

properties. As an example we show that these distances can be utilized to control chaos in a simple dynamical system given by the logistic map.
Keywords: detailed balance, non-equilibrium, chaos, complex systems.

A Multi-Parameter Extension of OGY Chaos Control Method

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The OGY method is a useful method to control unstable periodic orbits (UPO) in a chaotic system. If the system contains a parameter that is accessible to a control scheme, this method is a way to stabilize a UPO. There are some noted restrictions of this method which have been studied in many articles. We investigate a multi-parameter extension of OGY control method. This extension allows one to overcome some limitations of original approach. It is assumed that all parameters associated with this multi-dimensional control scheme are manipulated ones, thus the method may be applicable to a wide variety of MIMO dynamical systems. We illustrate our main contribution feasibility in well-established chaotic examples. Results show that the proposed procedure provides a much more effective stabilization than the single parameter OGY approach.

Keywords: Chaos control, OGY method, Multi-parameter.

Analytical expression for the period of orbits stabilized by extended delayed feedback control

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The application of the delayed feedback control (DFC) or extended DFC (EDFC) algorithms to dynamical systems requires the knowledge of the period of unstable periodic orbit. For autonomous systems, this period is a priori unknown. For the EDFC, we have derived an analytical expression which shows how the period of stabilized orbit depends on the delay time in the case of a small delay mismatch. The analysis is based on the phase reduction method adapted to the systems with time delay. The results are important for the practical implementation of the

EDFC algorithm, since they facilitate the determination of the unknown period in experiments.

Keywords: extended delayed feedback control, phase reduction.

Ideal Chaotic Pattern Recognition Using the Modified Adachi Neural Network

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The benchmark of a chaotic Pattern Recognition (PR) system is the following: First of all, one must be able to train the system with a set of "training" patterns. Subsequently, as long as there is no testing pattern, the system must be chaotic. However, if the system is, thereafter, presented with an unknown testing pattern, the behavior must ideally be as follows. If the testing pattern is not one of the trained patterns, the system must continue to be chaotic. As opposed to this, if the testing pattern is truly one of the trained patterns (or a noisy version of a trained pattern), the system must switch to being periodic, with the specific trained pattern appearing periodically at the output. This is truly an ambitious goal, with the requirement of switching from chaos to periodicity being the most demanding. The Adachi Neural Network (AdNN) [1-5] has properties which are pseudo-chaotic, but it also possesses limited PR characteristics. As opposed to this, the Modified Adachi Neural Network (M-AdNN) proposed by Calitoiu et al [7], is a fascinating NN which has been shown to possess the required periodicity property desirable for PR applications. In this paper, we shall tune the parameters of the M-AdNN for its weights, steepness and external inputs, to yield a new NN, which we shall refer to as the Ideal-M-AdNN. Using a rigorous Lyapunov analysis, we shall analyze the chaotic properties of the Ideal-M-AdNN, and demonstrate its chaotic characteristics. Thereafter, we shall verify that the system is also truly chaotic for untrained patterns. But most importantly, we demonstrate that it is able to switch to being periodic whenever it encounters patterns with which it was trained. Apart from being quite fascinating, as far as we know, the theoretical and experimental results presented here are both unreported and novel. Indeed, we are not aware of any NN that possesses these properties!

Keywords: Chaotic Neural Networks, Chaotic Pattern Recognition.