UC SANTA BARBARA

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Better, Faster, Smaller

We carry more computing power in our current smartphones than mission control had at its disposal when sending men to the moon in 1969 (They had a backup calculator, just in case!). Our handheld tablets and ebook readers can crunch numbers with more speed and ease than the first commercially available personal computer could, just over half a century ago. In 2015, a chip no bigger than a human fingertip can accomplish more than what 30 tons of computer could do back in 1946.

What's responsible for this incredible shrinking computer phenomenon? Integrated circuits. The brains behind today's modern devices, these are tiny components that relay and manipulate information and perform complex calculations in the blink of an eye. And it is for his work in the area of integrated circuits that Yuan Xie, professor of electrical and computer engineering, has been elected fellow by the Institute of Electrical and Electronics Engineers (IEEE).

"This well-deserved, prestigious recognition by his peers around the world is highly valued and much appreciated at UCSB," said Rod Alferness, dean of the UCSB College of Engineering.

"It's very exciting," Xie said of the recognition that honors his "contributions to design automation and architecture of three-dimensional integrated circuits."

According to Moore's law, the processing power of computers doubles every two years or so due to the number of tiny transistors that can be fit onto a computer's central processing unit, Xie noted. To stay on the leading edge of that wave without

creating monster-size devices, the components have had to shrink and become more efficient while the size of their footprints on the device's circuit boards have to be controlled.

The solution? Add another dimension.

"We can stack one layer of microprocessors on top of another and reduce the area they need, and pack multiple functions into one small device," said Xie. If today's smartphones didn't use three-dimensional integrated circuitry, he added, they would look like tablets or laptops. Additionally, three-dimensional integrated circuitry provides better performance and boosts efficiency.

The addition of another dimension also offers a wide range of possibility for design, one of the Xie's areas of specialization. He is eager to research the addition of photonic elements to the chip, which would add a whole new aspect of data processing that uses optics and its capabilities to the electronics.

"I look at it from the computer architecture perspective," he said. "So I ask myself, 'How can I build a faster computer processor for the different applications that we have?'"

Xie began his work just over a decade ago during his master's and doctoral studies at Princeton University. He joined the faculty at UCSB in 2014, after having taught at Penn State University for 11 years and spent a year at IBM's Microelectronics Division's Worldwide Design Center. He is the recipient of numerous honors, including an NSF CAREER award; an IBM faculty award; an ACM distinguished speaker; an IEEE Computer Society Distinguished Visitor; and Semiconductor Research Corporation's Inventor Recognition Award.

IEEE is the world's leading professional association for advancing technology for humanity. Through its 400,000 members in 160 countries, IEEE is a leading authority on a wide variety of areas ranging from aerospace systems, computers and telecommunications to biomedical engineering, electric power and consumer electronics. Dedicated to the advancement of technology, IEEE publishes 30 percent of the world's literature in the electrical and electronics engineering and computer science fields, and has developed more than 900 active industry standards.

About UC Santa Barbara

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