Guest Editorial

SWITCHING circuits and systems are an important class of circuits and systems which find applications in many electrical systems and appliances. This Special Issue intends to address the growing interest in the analysis, design, and applications of switching circuits and systems, which include a wide variety of physical and engineering devices such as power electronics systems, switched-capacitor networks, pulsewidth modulated systems, chaos generators, sliding-mode control systems, relaxation oscillators, relay feedback systems, piecewise-linear circuits, etc.

Despite the widespread use of switching circuits and systems, there has been no effective systematic method to analyze such systems and to facilitate their design, presumably because of their nonlinear and time-varying nature. While the last few decades have witnessed an explosive development in the theory of smooth dynamical systems, many fundamental problems remain open for hybrid and switched ones. These include well-posedness, system modeling, stability analysis, control design, circuit implementation, etc. Moreover, many phenomena observed in switching systems have been shown to generically involve interactions between the system trajectories and the so-called nonsmoothness sets. In fact, recent efforts in the research of nonsmooth systems have played a crucial role in the understanding of the behavior of switching circuits and systems. For instance, in pulsewidth-modulated systems, as the system parameters are varied, novel transitions have been observed in a number of practical switching circuits and systems. Such transitions, while permitting no explanation in terms of standard bifurcation analyses (those applicable to smooth systems), can be treated effectively in terms of nonsmooth system descriptions. Furthermore, there have been important advances in other aspects of switching circuits and systems. This Special Issue has put together recent research results in the analysis, design, and applications of switching circuits and systems and has specifically covered areas related to modeling methods and analysis tools, identification of bifurcation and chaotic behavior, control methods and system design, and power electronics applications.

We would like to acknowledge the efforts of all authors for their high-quality submissions which indeed have made our Editorial work particularly tough. Our Guest Associate Editors, Prof. Adrian Ioinovici, Prof. Marian Kazimierczuk, and Prof. Toshimichi Saito, deserve our grateful thanks for their hard work during the review process. Also, we are grateful to all the reviewers for their thorough and on-time reviews which helped us greatly in the selection process. Our deepest gratitude goes to the Editorial Board of these TRANSACTIONS for supporting our initiative, and in particular, Prof. M.N.S. Swamy and Prof. T. Roska, the previous and present Editors-in-Chief, for offering their advice and guiding us through the editorial process. Finally, we would like to thank all colleagues whose outstanding work appears in this Special Issue.

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