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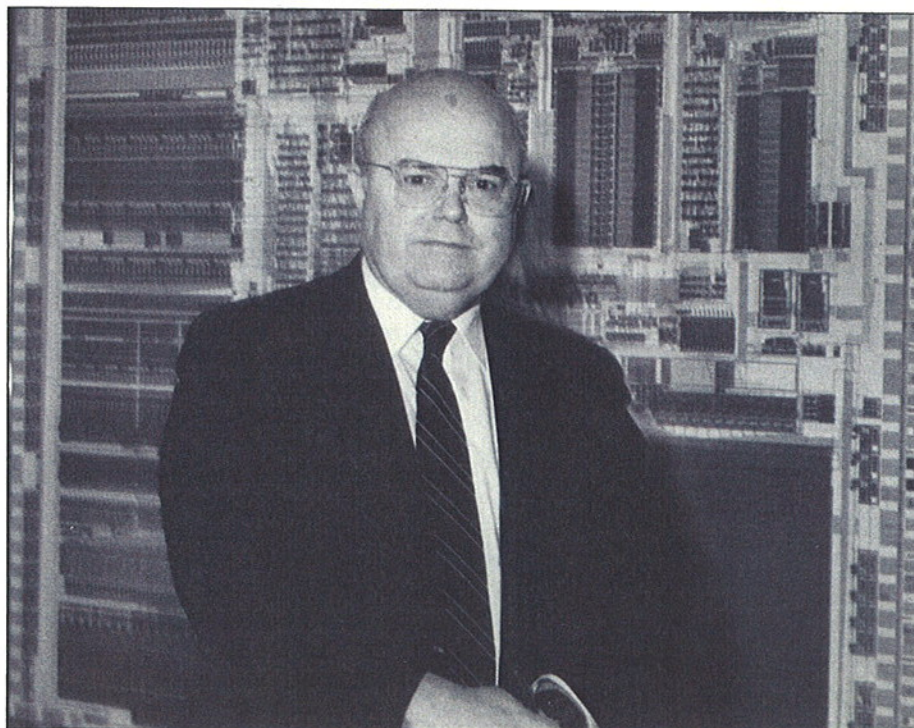
The Research Laboratory of Electronics at the Massachusetts Institute of Technology

Chipping Away at VLSI COMPUTER-AIDED DESIGN

In search of enlightenment, medieval theologians posed the question, "How many angels can dance on the head of a pin?" Today, faced with a similar but more mundane paradox, computer experts seek an answer to the question, "How many transistors can fit on a microchip?" As semiconductor materials and processing technologies have advanced, electronic components have become smaller, circuit arrays denser, microchips larger, and their functions faster and more complex. Scientists and engineers must now tame the rapid pace of this challenging technology by devising new design methods for integrated circuits that are quick, reliable, and economical.

Computer scientists, electrical engineers, mathematicians, materials scientists, and physicists are all engaged in the highly interdisciplinary field of integrated circuit design. Their investigations are driven, in part, by the quest for faster, more accurate, and more powerful digital computers. Conversely, these high-performance computers are the vehicles that transport researchers into still deeper and more fascinating areas of exploration.

It is simple to design a circuit that contains a few transistors, but the design of an entire system that uses thousands of transistors involves many designers who may work on different parts or stages of the design simultaneously. To



An integrated circuit mask layout of the Intel 386 microprocessor (magnified 200 times) provides a backdrop for Professor Jonathan Allen. This computer-generated plot of the 386 chip, which contains 275,000 transistors, was part of a recent display at the MIT Museum, "Information Art: Diagramming Microchips." (Photo by John F. Cook)

be successful, a design team must possess an understanding of each level of design. Rarely does one person possess expertise at all levels, nor is the entire

process achieved solely by human means. Without modern computer-

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