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Hyperchaotic behaviour of two bi-directionally coupled Chua's circuits. (English)

Zbl 1024.94522

Int. J. Circuit Theory Appl. 30, No. 6, 625-637 (2002).

Summary: A nonlinear bi-directional coupling of two Chua's circuits is presented. The coupling is obtained by using polynomial functions that are symmetric with respect to the state variables of the two Chua's circuits. Both a transverse and a tangent system are studied to ensure a global validity of the results in the state space. First, it is shown that the transverse system is an autonomous Chua's circuit, which directly allows the evaluation of the conditions on its chaotic behaviour, i.e. the absence of synchronization between the coupled circuits. Moreover, it is demonstrated that the tangent system is also a Chua's circuit, forced by the transverse system; therefore, its dynamics is ruled by a time-dependent equation. Thus, the calculus of conditional Lyapunov exponents is necessary in order to exclude antisynchronization along the tangent manifold.

The properties of the transverse and tangent systems simplify the study of the coupled Chua's circuits and the determination of the conditions on their hyperchaotic behaviour. In particular, it is shown that hyperchaotic behaviour occurs for proper values of the coupling strength between the two Chua's circuits. Finally, numerical examples are given and discussed.

MSC:

94C05 Analytic circuit theory

37N99 Applications of dynamical systems

Cited in **29** Documents

Keywords:

hyperchaos; Chua's circuit; bi-directional coupling

Full Text: [DOI](#)

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