

# **2011 IEEE/ACM International Symposium on Nanoscale Architectures**

**(NANOARCH 2011)**

**San Diego, California, USA  
8 – 9 June 2011**



**IEEE Catalog Number: CFP11DTD-PRT  
ISBN: 978-1-4577-0993-7**

# TABLE OF CONTENTS

## SESSION I: RECONFIGURABLE NANOCOMPUTING

<b>mrFPGA: A Novel FPGA Architecture with Memristor-Based Reconfiguration</b> .....	1
<i>J. Cong, B. Xiao</i>	
<b>Ultra-Fine Grain FPGAs: A Granularity Study</b> .....	9
<i>P. Gaillardon, M. Ben-Jamaa, F. Clermidy, I. O'Connor</i>	

## SESSION II: CROSSCUTS

<b>A Hybrid Memory Cell Using Single-Electron Transfer</b> .....	16
<i>W. Wei, J. Han, F. Lombardi</i>	
<b>Inexact Computing for Ultra Low-Power Nanometer Digital Circuit Design</b> .....	24
<i>J. Kim S. Tiwari</i>	
<b>Scalability and Design-Space Analysis of a 1T-1MTJ Memory Cell</b> .....	32
<i>R. Dorrance, F. Ren, Y. Toriyama, A. Amin, C. Yang, D. Markovic</i>	
<b>Improving Performance Of NEM Relay Logic Circuits Using Integrated Charge-Boosting Flip Flop</b> .....	37
<i>R. Venkatasubramanian, S. Manohar, P. Balsara</i>	

## SESSION III: MEMORIES

<b>Variation-Tolerant Ultra Low-Power Heterojunction Tunnel FET SRAM Design</b> .....	45
<i>V. Saripalli, S. Datta, V. Narayanan, J. Kulkarni</i>	
<b>Analysis of STT-RAM Cell Design with Multiple MTJs Per Access</b> .....	53
<i>H. Park, R. Dorrance, A. Amin, F. Ren, D. Markovic, C. Yang</i>	
<b>3D-HIM: A 3D High-density Interleaved Memory for Bipolar RRAM Design</b> .....	59
<i>Y. Chen, H. Li, W. Zhang, R. Pino</i>	
<b>Using OxRRAM Memories for Improving Communications of Reconfigurable FPGA Architectures</b> .....	65
<i>S. Onkaraiah, P. Gaillardon, J. Portal, M. Bocquet, C. Muller, M. Reyboz, F. Clermidy</i>	

## SESSION: POSTER SESSION I

<b>Regular 2D NASIC-based Architecture and Design Space Exploration</b> .....	70
<i>C. Teodorov, P. Narayanan, L. Lagadec, C. Dezan</i>	
<b>Self-Timed Nano-PLA</b> .....	78
<i>M. Zamani, M. Tahoori</i>	
<b>Graphene Nanoribbon Crossbar Nanomesh</b> .....	86
<i>K. Habib, A. Khitun, A. Balandin, R. Lake</i>	
<b>Nanofabric Power Analysis: Biosequence Alignment Case Study</b> .....	91
<i>S. Frache, L. Amaru, M. Graziano, M. Zamboni</i>	

## SESSION IV: NANOFABRIC UPDATES

<b>Nanoscale Application Specific Integrated Circuits</b> .....	99
<i>P. Narayanan, J. Kina, P. Panchapakshian, P. Vijayakumar, K. Shin, M. Rahman, M. Leuchtenburg, I. Koren, C. Chui, C. Moritz</i>	
<b>Spin Wave Functions Nanofabric Update</b> .....	107
<i>P. Shabadi, A. Khitun, K. Wong, P. Amiri, K. Wang, C. Moritz</i>	

## SESSION V: ENERGY AND POWER EFFICIENCY

<b>Power Efficient Nanophotonic on-Chip Network for Future Large Scale Multiprocessor Architectures</b> .....	114
<i>S. Koohi, S. Hessabi</i>	

<b>Energy Efficient Many-core Processor for Recognition and Mining using Spin-based Memory</b> .....	122
<i>R. Venkatesan, V. Chippa, C. Augustine, K. Roy, A. Raghunathan</i>	
<b>Low-Power Functionality Enhanced Computation Architecture Using Spin-Based Devices</b> .....	129
<i>C. Augustine, G. Panagopoulos, B. Behin-Aein, S. Srinivasan, A. Sarkar, K. Roy</i>	

### **SESSION: POSTER SESSION II**

<b>Robust Neural Logic Block (NLB) based on Memristor Crossbar Array</b> .....	137
<i>D. Chabi, W. Zhao, D. Querlioz, J. Klein</i>	
<b>A Scheme for Computation in Nanoscale Dynamical Systems: Gated Discrete Phase-Shift Interactions</b> .....	144
<i>P. Riechers, R. Kiehl</i>	
<b>Learning With Memristive Devices: How Should We Model Their Behavior?</b> .....	150
<i>D. Querlioz, P. Dollfus, O. Bichler, C. Gamrat</i>	
<b>Performance Assessment of Partially Unzipped Carbon Nanotube Field-Effect Transistors</b> .....	157
<i>Y. Yoon, S. Salahuddin</i>	

### **SESSION VI: METHODS, MODELS AND TOOLS**

<b>Ambipolar Double-Gate FET Binary-Decision- Diagram (Am-BDD) For Reconfigurable Logic Cells</b> .....	162
<i>K. Jabeur, N. Yakymets, I. O'Connor, S. Beux</i>	
<b>Determining Fundamental Heat Dissipation Bounds for Transistor-Based Nanocomputing Paradigms</b> .....	169
<i>I. Ercan, M. Rahman, N. Anderson</i>	
<b>A Unified Aging Model of NBTI and HCI Degradation towards Lifetime Reliability Management for Nanoscale MOSFET Circuits</b> .....	175
<i>Y. Wang, S. Cotozana, L. Fang</i>	
<b>Impact of Nanomanufacturing Flow on Systematic Yield Losses in Nanoscale Fabrics</b> .....	181
<i>P. Vijayakumar, P. Narayanan, I. Koren, C. Krishna, C. Moritz</i>	

### **SESSION VII: HYBRID SYSTEMS**

<b>Hybrid Graphene Nanoribbon-CMOS Tunneling Volatile Memory Fabric</b> .....	189
<i>S. Khasanvis, K. Habib, M. Rahman, P. Narayanan, R. Lake, C. Moritz</i>	
<b>N<sup>3</sup>ASICs: Designing Nanofabrics with Fine-Grained CMOS Integration</b> .....	196
<i>P. Panchapakshan, P. Narayanan, C. Moritz</i>	
<b>Towards “Zero-energy” using NEMFET-based Power Management for 3D Hybrid Stacked ICs</b> .....	203
<i>G. Voicu, M. Enachescu, S. Cotozana</i>	
<b>NEMTronics: Symbiotic Integration of Nanoelectronic and Nanomechanical Devices for Energy-Efficient Adaptive Computing</b> .....	210
<i>X. Wang, S. Narasimhan, S. Paul, S. Bhunia</i>	
<b>NEMS based Thermal Management for 3D Many-core System</b> .....	218
<i>X. Huang, H. Yu, W. Zhang</i>	
<b>Author Index</b>	