randomness" is a normal for the natural observed data (one of the main task is to determine their correlation in the time series). It's normal to expect that the quality of the approximation of this mixture depends on the specified ratio in the proposed model

fbm	$H = 0.2$	$H = 0.5$	$H = 0.6$
Tent map	0.5766	0.0078	1.0569
Mixture ($\alpha = 0.2$)	0.9591	0.8721	2.6039
Lorenz	1.8544	1.6360	1.9381
Mixture ($\alpha = 0.5$)	0.9244	1.0678	2.8903

(approximation of a random process fbm and the quality is defined by the specified statistics A_n, B_n, D_n).

Key words: fractional Brownian motion, Lyapunov exponent, Lorenz system.

Influence of Chaotic Behavior in Complex Networks by Changing Network Topology

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In our society, there are various type networks. We have lived our life by using networks. Examples of networks are transportation network, flight network and so on. Recently, various networks around our life have became more complex and large scale. Complex network have attracted grate deal of attention from various fields. Some researchers discover small-world network [1] and scale-free network [2]. These network models have various types of feature quantities. Examples of feature quantities are path length, degree distribution, clustering coefficient and so on. Moreover, in the complex network, there are various network with propagation. The pandemic outbreak of viral infection and the traffic jam of the transportation network are mentioned as an example of propagation in the real network. However, there are not many studies of large- scale network of continuous-time real physical systems such as electrical circuits Therefore, it is important to investigate the chaos propagation and the spread of chaotic behavior under some difficult situations for the circuits.

As previous studies, the chaos propagation and the spread of chaotic behavior have been investigated only in simple networks such as ladder and ring topology [3]. In this simple network, the periodic attractors change to the chaotic attractors by increasing the coupling strength.

The chaotic circuit is shown in Fig. 1. This circuit consists of a negative resistor, two inductors, a capacitor and dual- directional diodes. This chaotic circuit is called Nishio-Inaba circuit. We propose different topology complex networks with coupled chaotic circuit. Figure 2 shows the proposed two types networks. Proposed network models consist of many nodes and edges. We set chaotic circuit in node, and resistor R in edge. Each node is coupled by one edge. We use 25 coupled chaotic circuits in Fig. 2(A) and 49 coupled chaotic circuits in Fig. 2(B). Furthermore, one circuit is set to generate chaotic attractor and the other circuits are set to generate three-periodic attractors.

In this study, we investigate the influence of chaotic behavior in complex networks by changing network topology. First, we investigate ratio of spreading chaotic behavior by changing network topology in small network. Second, we verify chaotic behavior in large-scale complex network. Finally, we observe how to spread of chaotic behavior by increasing the coupling strength.

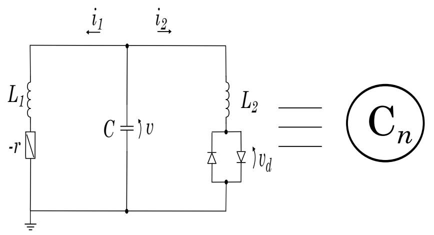

Figure 1: Chaotic circuit.

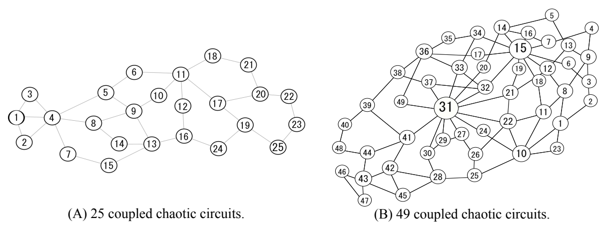

Figure 2: Attractors of chaotic circuit.

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The Concept of Integrability for Multifunctions and Dynamics of the Trace Map

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The concept of integrability of a continuous map in the plane introduced in [1] (see also [2]), is generalized for an upper semicontinuous two-valued map defined in a convex unbounded domain of the plane.

Criterion is proved for integrability of above multivalued maps. This criterion is based on the reduction of a considered two-valued map to an upper semicontinuous two-valued skew product of maps of an interval defined on an unbounded (with respect to second variable) rectangle of the plane.

Obtained results are applied to the investigation of the upper semicontinuous two-valued map connected with the trace map

$$F(x,\, y) = (xy,\, (x-2)^2).$$

This trace map arises in quasicrystal physics.

Considerations of this work are based on use of geometric results obtained in [1] for the above trace map.

This is the joint work with S.S. Belmesova.

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