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Boundedness and Dynamics of a Modified Discrete Chaotic System with Rational Fraction

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Abstract: A modified 2-D discrete chaotic system with rational fraction is introduced in this paper, it has more complicated dynamical structures than the Hénon map and Lozi map. Some dynamical behaviors, value domain, fixed point, period-doubling bifurcation, the route to chaos, and Lyapunov exponents spectrum are further investigated using both theoretical analysis and numerical simulation. In particular, the map under consideration is a simple rational discrete bounded map capable of generating multi-fold strange attractors via period-doubling bifurcation routes to chaos. This new discrete chaotic system has extensive application in many fields such as optimization chaos and secure communication.

Keywords: *2-D rational chaotic map; new chaotic attractor; coexisting attractors.*

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1 Introduction

A discrete-time dynamical system is given by a map $T : X \to X$ from a space X into itself; we are interested in the asymptotic behavior of sequences $(x(n))$ defined by $x(n+1) = T(x(n))$, depending on the initial condition $x(0)$. Interest in dynamical systems sprang up in the 1960s-70s when it was shown that: (a) very simple dynamical systems can have an extremely complex "chaotic" behavior, which appears to be "random"; (b) such "chaotic" behavior can paradoxically be "stable"; (c) the behavior of some dynamical systems is so "chaotic" and "random" that it is best studied statistically. One of these models is the Lozi map [1, 2]. Moreover, it is possible to change the form of

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