SOME PROBLEMS ON SYNCHRONIZATION OF CHAOTIC SYSTEMS

Thesis submitted in partial fulfillment for the Award of Degree

Doctor of Philosophy

By

Vijay Kumar Shukla

DEPARTMENT OF MATHEMATICAL SCIENCES
INDIAN INSTITUTE OF TECHNOLOGY
(BANARAS HINDU UNIVERSITY)
VARANASI – 221005
INDIA

Roll No. 13121004

2019

Chapter 7

Conclusion and future work

This thesis provides a comprehensive study of chaos and synchronization in nonlinear dynamical systems. The behavior of chaotic systems and their capacity for synchronization under various circumstances have been rigorously analyzed through theoretical investigation and numerical simulation.

The research started with a fundamental analysis of chaotic systems, highlighting their sensitive dependency on initial conditions, nonlinearity, and aperiodicity. A number of chaotic systems were examined to elucidate the fundamental properties of chaos. This work significantly contributes to the examination of synchronization types namely, complete synchronization, dual phase synchronization, exponential synchronization and function projective synchronization and the mechanisms behind their occurrence.

Various coupling mechanisms are also examined and their efficacy in attaining synchronization between both similar and non-identical chaotic systems is assessed. The thesis also addressed the stability analysis of chaotic systems. This research enhances the comprehension of chaotic behavior and its synchronization, providing both theoretical insights and practical applications. The analytical and numerical methods have demonstrated the efficacy of chaos and synchronization.

This thesis has explored significant facets of chaos and synchronization. However, numerous possibilities for further research exist across diverse domains, including biological systems, complex networks and neural networks. Integrating neural networks with conventional analytical models may produce more interpretable and dependable models of chaos and synchronization.

Extending the current research to include extensive networks of interconnected chaotic systems may provide significant insights into synchronization phenomena and their practical applications. Future research may investigate the utilization of neural networks to more effectively capture the intricate temporal and spatial attributes of chaotic systems. The investigation by graph theory enables a robust paradigm for analyzing and interpreting the architecture and functionality of systems.

*****