Latest Issue of Proceedings of the IEEE Delves into the Frontier of Possibilities in Reconfigurability

Piscataway, NJ – May 26, 2015 – Our future will depend on reconfigurability. Every memory pattern in our computers, cameras and phones is based on harnessing a rudimentary form of reconfigurability – the binary storage of electronic charge. But we have only scratched the surface of a vast frontier of possibilities in this realm. Two recent special issues of Proceedings of the IEEE, the most highly cited general interest journal in electrical engineering and computer science, are dedicated to exploring the implications of this frontier, and how, in coming decades, it could change our society in ways as profoundly as the digital revolution.

Reconfigurable systems are systems with soft-definable features. They can be as concrete as a small embedded computer in a wristwatch, or as abstract as programmable matter, analogous to concepts popularized in science fiction (think Terminator 2) and motivated by reshapeable collectives of tiny modular robots. The power of binary reconfigurability has given us the von Neumann (stored program) computer, mass storage and the field-programmable gate array (FPGA), along applications such as software-defined radio and software-defined networking. Of course, these are just the beginning. The two dedicated special issues of the Proceedings of the IEEE will explore the fundamental concepts behind reconfigurable systems, from the earliest foundations of computation to architectures of modern FPGAs. The publications will outline the principles through which reconfigurable systems can be understood, applied and extended.

The three key themes of the first special issue are digital reconfigurability, tools for reconfigurable systems and configurable radio technologies. Here’s an overview of some of the papers within the March 2015 issue:

“An Introduction to Reconfigurable Systems” (by James C. Lyke, Senior Member, IEEE; Christos Christodoulou, Fellow, IEEE; G. Alonzo Vera, Senior Member, IEEE; and Arthur H. Edwards Member, IEEE) discusses some of the key defining qualities of reconfigurable systems and examines two broad facets: designing for reconfigurability and designing with reconfigurability. In the former case, the paper is concerned with the disciplines of creating reconfigurable versions of traditional devices and systems, which involves engineering soft-defined features and establishing architectures to manage these engineered degrees of freedom. In the second case, the paper considers how one would take such systems and exploit their intrinsic flexibility. Ultimately, the designers include not just the platform developers, but the users themselves.

“Reconfigurable Radios: A Possible Solution to Reduce Entry Costs in Wireless Phones” (by Mina Rais-Zadeh, Senior Member IEEE; Jeremy Fox and David Wentzloff, Senior Members IEEE;
Yogesh Gianchandani, Fellow IEEE) discusses the advantages of reconfigurable radios in increasing the efficiency of spectrum usage and also in potentially reducing the cost of wireless handsets and the barriers for new wireless service providers to enter the market. In addition, the paper reviews available technologies that make the implementation of reconfigurable radios possible and discusses technical challenges to overcome before multi-standard reconfigurable radios are put into practice, while also evaluating the ability of reconfigurable radios in reducing entry costs for new competitors in wireless service.

“Software-Defined Radio: Bridging the Analog-Digital Divide” (by Raquel G. Machado, Student Member, IEEE and Alexander M Wyglinski, Senior Member, IEEE) focuses on software-defined radio (SDR) from a discrete-time sampling perspective, and discusses the efforts that are currently being pursued in order to further bridge the gap between these discrete-time samples, the hardware used to generate this information from continuous-time over-the-air signaling waveforms, and the software and digital logic used to process these samples into digital data via baseband processing. Given the extensive deployment of SDR technology across a growing number of applications, such as national defense, public safety, connected vehicles, education and scientific research and development activities, it is imperative that the wireless community understands the features, advantages and limitations of this technology.

The next special issue on this topic, which will be published in July, will examine important applications of reconfigurability in another potential “killer app” domain: software-definable networking (wired and wireless), along with advanced concepts pertaining to analog systems, photonics, meta-materials and more.

To learn about all of these concepts, and more, visit the Proceedings of the IEEE website.

About the Proceedings of the IEEE
Founded in 1912 and first published in early 1913, (originally as Proceedings of the IRE), Proceedings of the IEEE is the most highly cited general interest journal in electrical engineering and computer science. This journal provides the most in-depth tutorial and review coverage of the technical developments that shape our world, enlisting the help of guest editors and authors from the best research facilities, leading edge corporations and universities around the world. For more information on Proceedings of the IEEE and the latest ideas and innovative technologies, visit www.ieee.org/proceedings.

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