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Complex Dynamical Networks, Synchronization and Topology Identification

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Abstract:

Topology identification of networks has recently got high concern due to various properties of networks, such as cascade and robustness, which are determined by the structure of the network. Adaptive control has been proposed to estimate the unknown topology under a key condition: persistently exciting condition. However, when this condition is not satisfied, how to identify a network topology? In the first part of this talk, we show that noise induces topology identification when this condition is not satisfied. Meanwhile, the identification scheme is still effective for complex networks whose topology switches. In a second part of the talk, we deal with cluster synchronization which is an interesting issue in complex dynamical networks with community structure. We study cluster synchronization of complex networks with nonidentical systems by input-to-state stability. Some sufficient conditions that ensure cluster synchronization of complex networks are provided. The increase of coupling strength inside clusters is very useful to achieve cluster synchronization. However, the coupling among clusters is an obstacle for cluster synchronization. The analysis is then extended to the case where the outer coupling strengths are adaptive. Finally, numerical simulations are given to validate our theoretical analysis.

Biography:

M.A. Aziz-Alaoui is full Professor of Applied Mathematics in Le Havre University, France. He obtained the Ph.D. degree in mathematics at the University of Nice, France, where he was employed as a lecturer from 1987 to 1990. In 1991 he was employed as associate-professor in the University of Le Havre. In 2001, he received the Habilitation of Applied Mathematics from the University of Le Havre, where he is currently the head of the "Dynamical and complex Systems, Evolution Problems, Team" and head of LMAH. His current research interests in nonlinear dynamics include chaos theory and bifurcation, synchronization, complex systems, complex networks and bio or ecological modeling. Currently, he is especially interested in the relationship between chaos-synchronization and complex systems and in the understanding of self-organization and emergent properties arising from natural and artificial systems. He organized conferences and workshops on these topics, and contributed to many international conferences organizations. He is co-editor of two books in Springer Verlag "Understanding Complex Systems" series, and many conferences proceedings. He is the co-editor in chief of the international Journal of Nonlinear Systems and Application. With Prof. Cyrille Bertell he founded the Institute of Complex Systems in Normandy, the third node of the French National Network on Complex Systems.