

SPECIAL ISSUE

APPROXIMATE COMPUTING: FROM CIRCUITS TO APPLICATIONS

Edited by W. Liu, F. Lombardi, and M. Schulte

2108 Approximate Arithmetic Circuits: A Survey, Characterization, and Recent Applications

By H. Jiang, F. J. H. Santiago, H. Mo, L. Liu, and J. Han

| INVITED PAPER | This article provides a comprehensive evaluation of recently proposed approximate arithmetic circuits mainly including adders, multipliers, and dividers; they are compared under different design constraints and applied to image processing and deep learning applications.

2136 Elementary Functions and Approximate Computing

By J.-M. Muller

| INVITED PAPER | This article presents classical approaches of approximate elementary functions with the mainstream techniques of shift-and-add algorithms, polynomial or rational approximations, table-based methods, and bit manipulation.

2150 Circuit-Level Techniques for Logic and Memory Blocks in Approximate Computing Systems

By S. Amanollahi, M. Kamal, A. Afzali-Kusha, and M. Pedram

| INVITED PAPER | This article reviews the circuit-level techniques for both approximate logic and memory blocks.

2178 A Survey of Testing Techniques for Approximate Integrated Circuits

By M. Traiola, A. Virazel, P. Girard, M. Barbareschi, and A. Bosio

| INVITED PAPER | This article examines the test procedure of approximate integrated circuits by identifying the main approximation-aware testing phases.

2195 Approximate Logic Synthesis: A Survey

By I. Scarabottolo, G. Ansaloni, G. A. Constantinides, L. Pozzi, and S. Reda

| INVITED PAPER | This article reviews the transformation methods for functional approximation, which can achieve an approximate Boolean function from its exact designs.

2214 Security in Approximate Computing and Approximate Computing for Security: Challenges and Opportunities

By W. Liu, C. Gu, M. O'Neill, G. Qu, P. Montuschi, and F. Lombardi

| INVITED PAPER | This article focuses on an emerging area that links security and approximate computing.

DEPARTMENTS

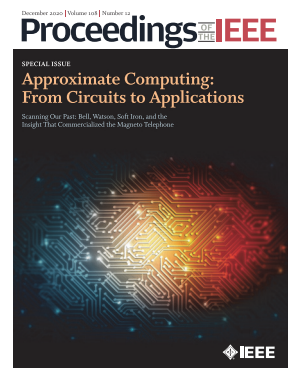
2103 SCANNING THE ISSUE

Approximate Computing: From Circuits to Applications
By W. Liu, F. Lombardi, and M. Schulte

2311 SCANNING OUR PAST

Bell, Watson, Soft Iron, and the Insight That Commercialized the Magneto Telephone
By R. O. Meyer

2321 FUTURE SPECIAL ISSUE/SPECIAL SECTIONS



On the Cover:
This month's cover image draws attention to printed circuit boards where approximate computing techniques are increasingly applied to achieve high performance and energy efficiency.

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2232 Efficient AI System Design With Cross-Layer Approximate Computing

By S. Venkataramani, X. Sun, N. Wang, C.-Y. Chen, J. Choi, M. Kang, A. Agarwal, J. Oh, S. Jain, T. Babinsky, N. Cao, T. Fox, B. Fleischer, G. Gristede, M. Guillorn, H. Haynie, H. Inoue, K. Ishizaki, M. Klaiber, S.-H. Lo, G. Maier, S. Mueller, M. Scheuermann, E. Ogawa, M. Schaal, M. Serrano, J. Silberman, C. Vezirtzis, W. Wang, F. Yee, J. Zhang, M. Ziegler, C. Zhou, M. Ohara, P.-F. Lu, B. Curran, S. Shukla, V. Srinivasan, L. Chang, and K. Gopalakrishnan

| INVITED PAPER | This article presents IBM's RAPID, which is a multi-TOPs DNN hardware accelerator core fabricated using 14-nm technology.

2251 Deep In-Memory Architectures in SRAM: An Analog Approach to Approximate Computing

By M. Kang, S. K. Gonugondla, and N. R. Shanbhag

| INVITED PAPER | This article provides an overview of the recently proposed deep in-memory architectures (DIMAs) with several approximate prototype chips using 65-nm technology for hardware acceleration of machine learning algorithms.

2276 Resistive Crossbars as Approximate Hardware Building Blocks for Machine Learning: Opportunities and Challenges

By I. Chakraborty, M. Ali, A. Ankit, S. Jain, S. Roy, S. Sridharan, A. Agrawal, A. Raghunathan, and K. Roy

| INVITED PAPER | This article presents a comprehensive overview of the emerging paradigm of approximate computing using NVM crossbars for accelerating machine learning workloads.

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