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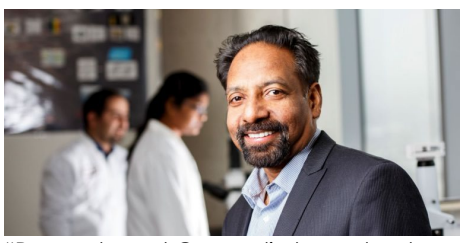
3D PRINTING

Holographic 3D Printing Has the Potential to Revolutionize Multiple Industries, Say Concordia Researchers



"Researchers at Concordia have developed a novel method of 3D printing that uses acoustic holograms. And they say it's quicker than existing methods and capable of making more complex objects.

The process, called holographic direct sound printing (HDSP), is described in a recent article in the journal Nature Communications. It builds on a method introduced in 2022 that described how sonochemical reactions in microscopic cavitations regions — tiny bubbles — create extremely high temperatures and pressure for trillionths of a second to harden resin into complex patterns.

Now, by embedding the technique in acoustic holograms that contain cross-sectional images of a particular design, polymerization occurs much more quickly. It can create objects simultaneously rather than voxel-by-voxel.

In order to retain the fidelity of the desired image, the hologram remains stationary within the printing material. The printing platform is attached to a robotic arm, which moves it based on a pre-programmed algorithm-designed pattern that will form the completed object.

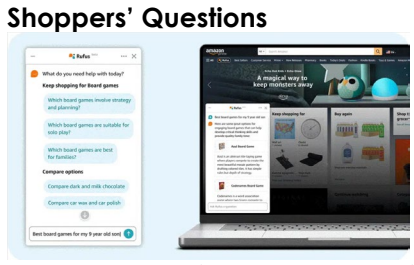
Muthukumaran Packirisamy, a professor in the Department of Mechanical, Industrial and Aerospace Engineering, led the project. He believes this can improve printing speed by up to 20 times while at the same time using less energy.

"We can also change the image while the operation is under way," he says. "We can change shapes, combine multiple motions and alter materials being printed. We can make a complicated structure by controlling the feed rate if we optimize the parameters to get the required structures.""

Source: Concordia (8 Oct 2024)

AI

How We Built Rufus, Amazon's AI-Powered Shopping Assistant: A Custom Language Model Uses New Techniques to Quickly Answer Shoppers' Questions



""What do I need for cold weather golf?"

"What are the differences between trail shoes and running shoes?"

"What are the best dinosaur toys for a five-year-old?"

These are some of the open-ended questions customers might ask a helpful sales associate in a brick-and-mortar store. But how can customers get answers to similar questions while shopping online?

Amazon's answer is Rufus, a shopping assistant powered by generative AI. Rufus helps Amazon customers make more informed shopping decisions by answering a wide range of questions within the Amazon app. Users can get product details, compare options, and receive product recommendations.

I lead the team of scientists and engineers that built the large language model (LLM) that powers Rufus. To build a helpful conversational shopping assistant, we used innovative techniques across multiple aspects of generative AI. We built a custom LLM specialized for shopping; employed retrieval-augmented generation with a variety of novel evidence sources; leveraged reinforcement learning to improve responses; made advances in high-performance computing to improve inference efficiency and reduce latency; and implemented a new streaming architecture to get shoppers their answers faster."

Source: IEEE Spectrum (4 Oct 2024)

ARCHITECTURE

Navigating Support Systems for Emerging Architects: Analyzing the Case of U.S. And Hong Kong

"How do societies support and nurture emerging architects? Young architects are heavily influenced by their formal education and initial exposure to the industry. Various organizational systems across regions, whether passive through environmental factors or active via tangible benefits, are in place to assist them in entering the field. However, it's worth questioning how often we reflect on these established support systems. Are they effective in fostering well-rounded professionals, or do they unintentionally reinforce certain biases in how architecture is practiced?

Architects typically undergo rigorous education and training that can take up to a decade or more before being licensed. Architectural education, often steeped in theoretical and conceptual explorations, is frequently criticized for disconnecting from the practical realities of design and construction. Nonetheless, this academic foundation remains crucial, offering insight into architectural history, theory, and broader design considerations. While these concepts may not always be immediately applicable during an architect's early career, they help shape an architect's ability to think critically and holistically about the built environment—skills that often come into play later in their career when serving their clients."

Source: Archdaily (14 Oct 2024)

DESIGN

Herzog & De Meuron Unveils Swiss Children's Hospital That "Functions Like a Town"

"A wood-clad acute-care facility modelled on a town forms part of University Children's Hospital, which Swiss architecture studio Herzog & de Meuron has completed in Zurich.

Forming a part of Kinderspital, Switzerland's largest hospital complex for children and adolescents, the 96,200-square-metre project by Herzog & de Meuron also includes a standalone building for research and teaching.

The wood-lined acute-care hospital and white cylindrical research facility are unified by a verdant landscape planted with over 250 trees, hoped to boost patient wellbeing.

According to the studio's co-founder Jacques Herzog, the overall design reflects the studio's belief that "architecture can contribute to healing".

"Hospitals all over the world and even in Switzerland are often the ugliest places," said Herzog.

"For the past 20 years, we have zeroed in on this issue, because we are convinced that architecture can contribute to the healing process; it can make a substantial difference," he continued.

"Here at the Children's Hospital, people can see for themselves how daylight coming in from outside and variations in proportion can animate and change a room, how plants and vegetation can blur the distinction between inside and outside and how materials are not just beautiful to look at but also pleasing to the touch.""

Source: Dezeen (13 Oct 2024)

MATERIALS SCIENCE

Inspired By Spider-Man, A Lab Recreates Web-Slinging Technology

"Every kid who has read a comic book or watched a Spider-Man movie has tried to imagine what it would be like to shoot a web from their wrist, fly over streets, and pin down villains. Researchers at Tufts University took those imaginary scenes seriously and created the first web-slinging technology in which a fluid material can shoot from a needle, immediately solidify as a string, and adhere to and lift objects.

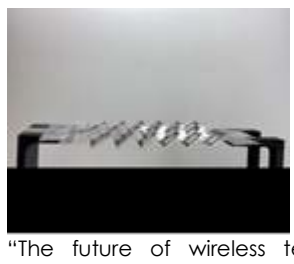
These sticky fibers, created at the Tufts University Silklab, come from silk moth cocoons, which are boiled in solution and broken down into their building block proteins called fibroin. The silk fibroin solution can be extruded through narrow bore needles to form a stream that, with the right additives, solidifies into a fiber when exposed to air.

Of course, nature is the original inspiration for deploying fibers of silk into tethers, webs, and cocoons. Spiders, ants, wasps, bees, butterflies, moths, beetles, and even flies can produce silk at some point in their lifecycle. Nature also inspired the Silklab to pioneer the use of silk fibroin to make powerful glues that can work underwater, printable sensors that can be applied to virtually any surface, edible coatings that can extend the shelf life of produce, a light collecting material that could significantly enhance the efficiency of solar cells, and more sustainable microchip manufacturing methods

However, while they made significant progress with silk-based materials, the researchers had yet to replicate the mastery of spiders, which can control the stiffness, elasticity, and

MATERIALS SCIENCE

Ancient 3D Paper Art, Kirigami, Could Shape Modern Wireless Technology



"The future of wireless technology — from charging devices to boosting communication signals — relies on the antennas that transmit electromagnetic waves becoming increasingly versatile, durable and easy to manufacture. Researchers at Drexel University and the University of British Columbia believe kirigami, the ancient Japanese art of cutting and folding paper to create intricate three-dimensional designs, could provide a model for manufacturing the next generation of antennas.

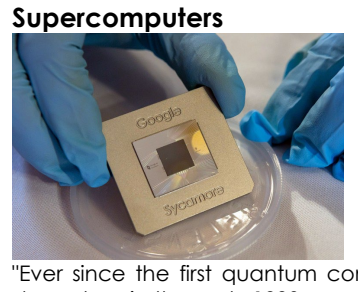
Recently published in the journal Nature Communications, research from the Drexel-UBC team showed how kirigami — a variation of origami — can transform a single sheet of acetate coated with conductive MXene ink into a flexible 3D microwave antenna whose transmission frequency can be adjusted simply by pulling or squeezing to slightly shift its shape.

The proof of concept is significant, according to the researchers, because it represents a new way to quickly and cost-effectively manufacture an antenna by simply coating aqueous MXene ink onto a clear elastic polymer substrate material.

"For wireless technology to support advancements in fields like soft robotics and aerospace, antennas need to be designed for tunable performance and with ease of fabrication," said Yury Gogotsi, PhD, Distinguished University and Bach Professor in Drexel's College of Engineering, and a co-author of the research. "Kirigami is a natural model for a manufacturing process, due to the simplicity with which complex 3D forms can be

QUANTUM PHYSICS

Google Uncovers How Quantum Computers Can Beat Today's Best Supercomputers



"Ever since the first quantum computers were dreamt up in the early 1980s, researchers have looked forward to the day the devices could solve problems that are too difficult for classical computers. In the past five years, the machines have finally begun to challenge their classical cousins — although definitive victory over them has remained elusive.

Now, in the latest chapter of the battle to achieve this 'quantum advantage', researchers at Google say they have determined the conditions under which quantum computers can beat their classical counterparts. To understand these conditions, they used a quantum-computer processor named Sycamore to run random circuit sampling (RCS), a simple quantum algorithm that essentially generates a random sequence of values.

The team analysed Sycamore's output and found that when it ran in a mode with a lot of noise interference while performing RCS, it could be 'spoofed', or beaten, by classical supercomputers. But, when the noise was lowered to a certain threshold, Sycamore's computation became complex enough that spoofing it was effectively impossible — by some estimates, it would take the fastest classical supercomputer in the world ten trillion years. The finding, first reported in a preprint on the arXiv server last year, was published today in Nature.

This is a convincing demonstration that Sycamore is capable of outpacing any classical computer running RCS, quantum specialists told Nature. In 2019, Google

ROBOTS

Toddlers Show Increased Physical Activity with A Robot Playmate Moving Around the Room

"Parents seeking help in encouraging toddlers to be physically active may soon need to look no further than an inexpensive robotic buddy for their kids, a new study by Oregon State University suggests.=

The findings are important because movement plays a key role in the overall health of children, both in youth and later on in adulthood, the authors note.

Researchers observed individual sessions for eight kids ages 2-3 once a week for two months in a playroom that included various toys as well as a toddler-sized GoBot: a custom, wheeled, foam-padded robot designed through a collaboration between the OSU colleges of Engineering and Health.

Weekly sessions with each of the five boys and three girls were broken into three segments.

During one of them, the GoBot was in the room but not active, though the child was free to push and pull the robot around if he or she wanted to.

In another, the GoBot's movements – basically keep-away maneuvers – were directed by an operator using a PlayStation DualShock4 controller, and in the third segment type, the motion was autonomous. In either scenario, the GoBot rewarded the child for getting close to it by emitting sounds, lights or bubbles.

The results showed that kids' activity levels, measured by multiple sensors and cameras, were higher in the presence of an active

adhesive properties of the threads they spin."

Source: Tufts (10 Oct 2024)

created from a single 2D piece of material.""

Source: Eurekalert! (14 Oct 2024)

reported that its quantum computer could run RCS and achieve a quantum advantage, but since then classical computers have been able to run the algorithm more quickly than estimated, eliminating the purported advantage. This time around, "Google did a very good job of both clarifying and addressing many of the known issues with RCS", says Michael Foss-Feig, a quantum-computing researcher at the computer software firm Quantinuum, who is based in Broomfield, Colorado. And the new findings show how much noise quantum computers can have and still beat classical computers, he says."

Source: Nature (9 Oct 2024)

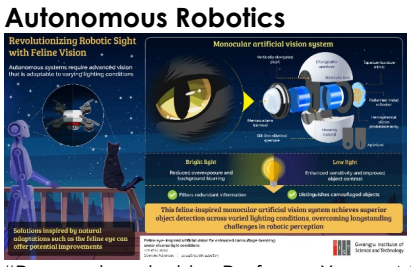
robot.

"It was interesting to us that the simple autonomous routine worked as well as directly teleoperated control when it came to engaging children," said the College of Engineering's Naomi Fitter, who led the study. "That means a relatively low-cost robot playmate – one that offers more intelligence and independence compared to current phone-operated robotic toys – might be feasible in the near future.""

Source: Oregon state (9 Oct 2024)

ROBOTICS

Gwangju Institute of Science and Technology Researchers Develop Cat's Eye-Inspired Vision System for Autonomous Robotics



"Researchers led by Professor Young Min Song from the Gwangju Institute of Science and Technology (GIST) have unveiled a vision system inspired by feline eyes to enhance object detection in various lighting conditions. Featuring a unique shape and reflective surface, the system reduces glare in bright environments and boosts sensitivity in low-light scenarios. By filtering unnecessary details, this technology significantly improves the performance of single-lens cameras, representing a notable advancement in robotic vision capabilities."

Source: GIST (10 Oct 2024)

ROBOTICS

New Breakthrough Helps Free Up Space for Robots To 'Think', Say Scientists

"Engineers have worked out how to give robots complex instructions without electricity for the first time which could free up more space in the robotic 'brain' for them to 'think'.

Mimicking how some parts of the human body work, researchers from King's College London have transmitted a series of commands to devices with a new kind of compact circuit, using variations in pressure from a fluid inside it.

They say this world first opens up the possibility of a new generation of robots, whose bodies could operate independently of their built-in control centre, with this space potentially being used instead for more complex AI powered software.

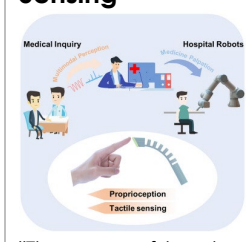
"Delegating tasks to different parts of the body frees up computational space for robots to 'think,' allowing future generations of robots to be more aware of their social context or even more dexterous. This opens the door for a new kind of robotics in places like social care and manufacturing," said Dr Antonio Forte, Senior Lecturer in Engineering at King's College London and senior author of the study.

The findings, published in Advanced Science and awarded the frontispieces of the journal for "outstanding results", could also enable the creation of robots able to operate in situations where electricity-powered devices cannot work, such as exploration in irradiated areas like Chernobyl which destroy circuits, and in electric sensitive environments like MRI rooms."

Source: KCL (9 Oct 2024)

TACTILE SENSING

Toward Human-Like Touch Sense Via a Bioinspired Soft Finger with Self-Decoupled Bending and Force Sensing



"The sense of touch means not only detecting force passively but also effortfully moving our fingers to touch and "feel" the world. Existing soft robotic hands can produce hand-like movements but are still far behind in terms of their sensing capabilities. Here, we propose a bioinspired soft finger (BSF) with self-decoupled bending and force sensing via a seamlessly integrated conductive fiber coil. By measuring the inductance and resistance, bending angle and force at the fingertip can be obtained with high resolutions of 0.02° and 0.4 mN, respectively. Both the sensing and actuation of the BSF have a response time (50 ms) comparable to that of human fingers and are mechanically durable for practical applications. The BSF can achieve a human-like touch sense of object stiffness and identify lumps underneath "normal tissues" by simply pressing it. Moreover, it can automatically locate the artery at a participant's wrist and take the pulse."

Source: SCIENCE DIRECT (16 Oct 2024)

WIRELESS

Bluetooth Microscope Reveals the Inner Workings of Mice: The Blescope Transmits In Vivo Imaging—No Strings Attached

"Any imaging technique that allows scientists to observe the inner workings of a living organism, in real-time, provides a wealth of information compared to experiments in a test tube. While there are many such imaging approaches in existence, they require test subjects—in this case rodents—to be tethered to the monitoring device. This limits the ability of animals under study to roam freely during experiments.

Researchers have recently designed a new microscope with a unique feature: It's capable of transmitting real-time imaging from inside live mice via Bluetooth to a nearby phone or laptop. Once the device has been further miniaturized, the wireless connection will allow mice and other test subject animals to roam freely, making it easier to observe them in a more natural state.

"To the best of our knowledge, this is the first Bluetooth wireless microscope," says Arvind Pathak, a professor at the Johns Hopkins University School of Medicine.

Through a series of experiments, Pathak and his colleagues demonstrate how the novel wireless microscope, called BLEscope, offers continuous monitoring of blood vessels and tumors in the brains of mice."

Source: IEEE Spectrum (13 Oct 2024)