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Relationship between Phenomena and the Number of Resonators on Coupled Chaotic System Based on Shinriki-Mori Circuit

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1 Introduction

There are many studies about synchronization phenomena of coupled chaotic circuits. In these system, some famous chaotic circuits are applied. One of famous chaotic circuit is Shinriki-Mori circuit[1][2]. There are many investigations about coupled chaotic circuits using this circuit[3][4]. We have been proposed a novel coupled system using Shinriki-Mori circuit for investigation of coupled chaotic system[5]. However, two coupled element case was investigated only.

In this study, we investigate the case of applying three or four elements.

2 Proposed System

Figure 1 shows a the coupled system proposed in [5]. This system is based on Shinriki-Mori circuit. Resistors R_n $(n = 1, 2, \cdots N)$ are added for changing a parameter of bidirectionally coupled diodes.

Normalized circuit equation is shown as follows.

$$\begin{cases} \dot{x}_n &= \beta_n \left\{ \alpha_n f(x_c - x_n) - x_{N+n} \right\}, \\ \dot{x}_{N+n} &= \gamma_n x_n, \\ \dot{x}_c &= \beta_c \left[\alpha_c x_c - \sum_{n=1}^{N} \left\{ \alpha_n f(x_c - x_n) \right\} \right], \end{cases} \tag{1}$$

where

$$f(x) = x + (|x - 1| - |x + 1|)/2. \tag{2}$$

3 Computer simulations

Cases of N=3 and N=4 are investigated. Control parameters are selected as α_c which is corresponding to R_c. By changing parameter α_c, one periodic orbit, two periodic orbit, double scroll type attractor and window are observed in all cases.

Figure 2 shows the case of applying different capacitances of resonators. These are not synchronized at all. By increasing the number of coupled elements, differences of waveforms decrease.

4 Conclusion

In this study, we have investigated coupled chaotic system based on Shinriki-Mori circuit. As a result, we confirmed that increasing the number of coupled elements decreases differences of waveforms.

In the future works, the case of $N > 4$ will be investigated.

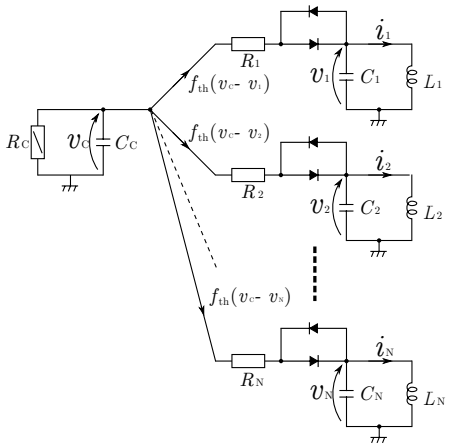

Figure 1 : Proposed System.

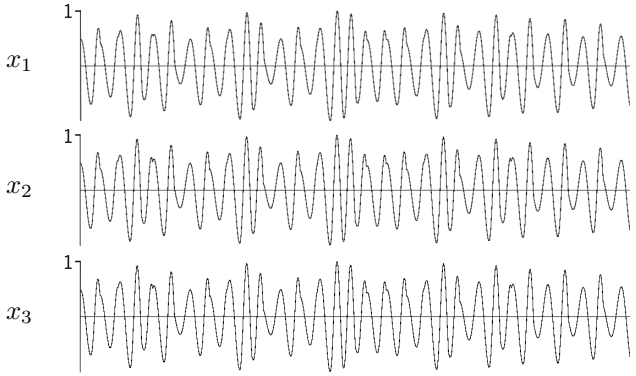

Figure 2 : Simulation Results. N=3, α_1=α_2=α_3 = 9.0, α_c=1.19, β_1=β_2 = 1.05, β_c=0.32, γ_1=γ_2=γ_3 = 1

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