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EDITORIAL

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Complex Networks theory is nowadays widely accepted as the formal tool for describing and analyzing the backbone interaction of a wide range of real complex systems. This theory has been successfully achieved in unveiling the common macroscopic and mesoscopic structural patterns behind the large number of microscopic interactions between the constituents of seemingly diverse complex systems. This diversity refers to the large variety of scientific disciplines in which complex networks theory has been applied, e.g. systems biology, neuroscience, sociology, telecommunication and computer sciences, etc. It is thus clear that network theory spans across life-scales providing their connection with a unified language and paving the way for a new and promising multidisplinary approach [Albert & Barabási, 2002; Bar-Yam, 1997; Boccaletti *et al.*, 2006; Fontoura-Costa *et al.*, 2008; Newman, 2003; Newman *et al.*, 2006; Strogatz, 2001].

The burst of activity in complex networks theory has been certainly encouraged by the optimized rating of computing facilities, and by the availability of large datasets on the interaction patterns of real complex systems, the most popular being the examples of the World Wide Web and the Internet. Therefore, the development of complex networks theory is intrinsically related to the study of real-world systems rather than being motivated by a merely theoretical problem. Also, it is important to remark that, since the publication of the two seminal papers, by Watts and Strogatz on the *small world effect* [Watts & Strogatz, 1998] and by Barabási and Albert on *scale-free networks* [Barabási & Albert, 1999] the growing interest in complex networks is supported by the application of this novel perspective for tackling different problems arising in the related areas in which networks theory applies. Some examples of these important problems are: The study of 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 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 special issue.

Following the traditional course of action of *International Journal of Bifurcation and Chaos*, this special issue deals with the structure and dynamics of complex networked systems. The purpose of this issue is to offer a collection of contributed papers that covers many relevant and modern aspects about the state of the art of complex networks theory and applications, giving a rather fair picture of the current research interests in this scientific field. The contributed papers presented in this special issue were selected among the works presented at the International Conference Net-Works 2010. This conference was held in cooperation with the Society for Industrial and Applied Mathematics (SIAM) and took place in Zaragoza (Spain) at the Institute for Biocomputation and Physics of Complex Systems on July 8–10, 2010.

The papers contained in this special issue cover a wide range of topics related to the topological and dynamical properties of complex networks and their applications to real problems. Opening with a tutorial by C. Granell *et al.* on the application of community detection methods to the general problem of data clustering, we then have a set of five manuscripts dealing with dynamical processes on top of complex networks. The first by P. M. Gleiser *et al.* studies the synchronization properties of Kuramoto phase oscillators coupled through a tree graph topology. We follow with a paper by D. Aguilar *et al.* on the dynamics of gene regulations through the implementation of Boolean dynamics on generic networks. Two papers in this block study diffusive processes on networks: the paper by J. Borge-Holthoefer *et al.* focuses on the study of navigation across lexical networks while that by J. Sanz *et al.* studies the spreading of diseases with long-latency periods in homogeneous graphs. We end the section devoted to the study of dynamical processes on networks with a paper by Miranda *et al.* in which networks of convective oscillators are used as an experimental set up to study the Kibble–Zurek mechanism. The block on dynamical processes is followed by another one in which diverse applications of network theory to real problems are discussed. First, A. Sánchez *et al.* shows the application of weighted graphs in the analysis of images. Then, we follow with a manuscript by A. Nuñez *et al.* in which they show how time periodic series can be efficiently identified via the use of a network representation called the visibility graph. Another interesting application is provided by F. Pedroche who shows the application of the page rank algorithm to the classification of users in large social networks. Another example of the wide applicability of the network approach is provided in the paper by F. De Vico Fallani *et al.* in which functional networks constructed from EEG recordings in the brain are analyzed. We end this block with the manuscript by Z. K. Zhang *et al.* in which they study a recommendation system based on social tags. Finally, this issue is rounded off with the paper by P. Erola *et al.* where a coarse-graining of the structure of large networks by means of Singular-Value-Decomposition of the graph topology is proposed.

This special issue was approved by Prof. L. Chua and was organized before the *International Journal of Bifurcation and Chaos* was converted to an electronic system. We are extremely grateful to the journal's Editor-in-Chief Prof. G. Chen and specially to Prof. Chua and the publisher for having hosted this theme issue. We finally would like to express our most sincere thanks and great appreciation to all the members of the Scientific Committee for their help and their important support, specially to R. M. Benito, M. Dahlem, A. Díaz-Guilera, L. M. Floría, J. Kurths, V. Latora, H. Mancini and E. Schöell. It has been a great honor to have them supporting us with their expertise in the field of complex networks, as members of the Scientific Committee of Net-Works 2010. We also wish to thank all those colleagues who have helped us in the realization of this special issue, to the contributors of the different manuscripts, and to all the colleagues who assisted us in the reviewing process of the papers. We are honored to bring to the readers this collection of papers generated from the contributions and discussions held at Net-Works 2010.

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