TECHCON 2018 – Submission Category Descriptions

Advanced Devices, Materials, and Packaging: Transistors and other semiconductor devices are the fundamental building blocks of computing, data storage, embedded intelligence, etc. As current technologies approach physical limits and novel architectures are developed, new materials and devices as well as advanced packaging solutions are essential. Advances will enable ultimate CMOS technologies, beyond-CMOS applications, and non-von Neumann computing paradigms.

Interconnect Technology and Architecture: Interconnects carry digital information within and between integrated circuits. Limitations of current interconnect technologies are leading to inefficiencies and impacting system performance. Revolutionary advances are needed in interconnect materials, mechanisms, and designs.

Intelligent Memory and Storage: The rapidly growing applications based on data analytics and machine learning will benefit from a paradigm shift in how memory is used and accessed. Advances in memory and storage technologies and architectures will improve system performance, enhance security, and enable intelligent systems.

Power Management: Critical infrastructure, industrial processes and other systems are powered by electricity. Next generation systems depend on innovations in wide-gap materials, active and passive power devices, designs, and packaging to revolutionize how power is switched, converted, controlled, conditioned, and stored efficiently.

Sensor and Communication Systems: A key enabler of the information age and the emerging IoT is the ubiquitous ability to sense and communicate information seamlessly. Future sensor systems will require energy-efficient devices, circuits, algorithms, and architectures that adaptively sense the environment, extract and process information, and autonomously react. Communications systems must be dynamically adaptive and resilient. Efficient spectrum use and interference mitigation will be required to ensure secure service.

Distributed Computing and Networking: The growing interconnected web of computing capability, as well as the enormous amounts of data across the IoT create a challenge and an opportunity for distributed computing. Large scale distributed computing systems, supporting very large numbers of participants and diverse applications, require advances in system scalability and efficiency, communications, and system management optimization, resilience, and architecture.

Cognitive Computing: Cognitive systems that can mimic the human brain, self-learn at scale, perform reasoning, make decisions, solve problems, and interact with humans will have unprecedented social and economic impact. Creating systems with essential cognitive capabilities requires advances in areas including perception, learning, reasoning, predicting, planning, and decision making; efficient algorithms and architectures for supervised and unsupervised learning; seamless human-machine interfaces; networking cognitive sub-systems; and integrating new cognitive systems with existing von Neumann computing systems.

Bio-Influenced Computing and Storage: The convergence of biology and semiconductor technologies has the potential to enable transformational advances in information processing and storage, design and synthesis, and nanofabrication at extreme scale. Examples include DNA-based storage, biosensors, cell-inspired information processing, design automation of biomolecular and hybrid bio-electronic systems, and biology-inspired nanofabrication.

Advanced and Nontraditional Architectures and Algorithms: New applications and advanced computing systems require scalable heterogeneous architectures co-designed with algorithms and hardware to achieve high performance, energy efficiency, resilience, and security. Alternatives to the prevalent von Neumann architecture include approximate computing, stochastic computing, and Shannon-inspired information frameworks can provide significant benefits in energy efficiency, delay, and error rates.

Security and Privacy: The dependence on interconnected, intelligent systems means that security and privacy need to be intrinsic properties of the components, circuits and systems. Design and manufacture of trustworthy and secure hardware will require design for security, security principles and metrics, security verification tools and techniques, understanding threats and vulnerabilities, and authentication strategies.

Design Tools, Methodologies, and Test: Advances in the design and test capabilities are coupled to breakthroughs in materials and architecture, enabling new capabilities to be incorporated in designs and produced at scale. Enormous challenges are posed by growing complexity and the diversity of beyond-CMOS technological options.

Next-Generation Manufacturing Paradigm: Advanced manufacturing techniques, including for technologies other than CMOS, as well as tools, and metrologies with high precision and yield, are required to process novel materials, fabricate emerging devices and circuits, and demonstrate functional systems.

Environmental Health and Safety Related to Materials and Processes: The semiconductor industry's reputation, freedom to innovate, and profitability depend on a proactive approach to environmental health and safety issues. In addition to developing EHS understanding of new materials and processes early, currently used materials and processes can be improved. Strategies and technologies are sought that minimize waste streams, emissions and occupational risk.

Innovative Metrology and Characterization: Semiconductor features are measured in nanometers and the trend is toward 3D stacked structures. Innovative characterization and metrology are critical for fundamental material studies, nanoscale fabrication, device testing, and complex system integration and assessment.