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What ultra-tiny nanocircuits can do

Harvard, MITRE researchers produce first programmable nanoprocessor

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Engineers and scientists collaborating at Harvard University and the MITRE Corp. have develo first programmable nanoprocessor.

The groundbreaking prototype computer system, described in a paper appearing today (Feb. significant step forward in the complexity of computer circuits that can be assembled from synthesized

It also represents an advance because these ultra-tiny nanocircuits can be programmed electronically arithmetic and logical functions.

"This work represents a quantum jump forward in the complexity and function of circuits built from th that this bottom-up paradigm, which is distinct from the way commercial circuits are built today, can integrated systems of the future," says principal investigator Charles M. Lieber, who holds a joint appo Chemistry and Chemical Biology and School of Engineering and Applied Sciences.

The work was enabled by advances in the design and synthesis of nanowire building blocks. These nan the reproducibility needed to build functional electronic circuits, and also do so at a size and material traditional top-down approaches.

Moreover, the tiled architecture is fully scalable, allowing the assembly of much larger and ever more f

"For the past 10 to 15 years, researchers working with nanowires, carbon nanotubes, and other nanost the most basic circuits, in large part due to variations in properties of individual nanostructures," says

of Chemistry. “We have shown that this limitation can now be overcome and are excited about prospe paradigm of biology in building future electronics.”

An additional feature of the advance is that the circuits in the nanoprocessor operate using very little p minuscule size, because their component nanowires contain transistor switches that are “nonvolatile.”

This means that unlike transistors in conventional microcomputer circuits, once the nanowire transist require any additional expenditure of electrical power for maintaining memory.

“Because of their very small size and very low power requirements, these new nanoprocessor circuits a enable an entirely new class of much smaller, lighter-weight electronic sensors and consumer electron lead engineer in MITRE’s Nanosystems Group.

“This new nanoprocessor represents a major milestone toward realizing the vision of a nanocomputer years ago by physicist Richard Feynman,” says James Ellenbogen, a chief scientist at MITRE.

Co-authors on the paper included four members of Lieber’s lab at Harvard — Hao Yan, Ph.D. ’10, Sung Ph.D. ’10 — and doctoral candidate Hwan Sung Choe, as well as collaborators at MITRE.

The research team at MITRE comprised Das, Ellenbogen, and nanotechnology laboratory Director Jin not-for-profit company that provides systems engineering, research and development, and informatio government. MITRE’s principal locations are in Bedford, Mass., and McLean, Va.

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