

# **Lu, Zhao, “Robust and Adaptive Control of Chaotic Systems via Computational Intelligence”**

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Chaos is a special feature of complex parametric nonlinear dynamical systems. It has the random-like behavior usually seen in stochastic systems although it is associated with deterministic dynamics. Chaos is at the edge of stability and therefore could easily lead systems to an unstable, performance-degraded, or even catastrophic situation. In such cases, chaos is considered as undesired and should be totally avoided or completely eliminated.

Given that most physical chaotic systems inherently contain unknown nonlinearities or uncertain parameters, this dissertation is concerned with the robust and adaptive control for uncertain and unknown chaotic systems. The methodology of computational intelligence is adopted to develop effective nonlinear control approaches for chaos control.

Sliding mode control is exploited for controlling chaotic systems with multi-input in presence of parametric uncertainties. The issues of synthesizing sliding manifolds and designing simplex control vectors are first formulated as global optimization problems, and then the chaos optimization is successfully applied in solving the optimization problems encountered.

In the face of unknown chaotic systems, neural networks are incorporated into the methodologies of Lyapunov control and feedback linearization in an adaptive way. Recurrent high-order neural network (RHONN) is used in modeling the unknown chaotic systems, and the proof for closed-loop stability of control systems is also presented.

Illustrative simulations with uncertain/unknown chaotic systems are also given to demonstrate the effectiveness of the proposed control methods.