

Preface

In the last decade, the increased power of computers and the informatics revolution have made possible the systematic gathering and handling of data sets on several large scale networks, allowing the detailed analysis of their structural and functional properties. In particular, mapping projects of the World-Wide Web and the physical Internet offered the first chance to study the topology and traffic of large scale networks. Gradually other studies followed describing networks of practical interest in social science, infrastructures analysis and epidemiology. The study of these systems involves researchers from many different disciplines such as physics, biology, mathematics, engineering and computer science and has led to a shift of paradigm in which the complexity of networks has become the central issue in their characterization, modeling and understanding. Indeed, the evidence that a complex topology is shared by many complex evolving networks cannot be considered as incidental. Rather, it points to the possibility of some general principle that can possibly explain the emergency of this architecture in such different contexts. In this perspective, it becomes particularly relevant to seek the development of a general methodological and theoretical framework rationalizing the general principles underlying the dynamics and structure of complex networks.

In this context the Information Technology section of the European commission has been a main actor in fostering the development of interdisciplinary researches and collaborations among European institutions with a focus on network science. In particular, the FET open project Coevolution and Self-Organization in Dynamical Networks (COSIN IST-2001-33555)^a has represented a major initiative tackling a wide spectrum of network research. Different scientists from different fields have decided to collaborate in order to build a common set of knowledge and expertise to be used in the description different phenomena. While the collaboration was intended

^a<http://www.cosinproject.org>

to principally tackle issues related to networks arising in the information technology domain, it has been fully pursuing an interdisciplinary approach where research activities in the field of ecological, economical and social systems have not been neglected. Results obtained in each of these fields could turn to be applicable or prospect innovative solutions and understanding in the other domains. Indeed, various nodes of the project work on fields as different as Protein Interaction Networks, the network of e-mails, the Internet Graph and the financial networks present in the stock exchange.

The purpose of this volume is twofold. First we intend to provide a snapshot of the forefront research activities in the area of complex networks, provide a good sampling of the disciplines involved, and the kinds of problems that form the subject of inquiry. In doing this, we organized the book in thematic chapter, each one addressing a special area or domain of network science. On the other hand, we want to present the many research achievements obtained within the COSIN project, as well as new identified problems and the various research directions still in their initial stages. In this spirit, chapters will be co-authored by leading scientists who have been involved, in a stage or the other, in the COSIN project. This will also allow us to emphasize the value of the interdisciplinary approach by showing specific pieces of research realized in each particular domain. Despite the contributed chapter format, a specific effort has been put in place to homogenize the various chapters in a general structure providing a coherent and unified framework for the study of networked structure. We hope that this presentation of the field will attract the interest of colleagues within and outside the network community, and serve to further improve our understanding of this fascinating subject.

Many people have contributed to the preparation of this book. First of all we thank all the authors for their extraordinary contributions. We thank all the colleagues that through various scientific interactions have helped all the authors of the book in their scientific activities. We also thank all institutions and funding agencies that along with the European community have generously supported the scientific activity of the authors of the present book. In particular, on top of the support received for the COSIN book, we also acknowledge the support of the Ministerio de Ciencia y Tecnología (Spain) through its program “Ramón y Cajal” and grant BFM 2001-2154; the European project “DELIS”. Finally we want to express our gratitude to who helped in the final preparation of the manuscript.