

# Investigation of Clustering of Parametrically Excited Oscillators with Small Mismatch in Random Network

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## SUMMARY

Synchronization phenomena 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. It is important to investigate the synchronization phenomena of coupled oscillators for the future engineering application. 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 excited 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.

In our previous study, we investigate synchronization of parametrically excited van der Pol oscillators with small mismatch [7]. The small mismatch is added to the amplitude of the function relating to parametrically excitation. In the case of two subcircuits, we confirm that the two subcircuits are synchronized at in-phase state when the adding mismatch is small. By increasing the small mismatch, we observe unsynchronous phenomena. Furthermore, we applied this circuit model to ten coupled oscillators as random network model with hub.

In this study, we investigate the clustering of ten coupled oscillators as random network model with hub and without hub in order to investigate effect of hub for the clustering.

## REFERENCES

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