

Switching Phenomena of Synchronization State in Coupled-Chaotic Circuits Network

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SUMMARY

Synchronization in a network is one of the interesting topics in scientific disciplines. It is observed over the various fields, for example, engineering, biology, sociology and so on [1]-[3]. Incidentally, the networks have different topology and characters in each even if they are similar type [4]-[6]. Therefore, the investigation of dynamics in a different network is significant and research has proceeded to analyze the dynamics of synchronization and control the synchronization state on each topology.

On the other hand, synchronization of a coupled chaotic system is interesting models to describe various higher-dimensional nonlinear phenomena [7], [8]. Recently, the study of chaotic phenomena by using coupled circuits has increased. Moreover, it is important for future engineering to investigate nonlinear phenomena like chaotic synchronization.

In this study, we investigate synchronization phenomena in coupled-chaotic circuits network. In our proposed network model, chaotic circuits are coupled by resistors. We set the bifurcation parameter of the circuits to generate periodic solutions or chaotic solutions and make the two types of position configured in chaotic network and regular network. By the computer simulation, we confirm that synchronization state is switched in various situation.

REFERENCES

- [1] P. M. Gade, "Synchronization in coupled map lattices with random nonlocal connectivity" *Phys. Rev. E*, vol. 54, no. 1, pp. 64-70, 1996.
- [2] I. Belykh, M. Hasler, M. Lauret and H. Nijmeijer, "Synchronization and graph topology" *Int. J. Bifurcation and Chaos*, vol.15, no.11, pp. 3423-3433, Nov. 2005.
- [3] D. Malagarriga, A. E. P. Villa, J. Garca-Ojalvo and A. J. Pons, "Consistency of heterogeneous synchronization patterns in complex weighted networks" *Chaos* 27, 031102 2017.
- [4] S. Boccaletti, V. Latora, Y. Moreno, M. Chavez and D.-U. Hwang, "Complex networks: structure and dynamics." *Phys. Rep.* 424, pp. 175308 2006.
- [5] J. W. Wang and Y. B. Zhang, "Network synchronization in a population of star-coupled fractional nonlinear oscillators" *Phys. Lett, A* 374, pp. 14641468 2010.
- [6] T. Nishiumi, Y. Uwate and Y. Nishio, "Synchronization Phenomena of Chaotic Circuits with Stochastically-Changed Network Topology", *Proceedings of International Symposium on Nonlinear Theory and its Applications (NOLTA'14)*, pp. 811-814, Sep. 2014.
- [7] N. F. Rullckov and M. M. Sushchik, "Robustness of Synchronized Chaotic Oscillations" *Int. J. Bifurcation and Chaos*, vol. 7, no. 3, pp. 625-643, 1997.
- [8] M. Miyamura, Y. Nishio and A. Ushida, "Clustering in Globally Coupled System of Chaotic Circuit" *Proceedings of IEEE International Symposium on Circuits and Systems (ISCAS'02)*, vol. 3, pp. 57-60, May 2002.