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A New Memristor-Based 4D Hyperchaotic System with Seven Terms and No Equilibrium Points

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Abstract: The most pressing challenge in the practical application of chaotic systems is the development of methods for encrypting information. This paper presents a new 4-dimensional (4D) memristive system that is simple, consisting of only seven terms and lacking equilibrium points, which allows it to generate hidden attractors. The paper thoroughly analyzes the system's dynamic properties, including bifurcation diagrams, Lyapunov exponents, Kaplan-York dimensions, and offset boosting analysis. Additionally, the theoretical model is validated through electronic simulation of the new two-winged chaotic system using Multisim.

Keywords: *two-wing attractors; memristor; chaotic behavior; offset boosting control; circuit implementation.*

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1 Introduction

A rapidly expanding area within nonlinear circuit theory is the development of chaos generators utilizing memristors. First introduced by Chua [1], the memristor is a device that links electric charge and magnetic flux, functioning as a resistor with memory. Since then, the concept has evolved to include a broader spectrum of memristive systems. HP Laboratories achieved the first successful implementation of a memristor, using a metal-dielectric-metal structure [2]. However, significant technological challenges in memristor fabrication have led to a considerable gap between theoretical models and experimental studies. Memristors have found extensive applications in fields such as image encryption, signal processing, biosystems, and neural networks, particularly in complex neural networks [3]. Their popularity is largely due to the complex dynamics achievable in chaotic

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