

PREFACE:
MESOSCALES AND EVOLUTION IN COMPLEX NETWORKS:
APPLICATIONS AND RELATED TOPICS

The study of networks has become one of the paradigms of the science of complexity as well as a fascinating branch of research in applied mathematics, physics, engineering, sociology, biology and science in general. Different systems such as transport networks (underground, train, airline networks, road networks), communication networks (computer servers, Internet, online social networks), neural networks (neural interaction networks and brain networks), biochemical networks (metabolic, protein and genomic networks), trophic networks, social community networks, marketing and recommendation networks, other infrastructure networks (electric power grids, water supply networks) and many others (including the World Wide Web)([1],[3],[4],[7],[8],[9],[10]) are known to have behavioral and structural characteristics in common, and they can be studied by using non-linear mathematical techniques and computer modeling approaches. The interest on complex networks has certainly been promoted by the optimized rating of computing facilities, and by the availability of data on large real networks (including the World Wide Web, cortical networks, citation networks from Scientific Citation Index and online social networks). This focused section is characterized for emphasizing the latest applications of complex networks rather than the theoretical aspects, but covering several aspects as topological properties, algorithms and computation tools, models of interactions between complex systems, synchronization, control and some other related topics.

As we said before, the burst of complex networks theory has been certainly promoted by the optimized rating of computing facilities, and by the availability of large datasets about the interaction patterns of real complex systems, being the most popular examples the World Wide Web and the Internet. So, the development of complex networks theory is intrinsically related to the study of real-world systems instead of being motivated by a merely theoretical problem. Since the publication of the two seminal papers, by Watts and Strogatz on *the small world effect*, [11], and by Barabási and Albert on *scale-free networks*, [2], growing interest for complex networks is supported in the application of this novel perspective for tackling different problems arisen in several areas where networks theory applies, and is reflected in the large number of papers that have been published about this topic.

Some examples of these important problems include the study of robustness and disease spreading in social and technological networks, the efficient information routing across the Internet, the study of search strategies on the World Wide Web, the characterization of synchronization processes in the brain, the interacting networks or the design of efficient community detection methods among others. This applied nature of complex networks theory is at the core of the works presented in this focused section.

This is a focused section about the structure and dynamics of complex networks and its goal is to give a selection of contributed papers that covers a wide range of relevant and modern aspects in the analysis of complex networks, giving a state of the art picture of this field. The aim of this focused section of *Network and Heterogeneous Media* is to provide a flavor of recent trends in this fast growing research area. It contains nine original papers about various aspects of the structure and dynamics of complex networks: some of them present new theoretical results whereas others deal with numerical algorithms and applications of the theory. The contributed papers presented in this focused section were selected among the most relevant works presented at the International Conference Net-Works 2011. This conference, which took place in El Escorial (Spain) on October 26th-28th, 2011, was held in cooperation with the Society for Industrial and Applied Mathematics (SIAM) and the American Institute for Mathematical Sciences (AIMS). The conference has gathered more than 80 researchers in this area from different countries and it has also attracted young researchers from neighbouring areas.

We are extremely grateful to the *Networks and Heterogeneous Media*, and specially warm thanks to the Editor in Chief Benedetto Piccoli for giving us this editorial opportunity, to the Director of the American Institute of Mathematical Sciences Shouchuan Hu and the Publishers for having hosted this theme section. Finally we would like to express our most sincere thanks and great appreciation to all the members of Scientific Committee for their help and their important support, specially to S. Boccaletti, J. Kurths, E. Schöell, V. Latora and H. Mancini. It was a great honour for us to count on the above leaders on Complex Networks as members of Scientific Committee of Net-Works 2011. We also want to thank all those colleagues who have helped us in the realization of this focused section, the contributors of the different manuscripts, and all our colleagues who assisted us in the reviewing process of the papers. We are honoured to bring you this collection of papers generated from the contributions and discussions held at Net-Works 2011. We hope that this focused section will contribute to the development of new activities in the field.

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