Topical Issue: Synchronization of Complex Systems and Networks

PREFACE

In this Topical Issue of the Cybernetics and Physics Journal (CAP) highly selected papers which focus on both theoretical and practical aspects of synchronization of complex systems are collected. This issue presents extended versions of significant works presented in the Invited Session called "Synchronization of Complex Systems and Networks" held at the 6th International Scientific Conference on Physics and Control (PhysCon 2013) on August, 26th–29th, 2013. The conference was organized by the International Physics and Control Society (IPACS) and the Institute for Scientific and Technological Research of San Luis Potosi (IPICYT) in the World Heritage Site of the historic center of San Luis Potosí, México.

The synchronization phenomenon is an intrinsic feature of real-world complex systems. As such is a fundamental topic of research in the areas of physics and control. In their essence complex systems require synchronization of their components to operate as a single entity. Therefore synchronization problems are relevant for many real-life systems such as networks, automobiles, and biological entities. The tools of mathematics and systems analysis are required to establish the existence of synchronization on such complex systems. Furthermore, the dynamical features of the synchronized behavior can be imposed on the system by designing controllers and observers with specific control objectives. In this sense, control theory is an fundamental tool in studying the synchronization phenomenon. This Topical Issue includes original results on both theoretical and practical aspects of the synchronization problem. In particular, the results presented address the synchronization of complex systems achieved by the design of nonlinear controllers and discontinuous observers. In these contributions the proposed techniques are shown to provide significant advantages. The problem of synchronization on growing networks of coupled dynamical systems is also investigated. The contributions included in this Topical Issue discuss the effects and potential advantages of growth algorithms on the synchronizability of the network. Additionally, the use of Poincaré maps as a method for the coupling of dynamical systems is investigated in terms of the dynamics that such form of discrete-time coupling can induced on a slave system. The different topics investigated in the papers that conform this Topical Issue provide initial works, and have the intention of generating further research and discussion; as well as to inspire the application of these techniques on similar problems.

We would like to thank the authors for their efforts in extending and complementing their contributions to the Invited Session of PhysCon2013, their work has ensured that the papers included in this Topical Issue are of increased quality and relevance.

J.G. Barajas-Ramirez
(Guest Editor)