IT matters

New method flips script on topological physics

The branch of mathematics known as topology has become a cornerstone of modern physics thanks to the remarkable - and above all reliable - properties it can impart to a material or system. Unfortunately, identifying topological systems, or even designing new ones, is generally a tedious process that requires exactly matching the physical system to a mathematical model. Researchers at the University of Amsterdam and the École Normale Supérieure of Lyon have demonstrated a model-free method for identifying topology, enabling the discovery of new topological materials using a purely experimental approach.

Topology encompasses the properties of a system that cannot be changed by any 'smooth deformation'. As you might be able to tell from this rather formal and abstract description, topology began its life as a branch of mathematics.

However, over the last few decades physicists have demonstrated that the mathematics underlying topology can have very real consequences.

Topological effects can be found in a wide range of physical systems, from individual electrons to large-scale ocean currents.

As a concrete example: in the field of quantum matter, topology rose to fame thanks to so-called topological insulators.

These materials do not conduct electricity through their bulk, but electrons move freely along their surfaces or edges.

This surface conduction will persist, unhindered by material imperfections, as long as you do not do something drastic like changing the entire atomic structure of the material.

Moreover, currents on the surfaces or edges of a topological insulator have a set direction (depending on the electron spin), again enforced by the topological nature of the electronic structure.

Such topological features can have very useful applications, and topology has become one of the frontiers of materials science.

Aside from identifying topological materials in nature, parallel research efforts focus on designing synthetic topological materials from the bottom up. Topological edge states of mechanical structures known as 'metamaterials' present unmatched opportunities for achieving reliable responses in wave guiding, sensing, computation and filtering.

Research in this area is slowed down by the lack of experimental ways to investigate the topological nature of a system.

The necessity of matching a mathematical model to a physical system limits research to materials for which we already have a theoretical description, and forms a bottleneck for identifying and designing topological materials.

To tackle this issue, Xiaofei Guo and Corentin Coulais of the Machine Materials Laboratory at the University of Amsterdam teamed up with Marcelo Guzmán, David Carpentier and Denis Bartolo of ENS Lyon.

"Until now, most experiments were intended to prove theories or showcase theoretical predictions in journals.

"We found a way to measure topologically protected soft or fragile spots in unknown mechanical metamaterials without the need for modelling. Our approach allows for practical exploration and characterisation of material properties without delving into complex theoretical frameworks," says Guo.

The researchers demonstrated their method with mechanical metamaterials consisting of a network of rotors (rigid rods which can rotate) connected by elastic springs.

Long-term wearable robots with EMG tech

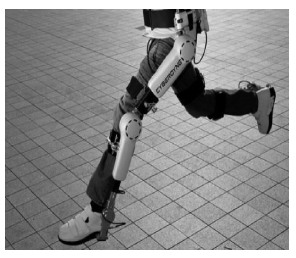
New electromyography (EMG) sensor technology that allows the long-term stable control of wearable robots and is not affected by the wearer's sweat and dead skin has gained attention recently. Wearable robots are devices used across a variety of rehabilitation treatments for the elderly and patients recovering from stroke or trauma.

A joint research team led by Professor Jae-Woong Jung from the KAIST School of Electrical Engineering (EE) and Professor Jung Kim from the KAIST Department of Mechanical Engineering (ME) announced that they have successfully developed a stretchable and adhesive microneedle sensor that can electrically sense physiological signals at a high level without being affected by the state of the user's skin.

For wearable robots to recognize the intentions behind human movement for their use in rehabilitation treatment, they require a wearable electrophysiological sensor that gives precise EMG measurements.

However, existing sensors often show deteriorating signal quality over time and are greatly affected by the user's skin conditions.

Furthermore, the sensor's higher mechanical hardness causes noise since the contact surface



is unable to keep up with the deformation of the skin.

These shortcomings limit the reliable, long-term control of wearable robots.

However, the recently developed technology is expected to allow long-term and high-quality EMG measurements as it uses a stretchable and adhesive conducting substrate integrated with microneedle arrays that can easily penetrate the stratum corneum without causing discomfort.

Through its excellent performance, the sensor is anticipated to be able to stably control wearable robots over a long period of time regardless of the wearer's changing skin conditions and without the need for a preparation step that removes sweat and dead cells from the surface of their skin.

The research team created a stretchable and adhesive microneedle sensor by integrating microneedles into a soft silicon polymer substrate.

The hard microneedles penetrate through the stratum corneum, which has high electrical resistance.

As a result, the sensor can effectively lower contact resistance with the skin and obtain high-quality electrophysiological signals regardless of contamination.

At the same time, the soft and adhesive conducting substrate can adapt to the skin's surface that stretches with the wearer's movement, providing a comfortable fit and minimizing noise caused by movement.

To verify the usability of the new patch, the research team conducted a motion assistance experiment using a wearable robot.

They attached the microneedle patch on a user's leg, where it could sense the electrical signals generated by the muscle.

The sensor then sent the detected intention to a wearable robot, allowing the robot to help the wearer lift a heavy object more easily.

Professor Jae-Woong Jung, who led the research, said, "The developed stretchable and adhesive microneedle sensor can stability detect EMG signals without being affected by the state of a user's skin. Through this, we will be able to control wearable robots with higher precision and stability, which will help the rehabilitation of patients who use robots."

Researchers unveil steps to counter mobile hacking

Computer science researchers have developed a new way to identify security weaknesses that leave people vulnerable to account takeover attacks, where a hacker gains unauthorised access to online accounts.

Most mobiles are now home to a complex ecosystem of interconnected operating software and Apps, and as the connections between online services has increased, so have the possibilities for hackers to exploit the security weaknesses, often with disastrous consequences for their owner.

Dr Luca Arnaboldi, from the University of Birmingham's School of Computer Science, explains: "The ruse of looking over someone's shoulder to find out their PIN is well known. However, the end game for the attacker is to gain access to the Apps, which store a wealth of personal information and can provide access to accounts such as Amazon, Google, X, Apple Pay, and even bank accounts."

To understand and prevent these attacks, researchers had to get into the mind of the hacker, who can build a complex attack by combining smaller tactical steps.

Dr Luca Arnaboldi worked with Professor David Aspinall from the University of Edinburgh, Dr Christina Kolb from the University of Twente, and Dr Sasa Radomirovic from the University of Surrey to define a way of cataloguing security vulnerabilities and modelling account takeover attacks, by

reducing them their constituent building blocks.

Until now, security vulnerabilities have been studied using 'account access graphs', which shows the phone, the SIM card, the Apps, and the security features that limit each stage of access.

However, account access graphs do not model account takeovers, where an attacker disconnects a device, or an App, from the account ecosystem by, for instance, by taking out the SIM card and putting it into a second phone.

As SMS messages will be visible on the second phone, the attacker can then use SMS-driven password recovery methods.

The researchers overcame this obstacle by developing a new way to model how account access changes as devices, SIM cards, or Apps are disconnected from the account ecosystem.

Their method, which is based on the formal logic used by mathematicians and philosophers, captures the choices faced by a hacker who has access to the mobile phone and the PIN.

The researchers expect this approach, which is published in the Proceedings of the 28th European Symposium on Research in Computer Security (ESORICS 23), to be adopted device manufacturers and App developers who wish to catalogue vulnerabilities, and further their understanding of complex hacking attacks.

The published account also details how the researchers tested their approach against claims made in a media , which speculated that an attack strategy used to access data and bank accounts on an iPhone could be replicated on Android, even though no such attacks were reported.

Apps for Android are installed from the Play Store, and installation requires a Google account, and the researchers found that this connection provides some protection against attacks.

Their work also suggested a security fix for iPhone.

Dr Arnaboldi said: "The results of our simulations showed the attack strategies used by iPhone hackers to access Apple Pay could not be used to access Android Pay on Android, due to security features on the Google account. The simulations also suggested a security fix for iPhone - requiring the use of a previous password as well as a pin, a simple choice that most users would welcome."

Cloud data security based on quantum physics

Distributed cloud storage is a hot topic for security researchers around the globe pursuing secure data storage, and a team in China is now merging quantum physics with mature cryptography and storage techniques to achieve a cost-effective cloud storage solution.

Shamir's secret sharing, a known method, is a key distribution algorithm. It involves distributing private information to a group so that "the secret" can be revealed only when a majority pools their knowledge.

It's common to combine quantum key distribution (QKD) and Shamir's secret sharing algorithm for secure storage - at an utmost security level. But utmost security solutions tend to bring substantial cost baggage, including significant cloud storage space requirements.

The team presented its method that uses quantum random numbers as encryption keys, disperses the keys via Sharmir's secret sharing algorithm, applies erasure coding within ciphertext, and securely transmits the data through QKD-protected networks to distributed clouds.

Their method not only provides quantum security to the entire system but also offers fault tolerance and efficient storage - and this may help speed the adoption of quantum technologies.

"In essence, our solution is quantum-secure and serves as a practical application of the fusion between quantum

and cryptography technologies," said corresponding author Yong Zhao, vice president of QuantumCTek Co. Ltd., a quantum information technology company.

"QKD-generated keys secure both user data uploads to servers and data transmissions to dispersed cloud storage nodes."

The team explored whether quantum security services could expand beyond secure data transmission to offer a richer spectrum of quantum security applications such as data storage and processing.

They came up with a more secure and cost-effective fault-tolerant cloud storage solution.

"It not only achieves quantum security but also saves storage space when compared to traditional mirroring methods or ones based on Shamir's secret sharing, which is commonly used for distributed management of sensitive data," said Zhao.When the team ran the solution through experimental tests ranging from encryption/decryption, key preservation, and data storage, it proved to be effective.The solution is currently feasible from both technological and engineering perspectives: It meets the requirement for relevant quantum and cryptographic standards to ensure a secure storage solution capable of withstanding the challenges posed by quantum computing.

E- AUCTION NOTICE
(Damaged stock of various TYPE Of CHEMICALS)

E- Auction forms are invited from interested buyers for disposal, strictly on "as is where is" basis, on 'Lump-sum basis', for salvage " **Flood Damaged different type chemicals of Approx 473.83 MT** survey handled by: (Mack IS&LA Pvt. Ltd.), Salvage of the above materialscan be inspected at **M/s Sriraam Chemicals Private Ltd.**, D NO-4/100, Thiruvika Nagar, Kandasamypuram, Tuticorin, Thoothukudi, Tamil Nadu between **14/02/24** to **21/02/24**, after taking prior appointment from Mr. Nitin Kumar 8810331841. E-Auction to be held on **22/02/24**. For E-Auction forms, Contact Ms. Khushi at Mob:- 9990857386 of:

Salvor Settlers Private Limited (Auctioneers)

Address:- 203, 2nd Floor, Usha Kiran Building, Azadpur Commercial Complex, Delhi-110033 or download from website: **www.salvorsettlers.com.** Last date for submission of E-Auction form is **22.02.2024** before 12.30 P.M.

Learning from insects to improve comp efficiency

With a brain the size of a pinhead, insects perform fantastic navigational feats. They avoid obstacles and move through small openings. How do they do this, with their limited brain power? Understanding the inner workings of an insect's brain can help us in our search towards energy-efficient computing, physicist Elisabetta Chicca of the University of Groningen demonstrates with her most recent result: a robot that acts like an insect.

It's not easy to make use of the images that come in through your eyes, when deciding what your feet or wings should do. A key aspect here is the apparent motion of things as you move.

"Like when you're on a train. The trees nearby appear to move faster than the houses far away," Chicca explains.

Insects use this information to infer how far away things are. This works well when moving in a straight line, but reality is not that simple.

Moving in curves makes the problem too complex for insects. To keep things manageable for their limited brainpower, they adjust their behaviour: they fly in a straight line, make a turn, then make another straight line.

Chicca explains: "What we learn from this is: if you don't have enough resources, you can simplify the problem with your behaviour."

In search of the neural mechanism that drives insect behaviour, PhD student Thorben Schoepe developed a model of its neuronal activity and a small robot that uses this model to navigate.

All this was done under Chicca's supervision, and in close collaboration with neurobiologist Martin Egelhaaf of Bielefeld University, who helped to identify the insects' computational principles.

Schoepe's model is based on one main principle: always steer towards the area with the least apparent motion.

He had his robot drive through a long 'corridor' - consisting of two walls with a random print on it - and the robot centred in the middle of the corridor, as insects tend to do.

SHIVALIK SMALL FINANCE BANK LTD.
Registered Office : 501, Salcon Aurum, Jasola District Centre, New Delhi - 110025
CIN : U65900DL2020PLC366027

AUCTION NOTICE

The following borrowers of Shivalik Small Finance Bank Ltd. are hereby informed that Gold Loan/s availed by them from the Bank have not been adjusted by them despite various demands and notices including individual notices issued by the Bank. All borrowers are hereby informed that it has been decided to auction the Gold ornaments kept as security with the Bank and accordingly **28.02.24** has been fixed as the date of auction at **12:00 noon** in the branch premises from where the loan was availed. All, including the borrowers, account holders and public at large can participate in this auction on as per the terms and conditions of auction.

Branch	Account No.	Actt Holder name	Father's/ Spouse Name	Address	Ac opening Date	Payoff
CHENNAI	101042518040	ARVINDYADAV NAMMALWAR	C/O NAMMALWAR	NO39B, 6TH STREET,,PERIYAR NAGAR MADIPAKKAM CHENNAI TAMIL NADU 600091	27-09-2023	215981.00
CHENNAI	101042518061	ARVINDYADAV NAMMALWAR	C/O NAMMALWAR	NO39B, 6TH STREET,,PERIYAR NAGAR MADIPAKKAM CHENNAI TAMIL NADU 600091	28-09-2023	64651.85
CHENNAI	101042518351	C LAKSHMIPATHI	S/O CHANDRAN	290, N S K NAGAR 15TH STREET,ARUMBAKKAM, CHENNAI TAMIL NADU 600106	12-10-2023	50671.30
CHENNAI	101042518950	C LAKSHMIPATHI	S/O CHANDRAN	290, N S K NAGAR 15TH STREET,ARUMBAKKAM, CHENNAI TAMIL NADU 600106	18-11-2023	26669.67
INDORE	101042519289	C LAKSHMIPATHI	S/O CHANDRAN	290, N S K NAGAR 15TH STREET,ARUMBAKKAM, CHENNAI TAMIL NADU 600106	08-12-2023	115225.12
CHENNAI	101042518363	DINESH K G	C/O GOPINATH	19 20 POONDI THANGAMMAL 1ST STREET NEW WASHERMENPET TONDIARPET CHENNAI TAMIL NADU 600081	13-10-2023	91009.46
CHENNAI	104142510142	DINESH K G	C/O GOPINATH	19 20 POONDI THANGAMMAL 1ST STREET NEW WASHERMENPET TONDIARPET CHENNAI TAMIL NADU 600081	23-01-2024	95784.92
CHENNAI	101042518189	K DINESH	S/O KARUPPATHEVAN	1 17 VEMBULI AMMAN KOVIL,STREET EXTN BRINDAVAN NAGAR ,PAZHAVANTHANGAL KANCHEEPURAM TAMIL NADU 600114	05-10-2023	78174.47
CHENNAI	101042516286	NAGESHWAREN KOTHANDAPANI	S/O KOTHANDAPANI	1 260 B,VANDALUR, NATESAN STREET, VANDALUR,KANCHEEPURAM,NEAR NATESAN PALACE CHENGALPATTU TAMIL NADU 600048	08-06-2023	93401.14

Auction date is 28.02.24 @12:00 Noon.

The Bank reserves the right to delete any account from the auction or cancel the auction without any prior notice.

Authorised Officer, Shivalik Small Finance Bank Ltd.