Electrical & Computer ENGINEERING

SEMINAR

Distinguished Lecture

Thursday
February 23, 2006

Scaife Hall Auditorium
Room 125

4:00 PM
Refreshments—3:30 PM

Mark Lundstrom

Purdue University

Professor Mark Lundstrom is the Don and Carol Scifres Distinguished Professor of Electrical and Computer Engineering at Purdue University where his research is on the physics, technology, and simulation of electronic devices. Lundstrom is the founding director of the NSF-funded Network for Computational Nanotechnology, which has a mission of research, education, leadership, and service to the nation's National Nanotechnology Initiative. He serves on the leadership councils of the NASA-funded Institute for Nanoelectronics and Computing and the MARCO Focus Center for Materials, Structures, and Devices. Lundstrom's work has been recognized by several awards, most recently, in 2005, from the Semiconductor Industry Association in recognition of his career contributions to the semiconductor industry.

Nanoscale Transistors:
The Ultimate MOSFET and Beyond

After forty years of advances in integrated circuit technology, microelectronics is undergoing a transformation to nanoelectronics. Modern day MOSFETs now have channel lengths less than 50 nm long, and billion transistor logic chips have arrived. Moore's Law continues, but the end of MOSFET scaling is in sight. Many researchers are exploring new materials and devices that might extend CMOS scaling, complement ultimate CMOS, or enable entirely new applications. My objective in this talk is to present a general approach to think about nanotransistors and then to examine the ultimate MOSFET, novel devices such as carbon nanotube and molecular transistors, and finally the fundamental limits for any transistor.

This talk will begin with a quick review of the standard electrical engineering view of the MOSFET. I'll then describe a very general and very simple way to understand nanoscale transistors and mention how it is generalized to the non-equilibrium Green's function approach to quantum transport at an atomistic scale. Using these approaches, we'll examine the performance potential of 10nm-scale silicon MOSFETs and what new channel materials, such as III-V semiconductors, might provide. Next, I'll briefly examine one-dimensional transistors made from carbon nanotubes. Finally, we'll take a brief look at molecular transistors. The talk will conclude with a discussion of fundamental limits for transistors and some speculations about where electronic device research is heading.

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