1 Introduction
There are many studies about synchronization phenomena of coupled chaotic circuits. In these systems, 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.

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

where

\[ f(x) = x + (|x-1|-|x+1|)/2. \]  

3 Computer simulations
Cases of \( N=3 \) and \( N=4 \) are investigated. Control parameters are selected as \( \alpha_c \) which is corresponding to \( R_c \). By changing parameter \( \alpha_c \), 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.

References


