SEMICON® EUROPA
NOV 12–15, 2024 | MUNICH, GERMANY
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Future of Computing

Virtual Fab for advanced semiconductor engineering

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Abstract
Innovative 3D semiconductor architectures are driving a major revolution in the design of logic and memory technologies. The development of these new 3D architectures, with dimensions at the nanometer and angstrom scale, will require the completion of a difficult series of engineering tasks during product development, prototyping, ramp-up and final manufacturing. As a result, the semiconductor industry may see a long time-to-market and drastically increased costs to develop these new technologies. To remain competitive, new engineering methodologies will be needed to improve 3D device development time and cost. This presentation will demonstrate how virtual semiconductor fabrication can be used to accelerate time-to-market and lower costs in the development of the latest 3D logic and memory technologies.

Biography
Benjamin Vincent, Ph.D., is a Director of Engineering in the Semiverse™ Solutions division of Lam Research. He has 15+ years of experience in semiconductor process engineering, including positions at imec (Belgium) as an epitaxy scientist in the advanced logic area, and at Intel as a process and design integration engineer and manager. Dr. Vincent joined Lam Research in July 2017 and is currently leading the global application team for SEMulator3D®, Lam's virtual semiconductor fabrication software. He received his M.S. in Physics and a Ph.D. in Materials Science from the Institut Polytechnique de Grenoble and CEA/LETI, in Grenoble, France.

References

Tailored Intelligence: The Art of Customized Processors for AI Acceleration

H. Amrouch
Prof. Dr.-Ing.
Technical University of Munich (TUM), Computer Engineering, Munich, Germany

Abstract

In the rapidly evolving field of artificial intelligence (AI), the drive for processor customization to substantially enhance efficiency is more critical than ever. In this talk, we will explore the pivotal role of tailoring the underlying RISC-V CPU architecture to meet the specific demands of AI algorithms. We will highlight how brain-inspired hyperdimensional computing presents a compelling alternative to deep learning, thanks to its remarkable capacity to learn from minimal and noisy data. Lastly, we will illustrate how in-memory computing and cryogenic computing open new avenues for dramatically enhancing the speed and efficiency of AI computations.

Biography

Hussam Amrouch is a professor heading the Chair of AI Processor Design at the Technical University of Munich (TUM). He is, additionally, heading the Brain-inspired Computing at the Munich Institute of Robotics and Machine Intelligence. Further, he is the head of the Semiconductor Test and Reliability at the University of Stuttgart. He received his Ph.D. degree with the distinction (summa cum laude) from KIT, Germany in 2015. He has more than 260 publications (including over 110 articles in many top journals like Nature Communications) in multidisciplinary research areas covering semiconductor device physics, circuit design and computer architecture. His research interest is transistor compact modeling, in-memory computing with a special focus on reliability, and cryogenic circuits for quantum computing.

References

Towards accessible, European hybrid quantum-HPC compute systems

R. Verberk
Director Semicon & Quantum
https://www.tno.nl, High Tech Industry- Semicon & Quantum, Delft, Netherlands

Abstract
Quantum Inspire was the first system to demonstrate the feasibility of an all-European, freely accessible quantum computer. Since then it has had improvements in the quantum backend, but it will also be connected to the European network of supercomputers. Through collaborations within QuTech (TNO + Technical University of Delft), on national level (QuantumDeltaNL), and on European level (Flagship, Euro-HPC) we will soon be able to provide the general public the functionality to execute hybrid quantum algorithms using local HPC nodes connected to our quantum backends. This demonstrates how quantum computing gets closer to mainstream technologies and applications.

Biography
Coming Soon

References

Superconducting Quantum Computing: Building on Decades of Semiconductor Innovation for Transformative Computational Power

S. Kulkarni
CEO
Rigetti Computing, Berkeley, United States of America

Abstract
Superconducting quantum computing is one of the leading modalities of quantum computing, a fundamentally different approach to processing information. Quantum computing has the potential to transform how many industries address their most challenging problems. Discover the current state of quantum computing and how Rigetti is leading the way to enable hands-on access to quantum hardware to continue to push the boundaries of what’s possible with this revolutionary technology.

Biography
Dr. Kulkarni has served as President and Chief Executive Officer at Rigetti since December 2022. Dr. Kulkarni is a seasoned public company CEO with thirty-plus years of experience in the semiconductor industry and a track record of success in scaling and commercializing cutting-edge technologies. Prior to joining Rigetti, Dr. Kulkarni was President, CEO, and member of the Board of CyberOptics Corporation, a developer and manufacturer of high precision sensors and inspection systems for the semiconductor and electronics industry. He held these roles from 2014 until CyberOptics was acquired by Nordson Corporation in November 2022. Prior to CyberOptics, Dr. Kulkarni was CEO of Prism Computational Sciences, a developer of software tools for scientific and commercial applications in the semiconductor industry. Earlier in his career, he held additional leadership positions, including Chief Technology Officer and Senior Vice President of OEM/Emerging business, global commercial business, R&D and manufacturing at Imation, a global scalable storage and data security company. Dr. Kulkarni began his career in research and management positions with 3M Corporation and IBM. He received his B.S. in chemical engineering from the Indian Institute of Technology, Mumbai, and later obtained a M.S. and Ph.D. in chemical engineering from MIT. Dr. Kulkarni currently serves on the Board of KeyTronic Corporation, a publicly traded electronics manufacturing services company, as well as Chairman of the Board for Prism Computational Sciences.

References

Energy-Efficient AI Using Stochastic Magnetic Tunnel Junctions

N. Alder
Research Assistant
Hasso Plattner Institute, Potsdam, Germany

Abstract
(Pseudo)random sampling is a costly and widely used method in AI algorithms. We introduce an energy-efficient algorithm for uniform Float16 sampling, utilizing a room-temperature stochastic magnetic tunnel junction device to generate truly random floating-point numbers. By avoiding expensive symbolic computation and mapping physical phenomena directly to the statistical properties of the floating-point format and uniform distribution, our approach achieves a higher level of energy efficiency.

Biography
Nicolas Alder is a PhD student at the Hasso Plattner Institute, specializing in energy-efficient artificial intelligence. With a strong academic foundation in Data Engineering and Computer Science, Nicolas has been involved in cutting-edge research at the intersection of AI, hardware, and sustainability. He serves as a Research Assistant at the AI and Sustainability Chair and is a part of the MIT-HPI Joint Research Program. Nicolas has also gained industry experience through roles at Volkswagen, the Hasso Plattner Foundation, and BearingPoint, focusing on AI and data science.

References