



CMOS Time-Mode Circuits and Systems: Fundamentals and Applications (Devices, Circuits, and Systems)

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Time-mode circuits, where information is represented by time difference between digital events, offer a viable and technology-friendly means to realize mixed-mode circuits and systems in nanometer complementary metal-oxide semiconductor (CMOS) technologies. Various architectures of time-based signal processing and design techniques of CMOS time-mode circuits have emerged; however, an in-depth examination of the principles of time-based signal processing and design techniques of time-mode circuits has not been available until now.

CMOS Time-Mode Circuits and Systems: Fundamentals and Applications is the first book to deliver a comprehensive treatment of CMOS time-mode circuits and systems. Featuring contributions from leading experts, this authoritative text contains a rich collection of literature on time-mode circuits and systems.

The book begins by presenting a critical comparison of voltage-mode, current-mode, and time-mode signaling for mixed-mode signal processing and then:

- Covers the fundamentals of time-mode signal processing, such as voltage-to-time converters, all-digital phase-locked loops, and frequency synthesizers
- Investigates the performance characteristics, architecture, design techniques, and implementation of time-to-digital converters
- Discusses time-mode delta-sigma-based analog-to-digital converters, placing a great emphasis on time-mode quantizers
- Includes a detailed study of ultra-low-power integrated time-mode temperature measurement systems

CMOS Time-Mode Circuits and Systems: Fundamentals and Applications provides a valuable reference for circuit design engineers, hardware system engineers, graduate students, and others seeking to master this fast-evolving field.

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Editorial Review

Review

"... provides the most, and perhaps the only, comprehensive treatment of CMOS time-mode circuits and signal processing from fundamentals to architectures, design techniques, and key applications. ... The editor takes a sound and easy-to-follow approach by presenting a detailed and clear treatment of the fundamentals first, followed by TDC architectures and their applications to data converters and phase lock loops, among others. ... The book addresses one of the most timely and relevant topics of today's emerging nanoscale systems on chips for applications in areas such as wearables and the Internet of Things. **CMOS Time-Mode Circuits and Systems** provides the solution to the bottleneck of CMOS technology scaling. The book, co-authored by pioneers in the field, is a welcome contribution that will help researchers and engineers perfect the design of next-generation low-voltage, low-power integrated circuits and systems."

?Mohammed Ismail, Ohio State University, Columbus, USA, and Khalifa University of Science, Technology and Research (KUSTAR), Abu Dhabi, United Arab Emirates

"... satisfies a need for complete information in one place. ... a good book to make an introduction to the field and to see the big picture (both fundamentals of time-mode circuits and their applications, as well as having design details for some TDC types). ... This book can serve as a starting point and even as a guide to design some of the explained circuits. ... Also, this book presents some applications in sigma-delta ADCs with references that provide chances to explore new opportunities."

?Mustafa Yayla, Sr. RFIC Design Engineer

"... a single point of reference for time-mode circuits, a topic mainly addressed by research papers. The most recent TDC and ADC architectures are presented. Also in the view are all-digital, fully HDL-synthesizable implementations. Applications of such circuits in PLLs, high-speed serializers and de-serializers, and software defined radio (SDR) make this book a comprehensive review of state-of-the-art time-related building blocks. This book can be very useful both for physicists and engineers willing to understand and to use the best, state-of-the-art instruments in many fields of fundamental and applied research. At the same time, it is a starting point for designers involved in innovative projects where the experimental needs are pushed to the limit of the technology."

?Alberto Aloisio, Department of Physics, University of Naples Federico II, Italy

About the Author

Fei Yuan is currently a professor and the chair of the Department of Electrical and Computer Engineering at Ryerson University, Toronto, Ontario, Canada. He was previously a lecturer at Changzhou Institute of Technology, Jiangsu, China; a visiting professor at Humber College of Applied Arts and Technology, Toronto, Ontario, Canada, and Lambton College of Applied Arts and Technology, Sarnia, Ontario, Canada; and a controls engineer at Paton Controls Limited, Sarnia, Ontario, Canada. He earned his BEng from Shandong University, Jinan, China, and his MASc and PhD from the University of Waterloo, Ontario, Canada. Widely published and highly decorated, Dr. Yuan is a registered professional engineer in the province of Ontario, Canada.

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