

Synchronization in Complex Networks Contain Dispersion by Using Parametric Excited Oscillators

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SUMMARY

Synchronization is one of the fundamental phenomena in nature and it is observed over the various fields. Studies on synchronization phenomena of coupled oscillators are extensively carried out in various fields, physics [1], biology [2], engineering and so on. The coupled van der Pol oscillator is one of coupled oscillators, and synchronization generated in the system can model certain synchronization of natural rhythm phenomena. Parametric excitation circuit is one of resonant circuits, and it is important to investigate various nonlinear phenomena of the parametric excitation circuits for future engineering applications. In simple oscillator including parametric excitation, Ref. [3] reports that the almost periodic oscillation occurs if nonlinear inductor has saturation characteristic. Additionally the occurrence of chaos is referenced in Refs. [4] and [5].

In our research group, we have investigated synchronization of parametrically excited van der Pol oscillators [6]. By carrying out computer calculations for two or three subcircuits case, we have confirmed that various kinds of synchronization phenomena of chaos are observed. In the case of two subcircuits, the anti-phase synchronization is observed. In the case of three subcircuits, self-switching phenomenon of synchronization states is observed.

However, we have investigated the only simple network models. It is important to investigate more complex network for the broad-ranging future engineering application. In this study, we challenge to investigate more complex network contain dispersion using parametrically excited van der Pol oscillators. In our previous study, we have challenged to investigate the synchronization and clustering in more complex network using ten coupled parametrically excited van der Pol oscillators with small mismatch [7].

In this study, we primarily intended to investigate effect of the hub in network of the synchronization. First, we compare synchronization phenomena of parametrically excited van der Pol oscillators with small mismatch in complex network with hub and without hub. Next, we investigate the mechanism of full synchronization in random network by adding several types of small mismatch to hub of random network.

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