

# **2021 International Conference on Simulation of Semiconductor Processes and Devices (SISPAD 2021)**

**Dallas, Texas, USA  
27 – 29 September 2021**



**IEEE Catalog Number: CFP21SSD-POD  
ISBN: 978-1-6654-0686-4**

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IEEE Catalog Number:	CFP21SSD-POD
ISBN (Print-On-Demand):	978-1-6654-0686-4
ISBN (Online):	978-1-6654-0685-7
ISSN:	1946-1569

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# Program

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**Monday, September 27**

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**Breakfast**      7:30 – 8:30

**Session: Plenary I (Monet)**

P01    8:30 – 9:30    **Plenary Talk: TCAD for logic technology process development.....1**  
**Stephen M. Cea**, S. Berrada, K. Ghosh, S. Hasan, P. Keys, R. Mehandru, B. Obradovic, V. Tiwari, C. Weber, and M. Stettler (Logic Technology Division, Intel Corporation, Hillsboro, OR, USA)

**Break**      9:30 – 9:50

**Session 1: Advanced Scaling and SRAM (Monet)**

*Chairperson*

Oskar Baumgartner (Global TCAD Solutions, Austria)

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Uihui Kwon, Yonghee Park, Yoon-Suk Kim, Jaehyun Yoo, and Dae Sin Kim (CSE Team, DIT Center, Samsung Electronics Corp. Ltd., Korea)

S1.2    10:20 – 10:40    **Complementary FET for Advanced Technology Nodes: Where Does It Stand?.....11**  
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S1.3    10:40 – 11:00    **Variability-Aware DTCO Flow: Projections to N3 FinFET and Nanosheet 6T SRAM.....15**  
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*Chairperson*

Devin Verreck (imec, Belgium)

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- S2.4 11:00 – 11:20 **Temperature-dependent mobility modeling of GaN HEMTs by cellular automaton method**.....40  
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- S2.5 11:20 – 11:40 **Miller-Capacitance Analysis of High-Voltage-MOSFETs and Optimization Strategies for Low-Power Dissipation**.....44  
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**Lunch (Break area) 11:40 – 1:15**

## Session 3: Novel Simulation Methodologies (Monet)

*Chairperson*

Victor Moroz (Synopsys, USA)

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(<sup>1</sup>TSMC, Hsinchu, Taiwan, and <sup>2</sup>TSMC, San Jose, CA, USA)

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#### Session 4: Steep Slope Devices (Morocco)

##### *Chairperson*

Sabyasachi Tiwari (The University of Texas at Dallas, USA)

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	6:00 – 7:00	<b>Reception (Break area)</b>	

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**Tuesday, September 28**

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*Chairperson*

Leonard (Frank) Register (The University of Texas at Austin, USA)

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S5.5	11:20 – 11:40	<b>Investigating the use of HSE Hybrid Functionals to Improve Electron Transport Calculations in Si, Ge, Diamond, and SiC</b> .....133 Dallin Nielsen, Maarten Van de Put, and Massimo Fischetti (Dept. of Materials Science and Engineering, The University of Texas at Dallas, USA)
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**Session 6: Magnetism (Morocco)**

*Chairperson*

Sumeet Gupta (Purdue University, USA)

S6.1	9:45 – 10:05	<b>Late News: Modal Stability of Spin-Hall Nano-Oscillators in Realistic Micromagnetic Simulations and Measurements</b> .....*
		Corrado Carlo Maria Capriata, and Bengt Gunnar Malm (Division of Electronics and Embedded Systems, KTH – Royal Institute of Technology, Sweden)
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William G. Vandenberghe<sup>1</sup>(<sup>1</sup>Department of Materials Science and Engineering, UT Dallas, Texas, USA, <sup>2</sup>Department of Materials Engineering, KU Leuven, Leuven, Belgium, <sup>3</sup>imec, Belgium, <sup>4</sup>Department of Electrical Engineering, KU Leuven, Leuven, Belgium, and <sup>5</sup>Department of Physics, Universiteit Antwerpen, Antwerp, Belgium)

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**Lunch** (Break area) 12:00 – 1:30

## Session 7: Two-dimensional Materials (Monet)

*Chairperson*

Yaoqiao Hu (The University of Texas at Dallas, USA)

- S7.1 1:30 – 2:00 **Invited talk: Materials and Device Strategies for Nanoelectronic 3D Heterogeneous Integration.....163**  
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- S7.4 2:40 – 3:00 **Modeling Contact Resistivity in Monolayer Molybdenum disulfide Edge Contacts**.....175  
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- S7.7 3:55 – 4:15 **Ballistic quantum transport study of Al contacting silicene using empirical pseudopotentials**.....184  
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## Session 8: Variability (Morocco)

*Chairperson*

Blanka Magyari-Köpe (TSMC, USA)

- S8.1 1:40 – 2:00 **Simulation-based DRAM Design Technology Co-Optimization: Why Random Dopant Fluctuations Matter**.....188  
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Northern Europe Ltd., Glasgow, Scotland, UK, <sup>2</sup>Synopsys Inc, Mountain View, CA, USA, and <sup>3</sup>Synopsys Taiwan Ltd., Hsinchu, Taiwan)

- S8.2 2:00 – 2:20 **Statistical Device Modeling with Arbitrary Model-Parameter Distribution via Markov Chain Monte Carlo**.....192  
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**Session 9: Quantum Transport (Morocco)**

*Chairperson*  
Seonghoon Jin (Samsung, USA)

- S9.1 3:15 – 3:35 **Non-Equilibrium Greens Function Approach to Majorana Bound States in 1D nanowires**.....206  
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**Break** 3:55 – 4:15

4:15 – 6:00 **On-site paper discussion (Monet)**

**Break** 6:00 – 7:00

7:00 – 9:00 **Conference dinner (Media Grill and Bar)**

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**Wednesday, September 29**

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7:30 – 8:30      **Breakfast & Virtual paper discussion**

**Session: Plenary IV (Monet)**

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Scotten W. Jones (IC Knowledge LLC, Georgetown, MA, USA)

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**Session 10: Process Simulation (Monet)**

*Chairperson*

El Mehdi Bazizi (Applied Materials, USA)

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S10.2    10:05 – 10:25      **Fast Model for Deposition in Trenches using Geometric Advection**.....**224**

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S10.4    11:00 – 11:20      **Mechanism Investigation of Temperature Dependent Growth and Etching Process of GeCl<sub>4</sub> on SiGe Surface: *ab-initio* Study**.....**233**

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and Dae Sin Kim<sup>1</sup> (<sup>1</sup>CSE Team, Data & Information Technology Center, Samsung Electronics Co., Ltd., Korea, and <sup>2</sup>Foundry Process Development Team, Semiconductor R&D Center, Samsung Electronics Co., Ltd., Korea)

- S10.5 11:20 – 11:40 **Reactive Force-Field Molecular Dynamics Study of the Effect of Gaseous Species on Silicon-Germanium Alloy Growth by PECVD Techniques**.....238  
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- S10.6 11:40 – 12:00 **TCAD Comprehensive Silicon Strain Model Using Finite Element Quasi-Fermi Discretization**.....242  
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**Session 11: Cryogenic Simulation and Parasitics (Morocco)**

*Chairperson*  
 Stephen Cea (Intel, USA)

- S11.1 9:35 - 10:05 **Invited Talk: Transistor modelling for mm-Wave technology pathfinding**.....247  
**Bertrand Parvais**<sup>1</sup>, R. ElKashlan<sup>1</sup>, H. Yu, A. Sibaja-Hernandez, B. Vermeersch, V. Putcha, P. Cardinael<sup>2</sup>, R. Rodriguez, A. Khaled, A. Alian, U. Peralagu, M. Zhao, S. Yadav, G. Gramegna, J. Van Driessche, and N. Collaert (imec, Belgium, also with <sup>1</sup>Vrije Universiteit Brussels, Belgium, and also with <sup>2</sup>UCLouvain, Louvain-la-Neuve, Belgium)
- S11.2 10:05 – 10:25 **Considerations for DD Simulation at Cryogenic Temperature**.....251  
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- S11.3 10:40 – 11:00 **TCAD Modeling of Cryogenic nMOSFET ON-State Current and Subthreshold Slope**.....255  
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Jose, USA, and <sup>2</sup> Electrical and Info. Engineering, The University of Sydney, Sydney, Australia)

- S11.4 11:00 – 11:20 **Bridge-Defect Prediction in SRAM Circuits Using Random Forest, XGBoost, and LightGBM Learners**.....**259**  
 Joydeep Ghosh, Shang Yi Lim, and Aaron Voon-Yew Thean (Electrical & Computer Engineering, National University of Singapore, Singapore)
- S11.5 11:20 – 11:40 **RFSOI n-MOSFET OI-Layer Ground-Plane Engineering with Quasi-3D Simulations**.....**263**  
 Daniel Connelly<sup>1</sup>, Hiu Yung Wong<sup>2</sup>, Richard Burton<sup>1</sup>, Hideki Takeuchi<sup>1</sup>, and Robert Mears<sup>1</sup> (<sup>1</sup>Atomera, Inc, and <sup>2</sup>San Jose State University)
- S11.6 11:40 – 12:00 **Program charge interference and mitigation in vertically scaled single and multiple-channel 3D NAND flash memory**.....**268**  
 D. Verreck, A. Arreghini, G. Van den bosch, A. Furnémont, and M. Rosmeulen (imec, Belgium)

**Lunch** (Break area) 12:00 – 1:20

## Session 12: Circuit Simulation and Compact models (Monet)

*Chairperson*

Markus Karner (Global TCAD Solutions, Austria)

- S12.1 1:20 – 1:40 **Unified SPICE Model for Transient Ionizing Radiation Response of SOI MOSFET**.....**272**  
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- S12.2 1:40 – 2:00 **Compact SPICE Model of Topological Textures on Magnetic Racetracks for Design Space Exploration**.....**276**  
 Mohammad Nazmus Sakib<sup>1</sup>, Hamed Vakili<sup>2</sup>, Samiran Ganguly<sup>1</sup>, Mircea Stan<sup>1</sup>, and Avik W. Ghosh<sup>1,2</sup> (<sup>1</sup>Dept. of Physics, University of Virginia, Charlottesville, VA, USA, and <sup>2</sup>Charles L. Brown Dept. of Electrical and Computer Engineering, University of Virginia, Charlottesville, VA, USA)
- S12.3 2:00 – 2:20 **Experimentally Validated Pr<sub>0.7</sub>Ca<sub>0.3</sub>MnO<sub>3</sub> RRAM Verilog-A model based Izhikevich Neuronal Dynamics**.....**280**  
 Omkar Phadke<sup>1</sup>, Arpan De<sup>2</sup>, Jayatika Sakhuja<sup>1</sup>, Vivek Saraswat<sup>1</sup>, and Udayan Ganguly<sup>1</sup> (<sup>1</sup>Department of Electrical Engineering, IIT Bombay, Mumbai, India, and <sup>2</sup>Dept. of Electronics and Telecommunication Engineering, Jadavpur University, Kolkata, India)
- S12.4 2:20 – 2:40 **Equivalent Circuit Macro-Compact Model of the 1T Bipolar SRAM Cell**.....**285**  
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S12.5 2:40 – 3:00 **Modeling of Doping Effects in Surface Potential Based Compact Model of Fully Depleted SOI MOSFET**.....289  
 Sébastien Martinie<sup>1</sup>, Olivier Rozeau<sup>1</sup>, Plamen Kolev<sup>2</sup>, Patrick Scheer<sup>3</sup>,  
 Salim El Ghouli<sup>3</sup>, André Juge<sup>3</sup>, Harrison Lee<sup>4</sup>, and Thierry Poiroux<sup>1</sup>  
 (<sup>1</sup>CEA, LETI, MINATEC Campus, Univ. Grenoble Alpes, Grenoble, France, <sup>2</sup>Qualcomm, USA, <sup>3</sup>STMicroelectronics, Crolles, France, and <sup>4</sup>Samsung, South Korea)

**Session 13: Optoelectronics (Morocco)**

*Chairperson*

Madhuchhanda Brahma (The University of Texas at Dallas, USA)

S13.1 1:30 – 2:00 **Invited Talk: Single Photon Avalanche Diode with Monte Carlo Simulations: PDE, Jitter and Quench Probability**.....293  
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S13.2 2:00 – 2:20 **Potential Engineering to Enhance Transfer Characteristics of Advanced CIS Pixel based on VTG – FDTI scheme**.....297  
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S13.3 2:20 – 2:40 **3D Electro-optical Simulations for Improving the Photon Detection Probability of SPAD Implemented in FD-SOI CMOS Technology**.....301  
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**Thursday, September 30**

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7:30 – 8:30 **Virtual paper discussion**