for researchers who would like to be better acquainted with the latest research in this area. Sample Chapter(s). Chapter 1: Introduction (76 KB). Contents: Graphs, Networks, Laplacian Matrices and Algebraic Connectivity; Graph Models; Synchronization in Networks of Nonlinear Continuous-Time Dynamical Systems; Synchronization in Networks of Coupled Discrete-Time Systems; Synchronization in Network of Systems with Linear Dynamics; Agreement and Consensus Problems in Groups of Interacting Agents. Readership: Graduate students and researchers in physics, applied mathematics and engineering.

Networks constitute the backbone of complex systems, from the human brain to computer communications, transport infrastructures to online social systems and metabolic reactions to financial markets. Characterising their structure improves our understanding of the physical, biological, economic and social phenomena that shape our world. Rigorous and thorough, this textbook presents a detailed overview of the new theory and methods of network science. Covering algorithms for graph exploration, node ranking and network generation, among others, the book allows students to experiment with network models and real-world data sets, providing them with a deep understanding of the basics of network theory and its practical applications. Systems of growing complexity are examined in detail, challenging students to increase their level of skill. An engaging presentation of the important principles of network science makes this the perfect reference for researchers and undergraduate and graduate students in physics, mathematics, engineering, biology, neuroscience and the social sciences.

This self-contained book systematically explores the statistical dynamics on and of complex networks with a special focus on time-varying networks. In the constantly changing modern world, there is an urgent need to understand problems related to systems that dynamically evolve in either structure or function, or both. This work is an attempt to address such problems in the framework of complex networks. Dynamics on and of Complex Networks, Volume 2: Applications to Time-Varying Dynamical Systems is a collection of surveys and cutting-edge research contributions exploring key issues, challenges, and characteristics of dynamical networks that emerge in various complex systems. Toward this goal, the work is thematically organized into three main sections with the primary thrust on time-varying networks: Part I studies social dynamics; Part II focuses on community identification; and Part III illustrates diffusion processes. The contributed chapters in this volume are intended to promote cross-fertilization in several research areas and will be valuable to newcomers in the field, experienced researchers, practitioners, and graduate students interested in pursuing research in dynamical networks with applications to computer science, statistical physics, nonlinear dynamics, linguistics, and the social sciences. This volume follows Dynamics On and Of Complex Networks: Applications to Biology, Computer Science, and the Social Sciences (2009), ISBN 978-0-8176-4750-6.