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A. Barrát, M. Barthélemy, A. Vespignani: Dynamical Processes on Complex Networks

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Fueled by the ability to manipulate and analyze huge data sets by means of modern computers, the study and science of complex networks has steadily grown in the past two decades, burgeoning into an immense body of knowledge that finds applications in virtually every discipline of science and technology, economy, and the arts. With this in mind, Alain Barrát, Marc Barthélemy, and Alessandro Vespignani, prolific researchers in the field of complex nets have written a remarkably comprehensive review of the dynamical aspects of the theory that will be accessible to a wide audience.

The first four chapters introduce basic concepts from graph theory, as well as some of the more recent concepts that evolved to gauge and classify networks, important network models, and some of the principal mathematical tools necessary to analyze dynamics on nets. Additional, more technical material is given in the various appendices. The rest of the book is organized into topics spanning the spectrum from equilibrium to non-equilibrium processes, starting with equilibrium phase transitions (Chap. 5), percolation, random and attack damage (Chap. 6), synchronization (Chap. 7), diffusion and navigation (Chap. 8), dynamics of the spread of epidemics (Chap. 9), social interaction and opinion and rumor spreading (Chap. 10), and ending with traffic and congestion models (Chap. 11). Chapter 12 is devoted to diverse applications in biology—one of the most fertile and largest growing areas of complex network science. Chapter 13 gives a thoughtful rebuttal to many of the criticisms that were leveled against the science of complex networks in the first years in which this was studied.

The book is written in review style, in a modular way that allows jumping into any particular topic without regard to the order of the chapters. As might be expected, the commitment to cover such a monumental body of information does not allow for excessive detail, and the book itself is probably not the best place to study many of its subjects (for instance, for an introduction to the field I would still refer my students to the seminal review paper of Albert and Barabási, whose elegance and clarity is difficult to surpass). On the other hand, the book

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does a terrific and admirable job at putting some order into the wealth of research that has emerged during the last decade, providing an overview of the current state of the art, and guiding the reader to relevant sources of information. The impressive body of techniques and applications covered in the book gives a resounding answer to the critics, perhaps more convincing than the arguments at the book's end. This is a fantastic resource book on dynamical processes on complex networks, and its wide scope promises to keep it relevant for several years to come.