

Preface

About the Subject

Memristor (concatenation of MEMory ResISTOR), is the fourth fundamental circuit element (joining the resistor, the capacitor and the inductor), predicted by Leon Chua in 1971. This element represents one of today's latest technological achievements with a great number of applications. Memristor is a passive two-terminal electronic device which behavior is described by a nonlinear constitutive relation between the voltage drop at its terminal and the current flowing through the device. But the reason why the memristor is substantially different from the other fundamental circuit elements is that, when the applied voltage is turned off, it still remembers how much voltage was applied before and for how long; thus presenting memory of its past. However, this innovative device attracted most of attention worldwide only after 2008 when its practical implementation was announced by Hewlett-Packard, originating intense research activity ever since.

Memristors have brought a revolution in various scientific fields, as many phenomena in systems, such as in thermistors, spintronic devices and molecules could be explained now with the use of the memristor. Also, electronic circuits with memory elements could simulate processes typical of biological systems, such as learning and associative memory and the adaptive behavior of unicellular organisms. Furthermore, neuromorphic computing circuits with memristors can potentially solve problems that are cumbersome or outright intractable by digital computation.

Memristors have been used in cellular neural networks, for performing a number of applications, such as logical operations, image processing operations, complex behavior and higher brain functions, or in designing Boolean logic gates for the AND, OR and NOT operations. In many well-known nonlinear circuits, the nonlinear element has been replaced by memristors and various interesting dynamical phenomena like chaos and hidden attractors have been observed. Therefore, with these wide range of applications, engineering aspects of memristor devices, memristive-based circuits and systems design become significant important.

About the Book

The new Springer book, *Advances in Memristors, Memristive Devices and Systems*, consists of 20 contributed chapters by subject experts who are specialized in the various topics addressed in this book. The special chapters have been brought out in this book after a rigorous review process in the broad areas of modeling and applications of memristors, memristive devices and systems. Special importance was given to chapters offering practical solutions and novel methods for the recent research problems in the modeling and applications of memristors, memristive devices and systems.

This book discusses trends and applications of memristors and memristive devices in engineering.

Objectives of the Book

This volume presents a selected collection of contributions on a focused treatment of recent advances and applications in memristors, memristive devices and systems. The book also discusses multidisciplinary applications in electrical engineering, control engineering, computer science and information technology. These are among those multidisciplinary applications where computational intelligence has excellent potentials for use. Both novice and expert readers should find this book a useful reference in the field of memristors and memristive devices.

Organization of the Book

This well-structured book consists of 20 full chapters.

Book Features

- The book chapters deal with the recent research problems in the areas of memristors and memristive devices.
- The book includes chapters by eminent experts and pioneers of memristors—Leon Chua and R.S. Williams.
- The book chapters contain a good literature survey with a long list of references.
- The book chapters are well-written with a good exposition of the research problem, methodology, block diagrams and circuits.
- The book chapters are lucidly illustrated with numerical examples and simulations.
- The book chapters discuss details of engineering applications and future research areas.

Audience

The book is primarily meant for researchers from academia and industry, who are working on memristors and memristive devices in the research areas—electrical engineering, control engineering, computer science, and information technology. The book can also be used at the graduate or advanced undergraduate level as a textbook or major reference for courses such as power systems, control systems, electrical devices, scientific modeling, computational science and many others.

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Advances in Memristors, Memristive Devices and
Systems

Vaidyanathan, S.; Volos, C. (Eds.)

2017, XII, 511 p. 294 illus., 229 illus. in color.,

Hardcover

ISBN: 978-3-319-51723-0