

Studies in Computational Intelligence 701

Sundarapandian Vaidyanathan  
Christos Volos *Editors*

# Advances in Memristors, Memristive Devices and Systems

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ISSN 1860-949X                      ISSN 1860-9503 (electronic)  
Studies in Computational Intelligence  
ISBN 978-3-319-51723-0              ISBN 978-3-319-51724-7 (eBook)  
DOI 10.1007/978-3-319-51724-7

Library of Congress Control Number: 2016961337

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Printed on acid-free paper

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The registered company is Springer International Publishing AG  
The registered company address is: Gewerbestrasse 11, 6330 Cham, Switzerland

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# A Hyperjerk Memristive System with Hidden Attractors

Viet-Thanh Pham, Sundarapandian Vaidyanathan, Christos Volos,  
Xiong Wang and Duy Vo Hoang

**Abstract** After the introduction by Leonov and Kuznetsov of a new classification of nonlinear dynamics with kinds of attractors (self-excited attractors and hidden attractors), this subject has received a significant interest. From an engineering point of view, hidden attractors are important and can lead to unexpected behavior. Various chaotic systems with the presence of hidden attractors have been discovered recently. Especially, memristor, the fourth basic circuit element, can be used to construct such chaotic systems. This chapter presents a new memristive system which can display hidden chaotic attractor. Interestingly, this memristive system is a hyperjerk system because it involves time derivatives of a jerk function. The fundamental dynamics properties of such memristive system are discovered by calculating the number of equilibrium points, using phase portraits, Poincaré map, bifurcation diagram, maximum Lyapunov exponents, and Kaplan–Yorke fractional dimension. Also, we have investigated the multi-stability in the memristive system by varying the value of its initial condition. In addition, adaptive synchronization for the hyperjerk memristive system is also studied. The proposed memristive system can be applied into chaos-based engineering applications because of its chaotic behavior.

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© Springer International Publishing AG 2017

S. Vaidyanathan and C. Volos (eds.), *Advances in Memristors,  
Memristive Devices and Systems*, Studies in Computational Intelligence 701,  
DOI 10.1007/978-3-319-51724-7\_3