

Synchronization and Wave Phenomena in Coupled Simultaneous Oscillators

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SUMMARY

In 1954, Schaffner reported that an oscillator with two degrees of freedom could oscillate simultaneously at two different frequencies when the nonlinear characteristics are described by a fifth-power polynomial function [1]. Datardina also investigate the fifth-power nonlinear characteristics theoretically and it has been experimentally verified using both analog simulations and electronic circuitry [2]. However, after their pioneering works, as far as the authors know, there have not been many researches clarifying the theoretical analysis of the simultaneous oscillations. In our past study, we have reported synchronization phenomena in a ladder of simultaneous oscillators with three or four LC resonators coupled by inductors [3][4]. We confirmed the various waves in a ladder of coupled simultaneous oscillators. The circuit model is shown in Fig. 1(a). In the circuit, two hard oscillators with three LC resonators are coupled by inductors L_C . Fig. 1(b) shows time waves of each resonators. From this result, we can say that generation of simultaneous oscillation were confirmed. Upper resonators shows in-phase, middle resonators shows anti-phase, and bottom resonators shows double-mode, respectively.

In this study, we investigate the theoretical analysis and circuit experiments in the two inductively coupled simultaneous oscillators. In addition, we also investigate the phenomena in the N inductively coupled simultaneous oscillators in detail. We analyze phenomena of double-mode and simultaneous oscillation shown in Fig. 1(b) and various propagation waves shown in past study to use averaging method. From these results, we expect progress to the practical applications.

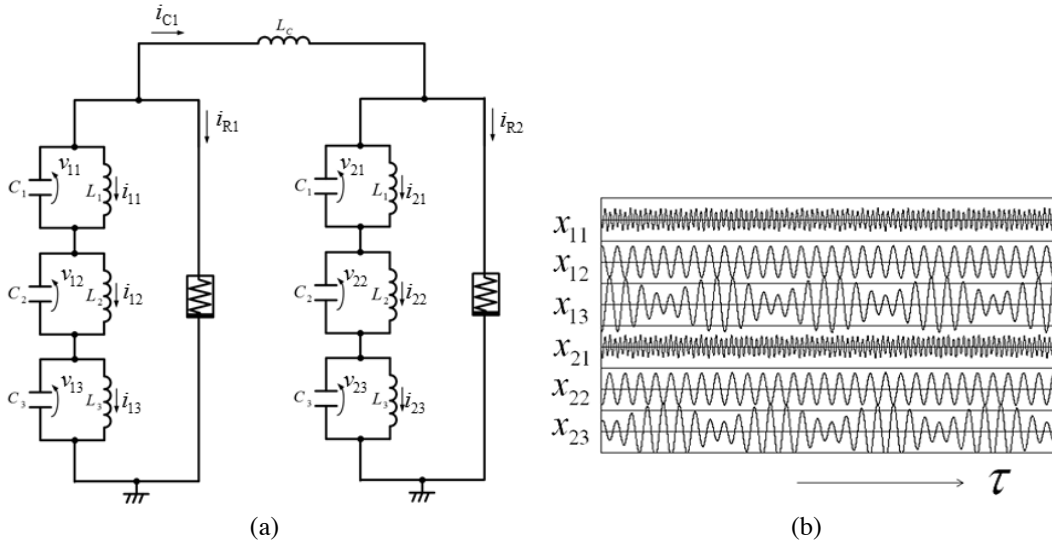


Fig. 1. (a) Ladder of coupled simultaneous oscillators with three resonators. (b) Time waves of 6 resonators

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