

SPECIAL ISSUE

NONSILICON, NON-VON NEUMANN COMPUTING—PART II

Edited by S. Basu, R. E. Bryant, G. De Micheli, T. Theis, and L. Whitman

Foundational Issues

1219 Addressing Unreliability in Emerging Devices and Non-von Neumann Architectures Using Coded Computing

By S. Dutta, H. Jeong, Y. Yang, V. Cadambe, T. M. Low, and P. Grover

|INVITED PAPER| This article considers fundamental limits and novel strategies regarding resiliency of computation by invoking information-theoretic principles for basic building blocks of scientific computation and data analytics (“dwarfs”).

1235 Tunnel-FET Switching Is Governed by Non-Lorentzian Spectral Line Shape

By S. K. Vadlamani, S. Agarwal, D. T. Limmer, S. G. Louie, F. R. Fischer, and E. Yablonovitch

|INVITED PAPER| This article provides new insights into fundamental limitations of the tunnel FETs (tFETs) for desirable energy-efficient operations, and how to possibly overcome them.

Deep Learning Neural Network Architectures

1245 The Heterogeneous Deep Neural Network Processor With a Non-von Neumann Architecture

By D. Shin and H.-J. Yoo

|INVITED PAPER| This article considers heterogeneous machine-learning-specific integrated circuits (MSICs) as a new non-von Neumann architecture implementing deep learning neural networks for diverse applications.

1261 Silicon Photonics Codesign for Deep Learning

By Q. Cheng, J. Kwon, M. Glick, M. Bahadori, L. P. Carloni, and K. Bergman

|INVITED PAPER| As an example of emerging optical technologies in computing, this article considers low-complexity silicon-photonics-enabled integrated optical vector-matrix multiplier for deep neural computations.

Analog Computing Architecture

1283 Large-Scale Field-Programmable Analog Arrays

By J. Hasler

|INVITED PAPER| This article examines the resurgence of analog computing. Tools enabling design of large-scale field-programmable analog arrays (FPAAs) as ubiquitous analog-mixed-signal, low-power sensors are elaborated, and their future potentials are commented on.

New Spin on Spintronics

1303 Magnetic Racetrack Memory: From Physics to the Cusp of Applications Within a Decade

By R. Bläsing, A. A. Khan, P. Ch. Filippou, C. Garg, F. Hameed, J. Castrillon, and S. S. P. Parkin

|INVITED PAPER| This article shows how spin-orbitronics can successfully overcome impediments to technology transfer of racetrack memory, as FLASH and magnetic hard disk drives approach their fundamental physical limits.

DEPARTMENTS

1211 SCANNING THE ISSUE

Nonsilicon, Non-von Neumann Computing—Part II

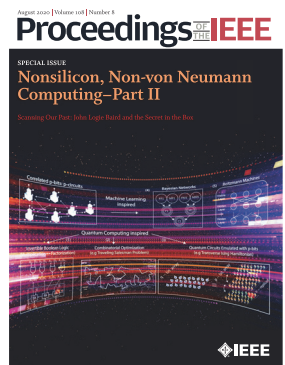
By S. Basu, R. E. Bryant, G. De Micheli, T. Theis, and L. Whitman

1371 SCANNING OUR PAST

John Logie Baird and the Secret in the Box: The Undiscovered Story Behind the World’s First Public Demonstration of Television

By B. D. Inglis and G. D. Couples

1383 FUTURE SPECIAL ISSUE/SPECIAL SECTIONS



On the Cover:
Our cover image this month highlights the many possible applications of p-circuits in two active fields of research, namely, machine learning and quantum computing.

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1322 From Charge to Spin and Spin to Charge: Stochastic Magnets for Probabilistic Switching

By K. Y. Camsari, P. Debashis, V. Ostwal, A. Z. Pervaiz, T. Shen, Z. Chen, S. Datta, and J. Appenzeller

| INVITED PAPER | This article discusses p-bits (probabilistic bits), an intermediary between the classical (deterministic) bits and the (quantum) q-bits, as an alternative computational paradigm for solving several problems of current interest.

Quantum Computing

1338 Challenges and Opportunities of Near-Term Quantum Computing Systems

By A. D. Córcoles, A. Kandala, A. Javadi-Abhari, D. T. McClure, A. W. Cross, K. Temme, P. D. Nation, M. Steffen, and J. M. Gambetta

| INVITED PAPER | This article provides a perspective on quantum computing from a leading industry laboratory, for providing access to users not acquainted with the hardware and to accommodate new applications.

1353 Resource-Efficient Quantum Computing by Breaking Abstractions

By Y. Shi, P. Gokhale, P. Murali, J. M. Baker, C. Duckering, Y. Ding, N. C. Brown, C. Chamberland, A. Javadi-Abhari, A. W. Cross, D. I. Schuster, K. R. Brown, M. Martonosi, and F. T. Chong

| INVITED PAPER | This article considers architecture of emerging quantum computers, and explores the value of breaking some basic abstractions traditionally used in the design of computational hardware and software.

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