Semiconductor R&D

Session Organizers:
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In a few decades, semiconductor technology has driven a changing social system. For example, in the 1990s, CMOS technology used by high-end microprocessors enabled personal computers, and billions of PCs are connected by the Internet to create a worldwide knowledge repository. These days, low-power system LSIs drive the evolution of cellular phones and changing communication style between individuals. These evolutions are caused by exponential scaling down of semiconductor process to the nanoscale order, which is known as Moore's law. Furthermore, the role of semiconductors is expanded from processors and memories to sensors and storages.

But current semiconductor technology faces several challenges to continue scaling down. For example, leakage current in transistors limits scaling down supply voltage, and it causes power problems of high-end microprocessors. On the other hand, process variation requires larger margin to design LSIs and it causes increasing power and cost. The first two talks of this session address the state of the art semiconductor R&D in computation technology and storage technology. The next two talks address near-team and long-term computation system design.

Dr. King will describe the general trends and approaches of macrobabrication technologies used for the computation aspect of the information technology that will lead to enhancing the functionality and lowering the cost of electronic systems, so that the gains in performance can be sustained in nanoscale CMOS technology. She will also describe the opportunity enabled by the advanced macrofabrication technology that leads to the age of ambient intelligence and ubiquitous computing.

Dr. Stipe will present the storage aspect of information technology, which is a good example of the breadth of semiconductor R&D. In the past few years we almost started to see cross-pollination in the storage technologies between the traditional semiconductor space and the hard disk space. Dr. Stipe will survey the latest development of the most advanced storage technology, including the hard disk drive technology and the NAND flash technology.

Dr. Mizuno will point out current challenges in making large-scale LSIs using nano order of semiconductor devices, and he will also present a new LSI design scheme with embedded measurement circuits to reduce needless design margins.

Dr. Itoh will focus on the "quantum computer," which can be a breakthrough technology for the nanoscale era, and utilizes each atom as a bit carrier by physical properties of single atoms governed by quantum rather than classical physics. He will describe how today's silicon classical computers may be transformed into quantum computers seamlessly to keep up with Moore's law.