ICCAD-2001 KEYNOTE

Thomas N. Theis
Director, Physical Sciences
IBM Corp. TJ Watson Research Ctr.
Yorktown Heights, NY

NANOTECHNOLOGY AND THE INFORMATION AGE

Description: The history of information technology can be viewed as a quest to make "bits" smaller and smaller. There is no obvious and hard physical limit to the minimum size of logical devices that process information or the marks that store information. Indeed, quantum physics is being recast as a theory of information, and even a single atom can no longer be seen as the ultimate limit to the minimum size of a bit. Yet the smallest logical devices being manufactured today contain billions of atoms, and the smallest magnetic bits on commercial hard drives contain millions of atoms. Optimistically assuming continued exponential improvement in our ability to pattern matter at ever-smaller dimensions, in perhaps 35 years we will have the capability to design and control the structure of an object on all length scales from the atomic to the macroscopic -- in other words, the beginnings of a mature nanotechnology. Progress along this road will depend not only on the continued extension of lithographic patterning techniques, but on increasing use of processes of natural pattern formation, commonly referred to as self-assembly. Continued evolutionary progress in silicon microelectronics and magnetic storage seems assured for at least another decade. Potential nanoscale successors, such as scanning-probe storage and carbon-nanotube electronics are under active investigation and suggest the possibility of continued exponential progress in information technology for decades to come.

Biography: Thomas Theis received a B.S. degree in Physics from Rensselaer Polytechnic Institute in 1972, and M.S. and Ph.D. degrees from Brown University in 1974 and 1978, respectively. A portion of his Ph.D. research was done at the Technical University of Munich, where he completed a postdoctoral year before joining IBM Research in 1979.