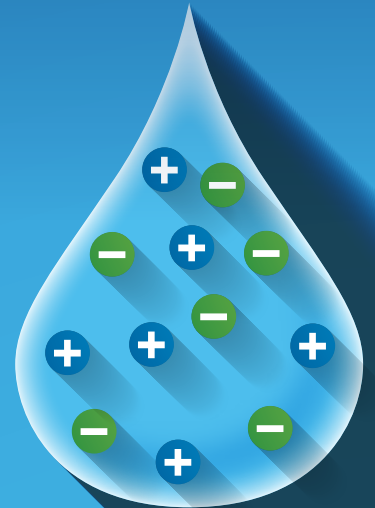
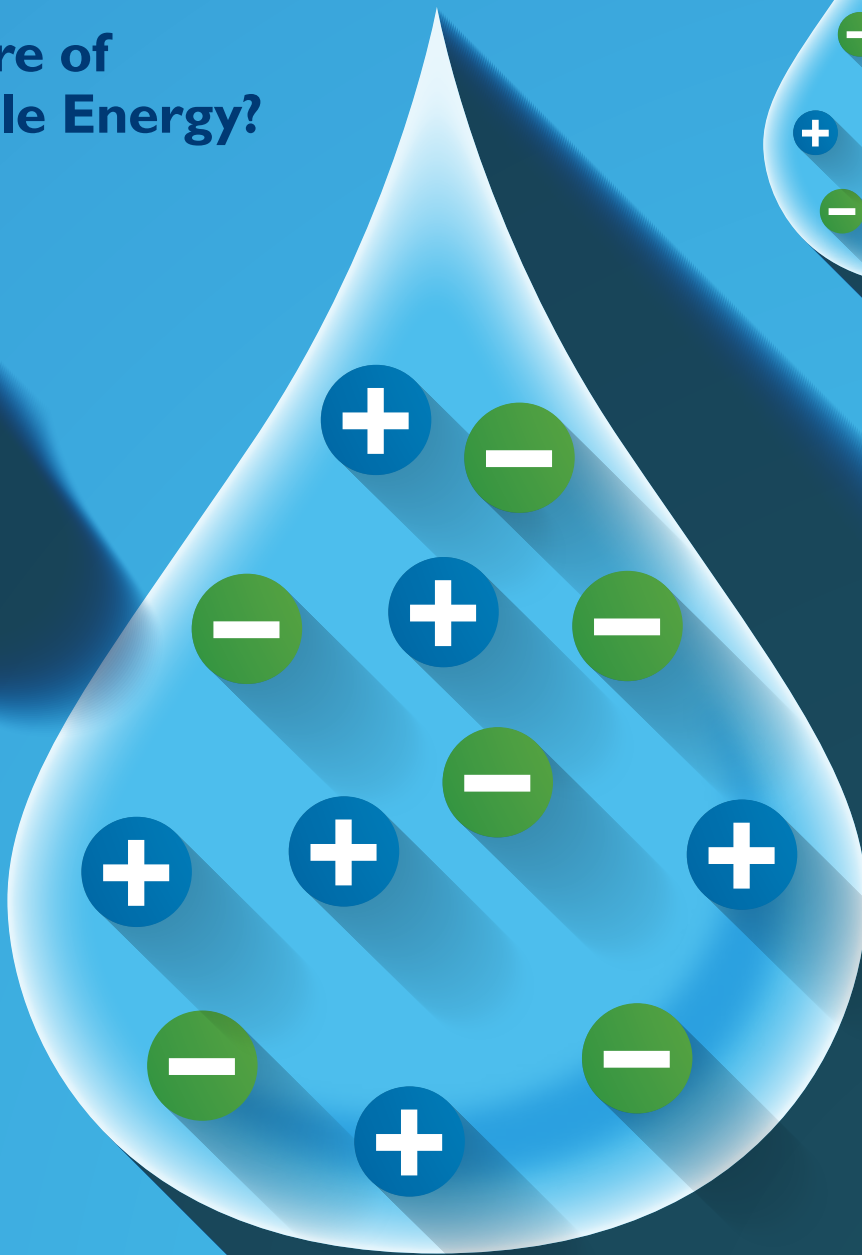
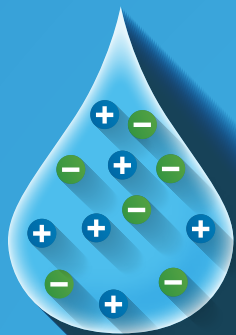


e-fuel

The Future of
Sustainable Energy?



SENG
SCHOOL OF
ENGINEERING

THE HONG KONG UNIVERSITY OF
SCIENCE AND TECHNOLOGY

CONTENTS

SPRING 2018 | NO.29

5

France-HKUST
Innovation Hub
Forging closer ties
with French industry

18

Speeding toward a
driverless future
Robotics researchers develop
novel autonomous vehicle
control system

6

Fueling change
Pioneering an electrically
rechargeable liquid fuel
and energy storage system

20

Different ways to make
a difference
Three students and their
community endeavors

10

The single-cell detective
Bioengineering techniques
that profile individual cells
with greater accuracy

30

Sweet smell of success
Alumni connections
foster graduate start-up

HKUST Engineering
In Focus Magazine
sengpr@ust.hk
(852) 2358 5917
infocus.ust.hk

Published by:
Communications and External Affairs
School of Engineering
The Hong Kong University of
Science and Technology

Editors: Diana Liu, Dorothy Yip
Contributing Editor: Sally Course
Designer: Kingsley Lau

16

All the right connections
Electronic and computer
engineer's inspirational
campus home

 [hkustengineering](#)
 [hkustengineering](#)
 [seng.ust.hk](#)





A world-changing impact

Welcome to the new-look *In Focus*, which is evolving in content and design in line with the School of Engineering's own advances.

As reported in this edition, we have initiated major developments in the School in past months. These significant changes have seen the realignment of departments and divisions to ensure our engineering education and research remain at the forefront globally. The moves have embraced exciting emerging fields: integrative systems and design; decision analytics; and biological engineering. All will have key roles to play, regionally and beyond, and this Fall we will be launching four undergraduate majors in these and other timely areas to foster the talent pool required. Among them is Hong Kong's first practicum-led, project-driven bachelor program, deployed with new pedagogical approaches, which seeks to train the next generation of innovators and entrepreneurs.

The School aspires not only to be an international leader in the academic arena but also to make a world-changing impact on society. As a relatively compact quality engineering school in terms of numbers, strategic focus is a must. But with core strengths in pivotal drivers, such as robotics and autonomous systems, artificial intelligence and big data, smart cities, and energy, we are well positioned to enhance our footprint globally.

To do so, we expect to foster more alumni-built or faculty-enabled high-impact companies such as DJI, now the global market leader in easy-to-use consumer drones. We will be continuing our active co-operation with industry and engagement with the community, as well as expanding our presence through joint collaborations and strategic partnerships. We will be growing our faculty team by about 10% in the next two to three years. And are committed to gender and multicultural diversity, and a multidisciplinary mindset, among faculty and students. Already, I am happy to report, our assistant professor team of young rising stars is 33% female.

Such concrete steps, along with more physical experimental areas for faculty and shared space for students from different disciplines to engage in discussions, will provide an environment that naturally lends itself to innovation, developing a robust culture for the long term. It all indicates an exhilarating future and I hope you will share it with us. Read on to find out more!

Prof Tim Kwang Ting Cheng
Dean of Engineering

Leading the way at HKUST



President-designate and Acting President
Prof Wei Shyy.

Prof Wei Shyy, Executive Vice-President and Provost, and Chair Professor of Mechanical and Aerospace Engineering, has been appointed HKUST's next President. He will take office on September 1, 2018, succeeding Prof Tony F Chan.

Prof Shyy joined HKUST in 2010 from the University of Michigan in the US, where he was Clarence L "Kelly" Johnson Collegiate Professor and the Department Chair of Aerospace Engineering. At HKUST, he has been a keen advocate for broadening the University's educational scope and advancing research and knowledge transfer. As President, his job would be to help colleagues and students to fulfil the University's goals and mission so that HKUST can "truly become a globally leading higher learning institution", he said. Prof Shyy is currently serving as Acting President.

Born and raised in Taiwan, Prof Shyy received his BS degree from Tsing Hua University in Taiwan, and his master's and doctoral degrees in Aerospace Engineering from the University of Michigan. He is a Fellow of the American Institute of Aeronautics and Astronautics (AIAA) and the American Society of Mechanical Engineers (ASME). He is also a winner of the AIAA Pendray Aerospace Literature Award, among other major honors.

Research interests include computational fluid dynamics, energy and power, heat/mass transfer, and biological and micro air vehicles. In line with Prof Shyy's focus on aerospace engineering, he is also a keen bird photographer.

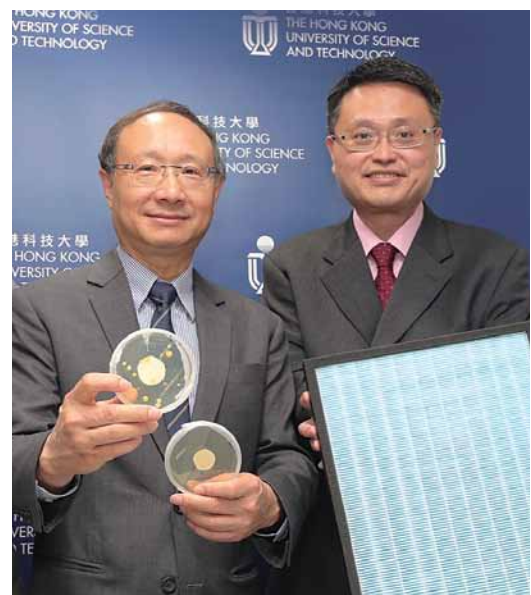
Innovative weapon in fight against flu

HKUST researchers have created a new weapon in the fight against the deadly Middle East Respiratory Syndrome Coronavirus (MERS-Cov), and influenza H1N1 and H3N2, with the development of an air purification system that removes close to 100% of airborne bacteria and viruses. The technology is now available as a household purifier on the retail market.

The air purification system was shown in tests to be effective in eliminating nearly 99% of MERS-Cov, 99.999% of H1N1, over 99% of H3N2, and 99% of EV71, a cause of hand-foot-and-mouth disease, as well as other bacteria. The technology comprises a multi-level antimicrobial filter covered in a microcapsule emulsion containing a biocide. As air passes through the filter, the biocide destroys airborne micro-organisms, the anti-adhesion coating stops germs sticking on to the filter's surface preventing the growth of micro-organisms, and slow, continuous release of disinfectants helps sterilize bacteria.

The research was led by Prof King Lun Yeung, Associate Dean of Engineering (Research and Graduate Studies), together with Prof Joseph Kwan, Director of HKUST's Health, Safety and Environment Office.

Clearing the air: Prof Joseph Kwan (left) holding bacterial samples and Prof King Lun Yeung with HKUST's antimicrobial-coated air filter.



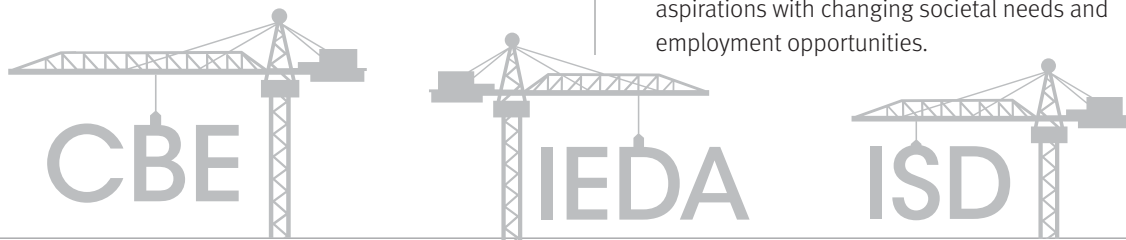
Designs on the future

The School of Engineering (SENG) has responded to today's rapidly evolving engineering landscape with a trio of far-sighted moves to embrace emerging fields in both its teaching and research.

The Division of Integrative Systems and Design (ISD, 綜合系統與設計學部), established in November 2017, aims to provide differentiated learning opportunities for students and develop their competencies in integrative systems design, design thinking and entrepreneurship. In a pioneering engineering education initiative, the Division will offer an undergraduate major in 2018-19, fusing systems and design through a practicum-led and learner-centric curriculum. The program will equip students with design fundamentals, internship experience, and use large-scale industry-supported capstones as teaching vehicles to prepare them for real-world multidisciplinary innovation of the future.

The Division of Biomedical Engineering, previously under the Interdisciplinary Programs Office, and SENG's Department of Chemical and Biomolecular Engineering have merged to become the Department of Chemical and Biological Engineering (CBE, 化學及生物工程學系), hosted by SENG. The merged department will seek to develop a new interdisciplinary undergraduate bioengineering program as well as consolidate existing ones. The Department of Industrial Engineering and Logistics Management has been renamed the Department of Industrial Engineering and Decision Analytics (IEDA, 工業工程及決策分析學系) to reflect a greater emphasis on predictive and prescriptive analytics, which are expected to play an increasingly significant role in the 21st century.

Dean of Engineering Prof Tim Kwang Ting Cheng said the different adjustments would all help to align students' aspirations with changing societal needs and employment opportunities.



First Chinese president of international soil society

A top Civil and Environmental Engineering academic has become the first from Greater China to be elected President of the International Society for Soil Mechanics and Geotechnical Engineering (ISSMGE), the leading professional body for geotechnical engineers, academics and contractors globally.

CLP Holdings Professor of Sustainability Prof Charles W W Ng, Chair Professor of Civil and Environmental Engineering and HKUST Associate Vice-President for Research and Graduate Studies, is a world authority on unsaturated soil mechanics, slope stability and sustainability. He has served on the ISSMGE board since 2010 in a range of roles. "As president, I am setting my sights on education, innovation and diversity," Prof Ng said. His term will run until 2021.

Prof Ng is a Fellow of the Institution of Civil Engineers (ICE), American Society of Civil Engineers, Hong Kong Institution of Engineers and Hong Kong Academy of Engineering

Sciences. His many awards include China's State Scientific and Technological Progress Award (Second Class) in 2015, ICE's Telford Premium Award in 2017, and the Prix R M Quigley Award from the Canadian Geotechnical Society three times, in 2008, 2013 and 2017.

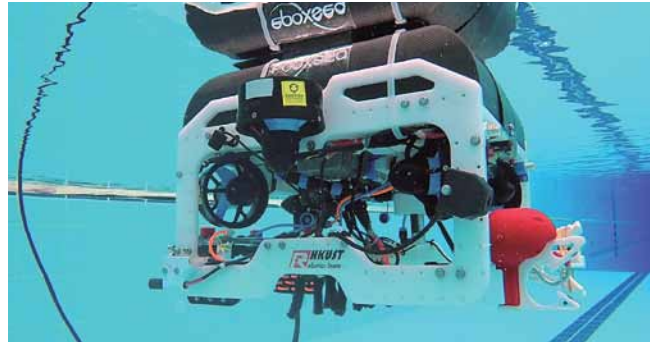


Incoming President of ISSMGE Prof Charles W W Ng introduced by outgoing President Prof Roger Frank (France).

Creating waves

The HKUST Robotics Team made an international splash when members of its Remotely Operated Vehicle (ROV) sub-team became the first Asian contestant to win the world championship of the Marine Advanced Technology Education (MATE) International ROV Competition 2017 (see also P24-25). The team became Hong Kong's representative in the global competition in Long Beach, California, after winning the regional contest.

The inaugural MATE International ROV Competition was held in 2002, with HKUST participating for the first time in 2011. The theme selected for the 2017 contest was "Port Cities of the Future" and how to ensure their safety. Contestants had to complete tasks on hyperloop construction, light and water show maintenance, environmental clean-up and risk mitigation underwater within 15 minutes as well as prepare promotional materials, technical and safety reports, and a presentation on their ideas. The HKUST ROV team, comprising 15



HKUST students' world-beating "Beluga" remotely operated underwater vehicle had the benefit of input from multicultural team members from 10 different parts of the globe.

engineering undergraduates from different disciplines and backgrounds, had to compete against more than 20 other regional contest winners to take the title.

Overall, the HKUST Robotics Team received nine accolades in different competitions in 2017, including winning the annual Robocon Hong Kong Contest for the eighth time.

Novel bathing chair for elderly

With the growing challenge of aging populations globally, an innovative "Sit & Shower" chair, specifically designed to enable seniors to bathe safely, comfortably, and more independently, has been designed and brought to market by Prof Neville Lee, Associate Professor Emeritus, Industrial Engineering and Decision Analytics, and departmental alumni Albert Chan and Jacky Chow, 2006 MPhil.

The cost-effective, fully automated bathing chair is equipped with dual shower and toileting functions. An open design makes it easy to get in and out, with angled water jets to avoid splashing and an internal thermometer to ensure the water never gets too hot.

In designing the chair, the team carried out extensive research with social workers and frontline caregivers. It can be installed in most bathrooms without modification or removing existing fittings and enables elderly people to retain independence in the highly private activity of bathing, Prof Lee said. In addition, the novel shower can save carers' time by allowing a senior to bathe on their own. More details are available at www.sitnshower.com.



Designed to help seniors shower independently.

Advancing AI and cybersecurity

Two new laboratories are keeping HKUST at the cutting edge of the computer field.

Following the signing of a memorandum of understanding in December 2017, a joint lab on artificial intelligence (AI) and computer vision is to be established by HKUST and Megvii, a Beijing-based pioneer in computer vision and deep learning, commonly known as Face++. The lab, led by Prof Long Quan, Computer Science and Engineering, will look into research on AI, computer vision, 3D reconstruction, and image analysis, recognition and understanding.

In addition, Hong Kong's first major university Cybersecurity Laboratory, dedicated to research into online security, has been established at HKUST. The lab, directed by Prof Charles Zhang, Computer Science and Engineering, will develop a wide range of methods and tools to fight cyber threats and explore security, privacy, and cryptography issues.

C'est une très bonne idée!

France-HKUST Innovation Hub to spark closer ties with French industry

In an international partnership initiative to build technological research and entrepreneurship across borders, HKUST and the Consulate General of France in Hong Kong & Macau have joined together to form the France-HKUST Innovation Hub. The hub seeks to provide a one-stop platform to encourage ties between French and Hong Kong partners in education, science, technology and entrepreneurship, serving initially as an incubator of ideas and opportunities; and in the longer term as a catalyst for research and development projects within HKUST.

The move builds on earlier successful projects between French companies and the University, including smart city research together with Thales, a major French aerospace and transportation company, and a collaboration between Schneider Electric, a French energy management and automation specialist with global reach, and the HKUST-MIT Research Alliance Consortium.

Leaders from both the University and Consulate were delighted by the development. HKUST President Prof Tony F Chan described the hub as “a great platform for both sides to collaborate and spur innovation and technology development in tandem with many French industries”. For Consul General Mr Eric Berti, the prospect of matching the talent of HKUST students with the experience and business culture of French industry to develop innovation, science and technology would be “very exciting”.

As an indication of the significance of the new center, Prof Jean-Pierre Bourguignon, President of the European Research Council, delivered the inaugural lecture at HKUST. His talk focused on “When Fundamental Discoveries Meet Daily Life”. The School of Engineering later invited Prof Laurent Boutillon, Scientific Director of Vinci Construction Grands Projets, to give a presentation on “Chernobyl’s New Sarcophagus”. This recent company project provided a pioneering confinement shelter to assist site clean-up at the Ukrainian nuclear power plant, which suffered a catastrophic explosion in 1986.

In October 2017, an executive delegation from Orange, a major French telecoms company, visited HKUST Robotics Institute and introduced the company’s innovation strategy. A quarterly hub newsletter has also been launched.



Strengthening links: Dean of Engineering Tim Kwang Ting Cheng (left), President Tony F Chan (center) and French Consul General Eric Berti (right) launch the enterprising joint technological research initiative.

Fueling change

A sustainable net zero community is the lifetime goal of Prof Tianshou Zhao, and his ground-breaking e-fuel energy storage system is set to power this quest forward

Cheong Ying Chan Professor of Engineering and Environment Prof Tianshou Zhao is well suited to the mission of pioneering alternative energy research. His own stored reserves of vim and vigor are seemingly inexhaustible as he powers on through each day, determined to realize his dream of one day ushering in a self-sustaining net zero energy community, with Hong Kong leading the way.

Such drive has seen Prof Zhao, Chair Professor of Mechanical and Aerospace Engineering and Director of the HKUST Energy Institute, receive HK\$50 million funding from the Hong Kong Research Grants Council to lead a five-year theme-based research project to develop a remarkable e-fuel storage system.



Charging ahead

The collaborative project is focused on electrically rechargeable liquid fuel (e-fuel), which will be designed by Prof Zhao and his researchers, an e-fuel charger and e-power pack. When still at the proposal stage, it was regarded as too amazing to be feasible. But following preliminary research to further establish the potential of the concept, the funding was forthcoming. Researchers from Chinese University of Hong Kong, University of Hong Kong, and Hong Kong Polytechnic University will also be involved.

“This is our brand-new concept: electrically rechargeable liquid fuel that is cost-effective, efficient and high energy. It will be like gasoline but instead of being a fossil fuel it will be renewable and environmentally benign”

“The e-fuel charger will electrochemically convert electricity into e-fuels, which can then be converted back into electricity for end use through using an e-fuel cell,” Prof Zhao said. “Wind and solar power can be converted to e-fuels and the e-fuels stored or transported to where they are needed without losing any quality.”

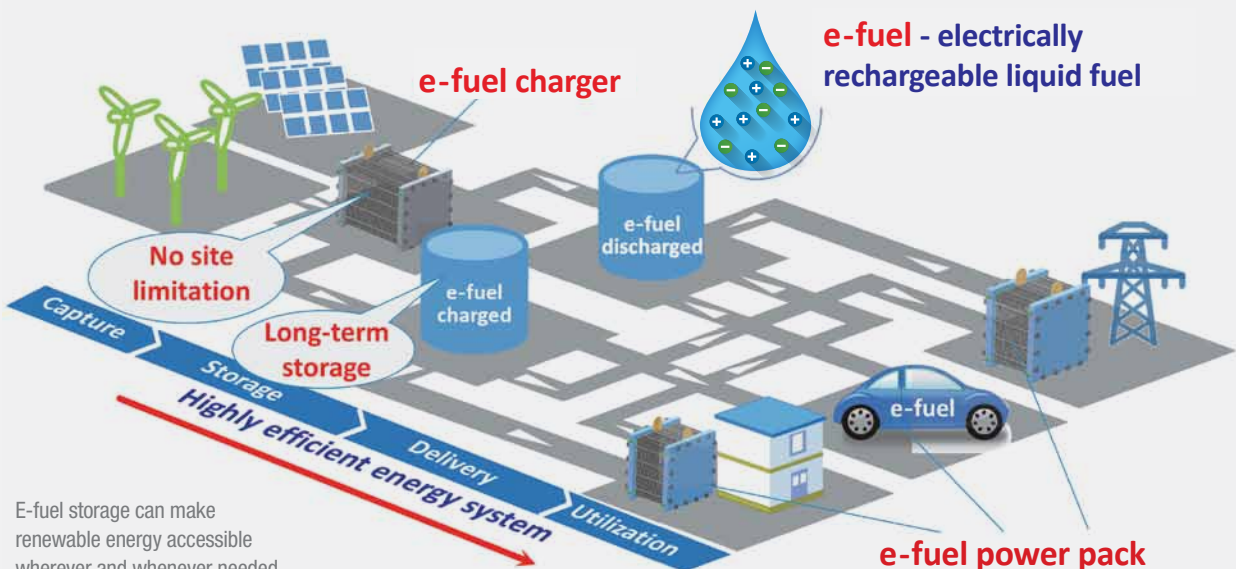
Currently, energy sources such as wind and solar contribute less than 5% of the global total. Among the greatest challenges to wider adoption is the intermittency problem – “the wind doesn’t always blow and the sun doesn’t always shine” Prof Zhao noted – and their site specific needs making storage and transport key issues.

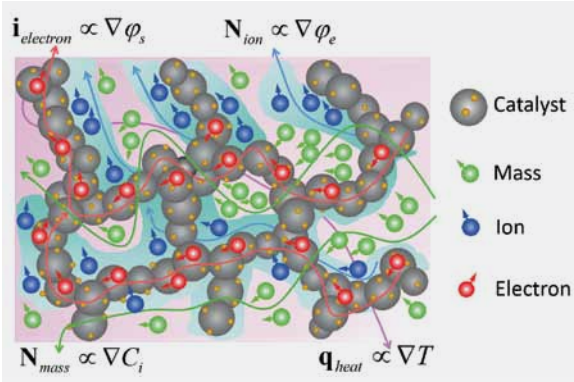
The project’s target is to provide an electricity-fuel-electricity conversion system with efficiencies reaching over 80%. Other benefits include electricity generated by e-fuel cells that can be integrated into the grid; an e-fuel storage system that can simultaneously store and release electricity forming a renewable power supply for off-grid communities; and possible use in next-generation vehicles, providing a refueling time close to gasoline. A demonstration site on the HKUST campus that will power the University’s own Energy Institute laboratory is also planned.

Renewable record-setter

Prof Zhao has already spent the past 20 years at HKUST making pioneering contributions to renewable energy storage devices, ranging from direct alcohol fuel cells to flow batteries and lithium-air batteries in a bid to boost solutions to air pollution and climate change caused by fossil fuels. What makes his research insights so special is his innovative interdisciplinary combination of electrochemistry and thermal-fluid science and his focus on energy storage to drive breakthroughs in theory and applications that can increase the use of renewables.

A revolutionary concept: e-fuel storage





Managing flows of electrons, ions, mass and heat as thermo-fluid science meets electrochemistry, enabling theoretical and application breakthroughs.

Achievements have included successfully revealing the underlying mechanism of coupled heat/mass transfer and electrochemical kinetics in direct alcohol fuel cells, establishing a new theoretical framework which has subsequently enabled much higher performances for both direct methanol and direct ethanol fuel cells. Prof Zhao and his research team have achieved methanol fuel cell performance with a power density of 200mW/cm², which is four times higher than the previous record; set a world record of 180mW/cm² for direct ethanol fuel cells; and created a laboratory fuel cell prototype that could power a model car for 10 hours on five cubic centimeters of fuel.

The significant impact of such cross-field insights has been widely recognized. Prof Zhao has been selected as a Highly Cited Researcher for four consecutive

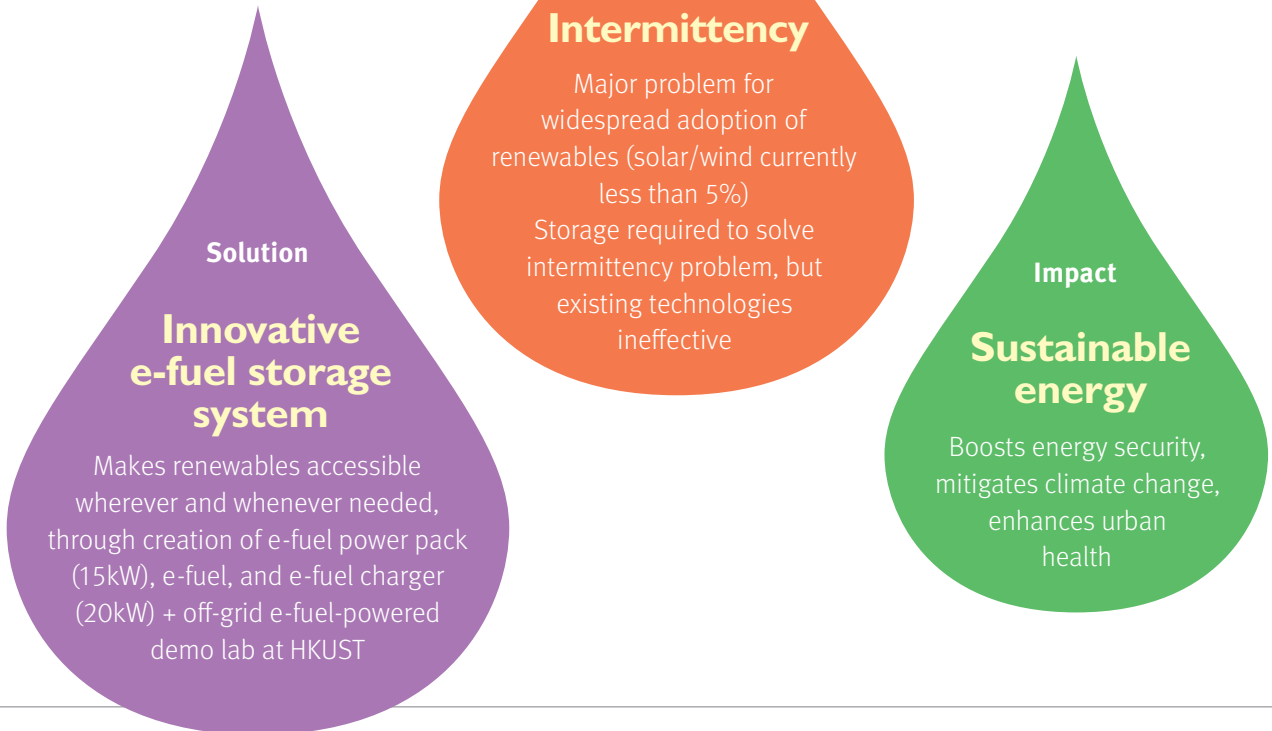
years from 2014-2017 (first three years run by Thomson Reuters and last year by Clarivate Analytics) and received a State Natural Science Award, one of China's highest scientific recognitions, for two consecutive years. He is a Fellow of the American Society of Mechanical Engineers as well as a Fellow of the Royal Society of Chemistry. His endeavors have also been supported by a Croucher Senior Research Fellowship, a prestigious Hong Kong accolade awarded to eminent academics to support a year's full-time research.

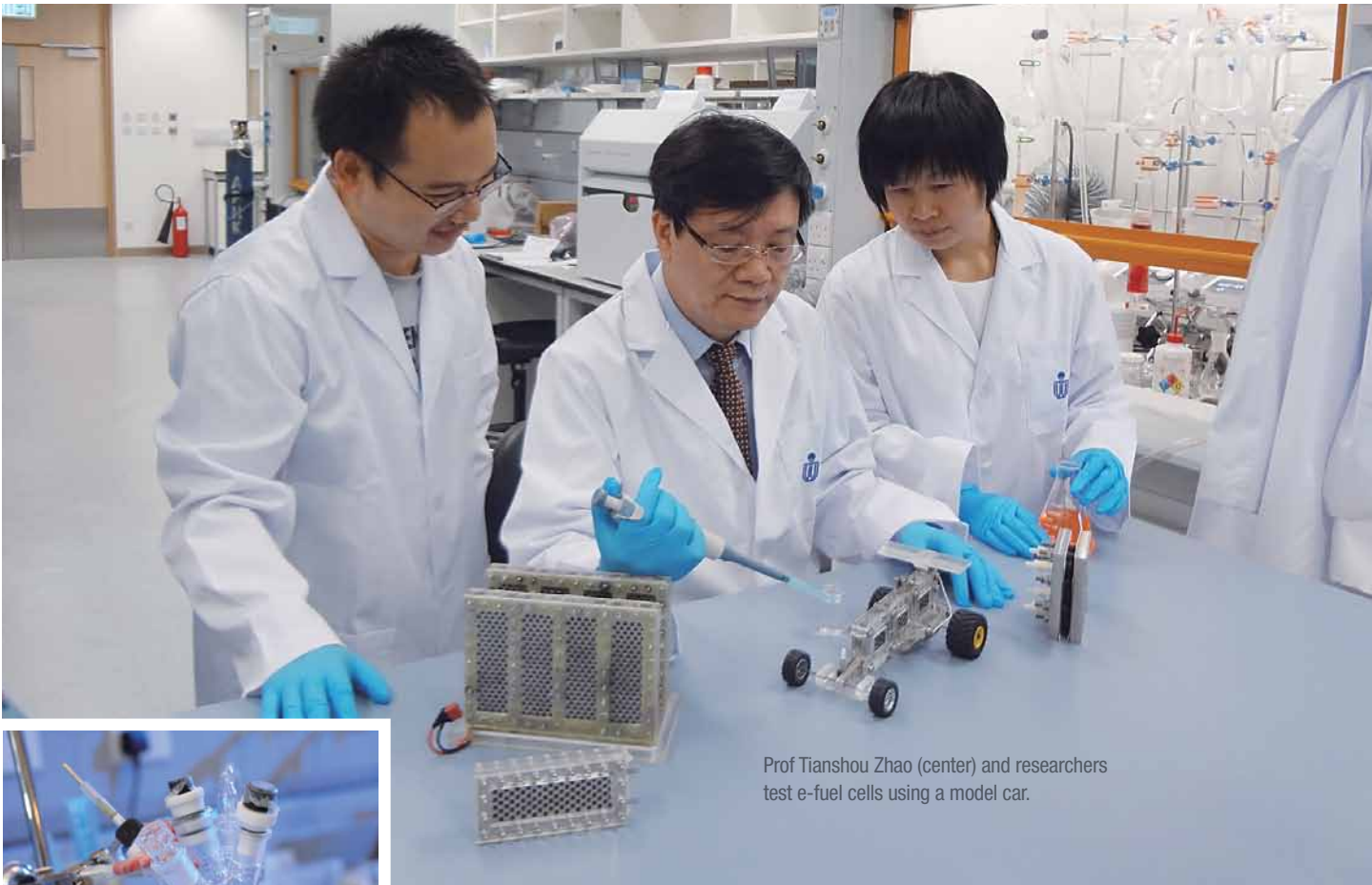
Inspirational force

In addition, his passion for his field has steered him to winning ways as an educator, as reflected in the many teaching honors that adorn his office wall. To inspire interest in thermodynamics among students, he uses his own research and examples from real life, such as boiling water, to introduce the concepts behind a particular phenomenon.

He himself was introduced to the idea of energy conversion at school and immediately felt an affinity for the subject. At Tianjin University, he studied thermophysics engineering at bachelor and master's levels. Later, to further his keen interest in heat transfer, he applied to take his doctoral degree in mechanical engineering at the University of Hawaii at Manoa, where one of the key people in the field was located. It proved to be a wonderful place to study amid spectacular surroundings, even though he spent most of his time in the lab and only occasionally went to beach.

Alternative power pioneer





Prof Tianshou Zhao (center) and researchers test e-fuel cells using a model car.



Characterizing the properties of e-fuels.

In 1995, he then swapped this fruitful and beautiful environment for another at HKUST, which was closer to his home town of Xian and offered the freedom to explore his life's goal of that net zero sustainable energy community. It has been time well spent as he has gradually built up a unique body of knowledge that may hold a vital key to unlocking the greater adoption of renewables.

In charting the genesis of his e-fuel storage system, Prof Zhao explained: "I had been mulling over and gradually piecing together all the knowledge I had gained over the past two decades and realized this was an exciting way to really drive such research and development forward. If we can realize our goals with our e-fuel storage system, we can really put Hong Kong on the map as a sustainable energy city."

Fresh light on our sustainable future



This University-wide multidisciplinary platform, led by Prof Tianshou Zhao, encompasses close to 90 core and affiliated faculty members, integrating and enabling energy-related research, development and education. Members of the Institute are investigating sustainable energy production, energy storage, and conservation, including biofuels, next-generation solar cells, Li-based batteries, energy-efficient technologies for green buildings and energy policy, among other areas. In addition, the Institute has developed Hong Kong's first bachelor program in sustainable energy engineering. The inaugural cohort will begin their studies in Fall 2018.

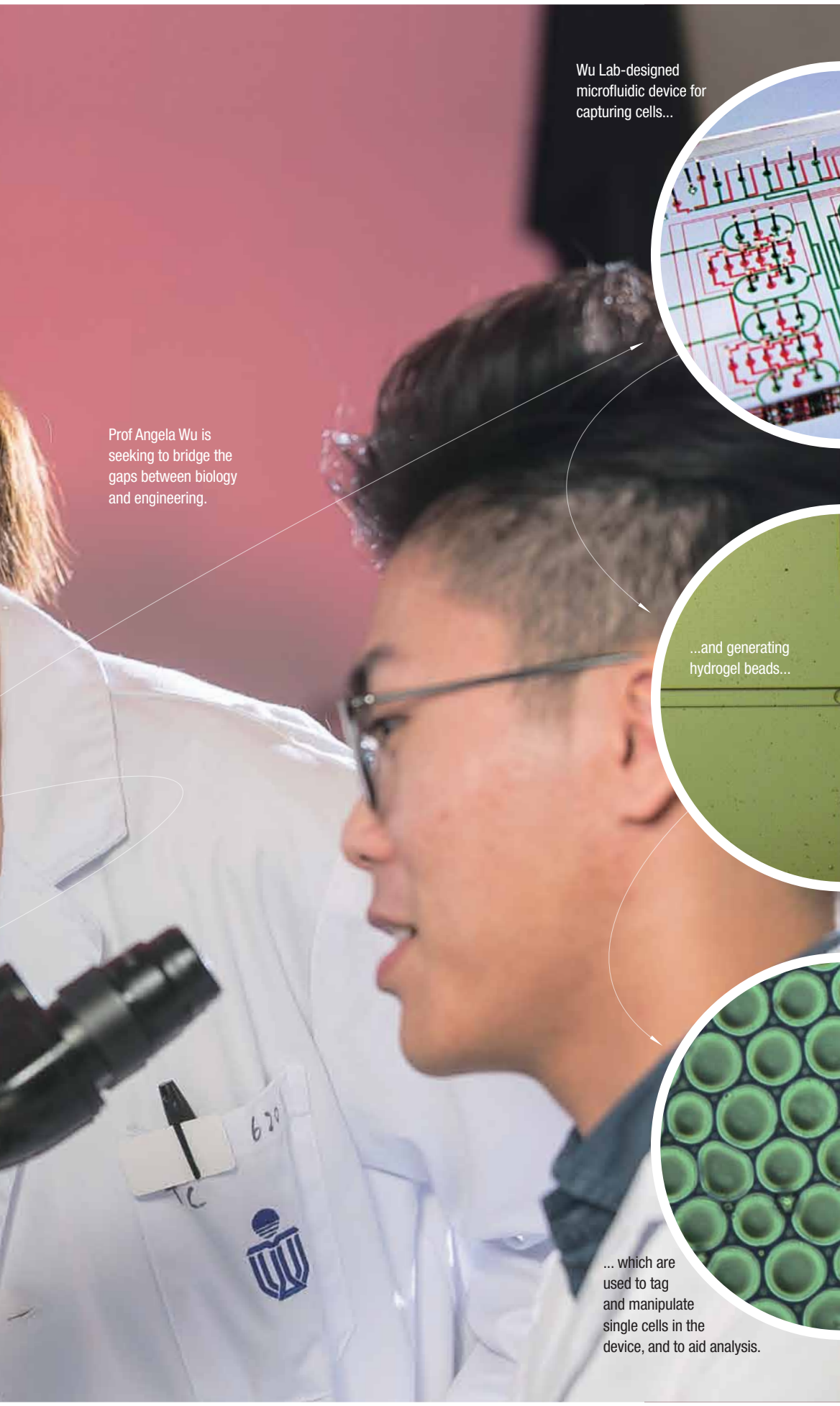


From basic research to visionary applications and education, the HKUST Energy Institute is advancing alternative solutions.

The single-cell detective

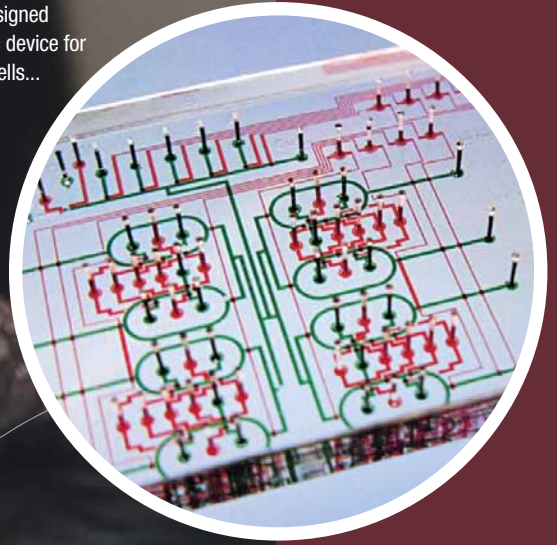
Prof Angela Ruohao Wu is hunting down the cells that cause cancer using novel bioengineering techniques that can profile individual cells with greater accuracy and sensitivity



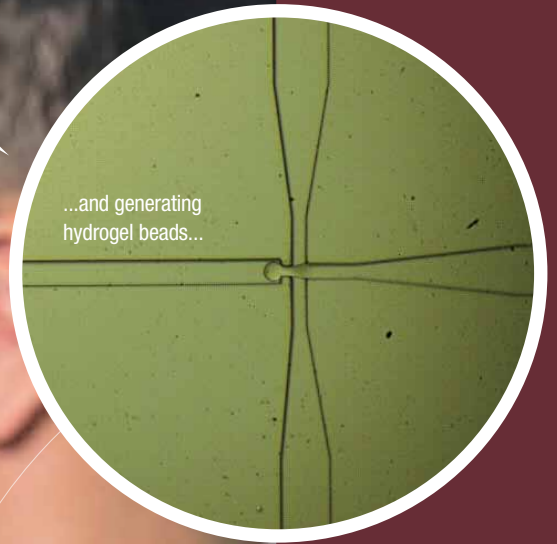


Prof Angela Wu is seeking to bridge the gaps between biology and engineering.

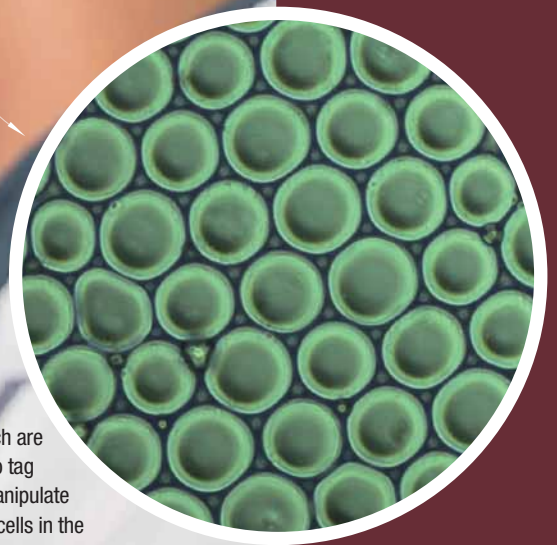
Wu Lab-designed microfluidic device for capturing cells...



...and generating hydrogel beads...



... which are used to tag and manipulate single cells in the device, and to aid analysis.



Rising academic star Prof Angela Ruohao Wu, Chemical and Biological Engineering, and her research into tumor initiation reveal her passion for engineering that makes a difference.

Where she is making that difference is in the cutting-edge emerging field of single-cell genomics and the design of microfluidic devices (“lab-on-a-chip”) that can isolate individual cells, enabling single-cell analysis of their genome and uncovering errors, including mutations. “Just as different people have different characteristics and play diverse roles in society, different cells have their own unique identities and functions in an organ. Traditionally, researchers take millions of cells from an organ and study their average genomic profile, which doesn’t say much about an individual cell,” she noted. Her work helps to provide the techniques to enable each cell to be located and identified to provide a “human cell atlas”, rather like a Google map.

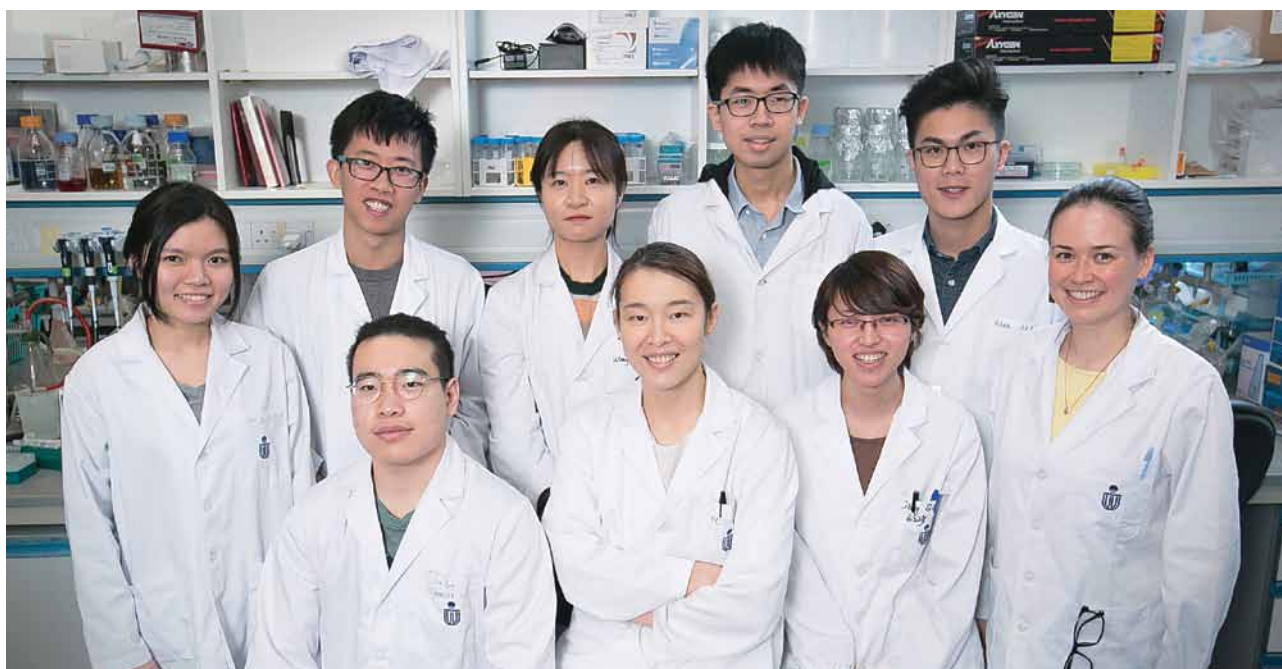
“What motivates me every day is the joy of working with my team to invent new technologies, and make discoveries about biology to help us fight diseases such as cancer”

“Even when the cells ‘go rogue’ and become pathological, for example in cancer, the diversity of cell types in tumors remains important at the individual cell level. To give us the location, function, and role of each individual cell, I design microfluidic devices to isolate individual cells,” she said. “We can then read and analyze their genome individually at the single-cell level and discover mistakes, such as mutations.”

Understanding cancer

While most one-cell researchers to date have explored DNA and RNA separately, Prof Wu and her team are seeking to make a unique contribution by studying them together, using a new technique that will provide a more complete set of information about a cell. What this technique could offer is the potential to learn more about the origins of the disease, for example, the fundamental reason – “big bang event” – that initiates a cancer tumor.

The Wu Lab team: one-cell researchers using novel technologies to study DNA and RNA together.



Prof Wu's findings should be generally applicable to many cancer types. "Currently, people who study cancer from the DNA mutation perspective have found evidence that cancer is a disease caused by these mutations. Those who study cancers and their growth have evidence that there may be a so-called cancer stem cell giving rise to the rest of the cancer. So far there is no way to directly connect these two phenomena," she said.

Bioengineering pioneer

Prof Wu was born in China and raised in the Mainland, Hong Kong, and Australia. She initially took up biology because her "tiger parents" thought it was a promising direction for a career. Before long, she had become utterly fascinated, leading her to the "eureka" moment during her first single-cell experiment where she saw individual cells being caught in each chamber inside a microfluidic biochip. "Wow, I'm one of the very first people to do this," she recalled thinking. "It was really exciting."

She studied for her bachelor degree in bioengineering at the University of California, Berkeley and for her master's and doctoral degrees in the same field at Stanford University. At Stanford she was supervised by Prof Stephen Quake, a leading figure in genomics, biophysics and bioengineering technologies that facilitate rapid analysis of the human genome and microfluidic automation. She was awarded the Bio-X Bowes Graduate Student Fellowship for interdisciplinary research and the Siebel Scholarship for top bioengineering graduates. As a postdoctoral fellow in the Quake lab, she was one of the first to come up with a framework for analyzing complex single-cell datasets.

Prof Wu joined HKUST in December 2015 as a faculty member. During interviews with Asian institutions, she found HKUST to have the most open and independent academic culture. She was also drawn to the international atmosphere, culturally diverse and productive faculty, dynamic students, and the University's spectacular campus.

Practical applications

With an ultimate goal of bridging gaps between biology and engineering, Prof Wu is not only working on basic research but also on practical ways to benefit healthcare. Her research team is developing DNA-based diagnostics for intensive care units together with Prince of Wales Hospital in Hong Kong and the Chinese University of Hong Kong. In addition, as the co-founder of Agenovir Corporation, a US start-up established in 2014, she is driving forward the use of genome editing technology to target and delete disease- and cancer-causing viruses inside the genome. In targeting destruction of viral DNA, the biomedical firm aims to remove viruses from the cell to make the cure permanent.

Prof Wu's contributions to the field of single-cell analysis technologies and her work at Agenovir were recognized internationally when she was named one of *MIT Technology Review's* Top 10 Innovators Under 35 in Asia in 2017. Her research has also been published in prestigious journals including *Nature*, *Nature Methods*, and *PLoS Genetics*.

With her passion for solving problems, Prof Wu finds engineering both rewarding and empowering. "When I am presented with challenges, it feels extra-good to overcome them," she said. "I hope more women will consider engineering as a career to change the status quo and to say, 'I can do it too'."

Team spirit and novel technologies

Prof Angela Wu considers the 2014 founding of Agenovir Corporation, together with her Stanford University PhD advisor Prof Stephen Quake and two other Stanford University affiliates, to be a milestone in her learning curve, providing insight into the importance of good communication, team spirit, respect for different perspectives and partners with complementary skill sets. Prof Wu still harbors a passion for bringing useful technologies to market to help patients, and her experience at Agenovir helped her explore how to translate academic concepts into a commercial setting. She hopes to continue her entrepreneurial pursuits in her career at HKUST.



Prof Pascale Fung, Electronic and Computer Engineering, is the creator of Zara the Supergirl, the world's first empathetic virtual robot, and HKUST's representative to the Partnership on AI to Benefit People and Society, launched by technology giants including Amazon, Google and Facebook. HKUST is the consortium's first Asian institutional member.



Watch the World Economic Forum video of Prof Pascale Fung discussing AI and robotics.

The ethics behind AI

By Prof Pascale Fung

After decades of research and development, artificial intelligence (AI) is now poised to disrupt every walk of human life: from finance to healthcare, retail to the creative industries, even to areas such as the future of work and society overall. Through the combined advancement of graphics processing unit platforms, big data, machine-learning algorithms and neural networks, AI has reached a tipping point.

At the same time, AI's increasing visibility has brought a certain unease about this "existential threat", perhaps most chillingly mooted through the "Singularity", a hypothetical future network of super-intelligent machines through which AI will overtake humans.

While to my mind, this long-term fear is unfounded, there are many near-term social issues regarding the safety, transparency, and security of AI technologies. Today, global organizations such as the Partnership on AI to Benefit People and Society, which HKUST joined in October 2017, are rightly starting initiatives on fair, accountable, transparent and explainable (FATE) AI. These involve setting standards and policies, implementing FATE measures, designing testing criteria, and more.

"The international exchange of ideas in AI in Asia must extend beyond the purely technical to discussions of social impact and ethical practices"

Asia, in particular China, South Korea and Japan, are major drivers of AI innovation while the continent's population size makes it the largest market for AI applications today and in the foreseeable future. Top Asian technology companies, such as Baidu, Alibaba, Tencent, Naver and Samsung are highly active in pushing cutting-edge AI research, with Asian consumers accepting of and open to the latest AI technology.

Given such a context and the hugely competitive nature of today's global economy, job loss to machines, the social impact of new AI products and AI's "existential threat" are not on the minds of most Asians yet. However, the time is now for us to start to design ethical principles for AI that do take into account the culture and philosophy of Asian societies; and to motivate companies to adhere and aspire to such principles.

At HKUST, we are currently pooling our expertise in the Schools of Engineering, Science and Business & Management to use AI in the development of ethical FinTech. Our Institute for Public Policy is interested in collaborating on AI policy and governance. Our School of Humanities and Social Science has experts on social impact. Together, we believe, we can make a difference in this critical area of the future, regionally and globally. The AI future certainly promises to be an exciting and disruptive one. Let's also ensure through responsible and ethical development in Asia it is one that truly does usher in a better way of life for all.



香港科技大學
THE HONG KONG UNIVERSITY OF
SCIENCE AND TECHNOLOGY

TOP



ENGINEERING SCHOOL

in Asia and the World

Ranked 17th Engineering School in the world by Quacquarelli Symonds (QS) (2018)

International City within China
Idyllic Environment for Study

MASTER OF SCIENCE DEGREE PROGRAMS

Medium of Instruction: English

- Aeronautical Engineering (AE) *
- Big Data Technology (BDT)
- Chemical and Biomolecular Engineering (CBME)
- Civil Infrastructural Engineering and Management (CIEM)
- Electronic Engineering (ELEG)
- Engineering Enterprise Management (EEM)
- Environmental Engineering and Management (EVEM)
- IC Design Engineering (ICDE)
- Information Technology (IT)
- Intelligent Building Technology and Management (IBTM)
- International Air Transport Operations Management (IATOM) * ^
- Mechanical Engineering (MECH)
- Telecommunications (Telecom)

* In collaboration with Ecole Nationale de l'Aviation Civile (ENAC), France
^ This is an exempted program under the Non-local Higher and Professional Education (Regulation) Ordinance in Hong Kong.
It is a matter of discretion for individual employers to recognise any qualifications to which this program may lead.

www.seng.ust.hk/programs





Prof Bert Shi (second left) builds bonds with and between students.

All the right connections

HKUST's scenic setting and collaborative spirit create an inspirational home for engineering academics. Prof Bert Shi is among those who arrived long ago and never wanted to leave

Walk into the Department of Electronic and Computer Engineering (ECE) office and you will be struck by the light and airy open space, with glass panels offering a stunning sea view. Department Head Prof Bertram Shi explains that the new look was spurred by the idea of making connections – between people, and between humans and their environment. This is a concept now central to the ECE discipline. If electronic engineering in the 1990s was all about studying how to control the flow of electrons, today the focus is on facilitating connections between parts of a system, he noted.

Prof Shi is an internationally renowned expert in robotics, fascinated by the links between neural networks and circuit design – a direction that combines his interests in biology and electrical engineering. He joined HKUST as a young academic in 1994, after earning his bachelor and master's from Stanford University and his PhD from the University of California, Berkeley. He arrived just three years after HKUST was founded. He has called the campus home ever since.

“It was unlike any other university I had seen,” he recalled. Many of the other faculty members at that time were, like him, starting out on their academic careers. But a tier of eminent senior professors had also been recruited to set a world-class research pace, and to encourage and guide international aspiration among those starting out. “Many of us have built our entire careers here. It was a very collaborative effort. We were surrounded by top people from whom we could learn.”

“It was unlike any other university I had seen. Many of us have built our entire careers here”

Learn Prof Shi did, going on to become an internationally renowned explorer in his field. One current major area of research for Prof Shi and his team is the advancement of the Active Efficient Coding framework, which seeks to find general principles governing the development of biological neural systems, and to develop corresponding algorithms enabling robots to adaptively structure their own behavior without supervision. “When a baby is gestated, new cells are generated and connect largely automatically. These connections continue to evolve after birth,” Prof Shi said. “My research is focused on the principles that allow these connections to develop.”

A particular applied focus for the Shi Lab is vision. Not only are the researchers seeking to assist autonomous machines to see but to respond to what they see, just as a human would. This perception-action cycle is a key part of enabling a machine to adapt to changes in its environment

as it recognizes the importance of active interaction, a fitting area for a triathlete such as Prof Shi. “Passivity doesn’t require intelligence,” he said. “Intelligence is intimately tied to physical activity. I don’t see a separation between mind and body. They are intimately connected.” A second area of interest is exploiting models of human behavior and emotion recognition in developing human-machine interfaces that can anticipate and adapt to user needs.

As an educator, Prof Shi has also dedicated himself to the cutting edge. His co-designed System View of Communications course was one of the first offered under HKUST’s credit-bearing Massive Open Online Course (MOOC) initiative, opening out the University’s education to learners worldwide. Within the department, he sees more blended learning – combining face-to-face learning and online activities – playing a larger part in the future.

HKUST and the School of Engineering are now ranked among the world’s best, even though less than three decades old (see P36-37). For Prof Shi, the freedom to explore as a researcher and teacher, the drive for excellence, and camaraderie of colleagues, drawn together in a collective endeavor to put HKUST on the map globally, have all played their part in such a meteoric rise. And made his individual career a fulfilling one.

“Engineering design is about how to find the right place to put a particular component and how to connect it,” he said. “If you think of yourself as a component in this world, when you find the right place to connect, the right people to connect with, and the right ways to contribute, that is the best measure of success.”



Day and night : the stunning HKUST campus that fosters creativity.

A HKUST robotics research team is accelerating forward the driverless transport revolution with the development of an efficient, cost-effective, low-power consumption autonomous control system for slow-moving vehicles. The exciting technology encompasses golf carts and hospital service carts, among others. It can also be extended to other autonomous vehicles involved in relatively complex scenarios, such as manoeuvring in congested urban traffic as opposed to the more straightforward conditions of highway driving.

The team, comprising faculty and students at the HKUST Robotics Institute and led by Prof Ming Liu, Electronic and Computer Engineering, has developed a customized “control bus” – used by the central processing unit (CPU) to talk to other devices in the computer – to facilitate centralized control of the vehicle’s mobility functions, including wire-driven steering, acceleration and brakes.

Working closely with a light detection and ranging (Lidar) company that develops remote sensing, along with car companies and manufacturers, the researchers have created a near-to-market prototype, costing around HK\$200,000. The technology uses a single Lidar to achieve perception, control, mapping, localization and navigation in real-time, with only minor computational



resources and no graphics processing unit (GPU). “Such a development gives industry a fresh way to look at driverless cars and tackle the key challenge of enhancing the safety of such vehicles,” Prof Liu said.

Safety should be enhanced as the Lidar can percept its surroundings at a rate of 10Hz (or higher based on the latest technology) at cm-level precision, which is far beyond the capability of the human perception system, Prof Liu explained. It can also cover a 360-degree field-of-view and never feels tired. “All these factors point to the fact that utilization of additional sensors, such as Lidar, will enhance safety, once the algorithms are efficient and effective,” he said.

Speeding toward a driverless future

The retrofitted electric golf cart used to test the HKUST autonomous control system can travel 30-40 kilometers without recharging.

Different ways to make a difference

Mary Ming Fong Leung

BEng in Computer Science (2017)

I first discovered my passion for programming when I had a chance to write simple programs during a computer lesson at high school. I felt this subject had a special closeness to people's daily lives. I realized a lot of everyday activities, for example, riding in lifts, or pursuits I really liked, such as surfing the Internet and playing online games, were related to programming. This motivated me to learn more about it in the hope of creating something useful myself one day.

The chance arose during my Final Year Project. In addition to my degree studies, I had been learning Hong Kong Sign Language for several years. This had introduced me to the world of hearing and speech impairment and the difficulties in learning how to sign. When I saw that designing a novel translation app for Hong Kong Sign Language was on the Final Year Project list, I was really excited. Although I was the only one of our group who knew how to sign, the other two students agreed it was a valuable undertaking and we asked our advisor, Prof Brian Mak, if we could be assigned to this project.

Traditional sign language apps can usually only translate individual words or terms. Our aim was to develop a

Three School of Engineering students, three enterprising endeavors with a community contribution to make and a life-changing personal impact

pioneering app that could instantaneously translate a Chinese sentence into sign language. The benefits would enhance communication with the hearing-impaired and help sign language learners become familiar with sign language syntax (which varies from the usual word order used in Chinese sentence structure).

It certainly proved a demanding endeavor but also a great, all-round knowledge and skill-building experience. Among other tasks, we had to undertake research related to Hong Kong Sign Language, design a system structure, film numerous demonstration videos, write code, and test our application. But, after a year, our prototype was ready.

I found the whole development process tremendously rewarding. I also realized that even when the Final Year Project had finished, we should keep on working to improve our app. Just as importantly, I really wanted to make our invention better and better, and now truly understood the meaning of "the joy of learning".

Mary Leung's syntax app assists Chinese sign language learners.



*English added to graphic. Not included in app.





Urvil Sheth

BEng in Mechanical Engineering (2018)

When I was admitted to the School of Engineering, I decided on Mechanical Engineering to explore more about the application of concepts and formulas. After two years, and keen to see engineering from a different angle, I enrolled in the interdisciplinary month-long Design Thinking summer course, organized by the Industrial Engineering and Decision Analytics Department together with the China Academy of Art in Hangzhou. Working in groups – two HKUST students paired with two from China Academy – we set out to design and manufacture an interactive product for elderly people in Hong Kong day care centers.

As my Thai computer science HKUST teammate Naveen and I were not well-versed in Mandarin and our China Academy groupmates were not comfortable in English, it was a challenge from the start. However, on Day 1, we went for hotpot and became close friends. On Day 2, we discovered design thinking was no easy feat: we had no idea what to make. I encouraged my team to apply the design thinking techniques we had learned, such as brainstorming, affinity clustering, storyboarding, and drawing up an importance vs priority matrix. After filtering, prioritizing, and combining ideas, MemoTV was born.

My vision was a television that could display nostalgic photographs, videos, and newspaper clippings of Hong Kong in the past century, drawing the elderly together and helping them share memories. To create this, I assigned tasks to my teammates based on their strengths. One focused on programming the Arduino (an open-source electronics platform), while another assembled the speakers and mounted the personal computer inside. The third began

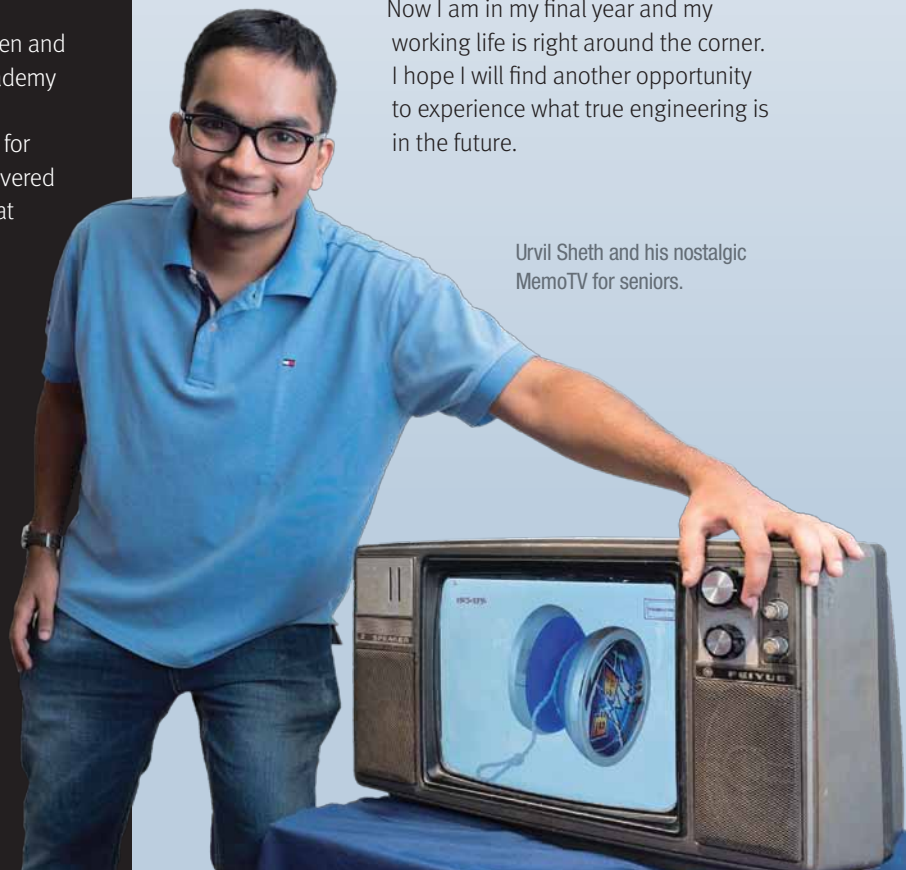
finding old pictures of Hong Kong, along with Cantopop songs ranging from Leslie Cheung to Anita Mui. After locating an abandoned old-fashioned television (which was at least 50 years old), we removed the glass, and assembled the PC, Arduino and speakers inside. I couldn't believe it. Together with constant mentoring from our professors, we had managed to design and manufacture a novel concept in just four weeks!

It was now time to test the invention. On exhibition day, a group of seniors came to the HKUST Library to inspect and interact with the different student products. Finally, they reached MemoTV. Naveen turned the television on and after a few seconds of silence, the screen burst into life. The familiar voice of "King of Comedy" Kee Chan Tang (鄧寄塵) rang out, and our elderly viewers began laughing. The visitor nearest to the television then turned the set's dials, which changed the content and era respectively, and the screen flashed up a black-and-white image of the HSBC Main Building in Central in the 1930s. "Waaaaaah!", the 15 seniors sang out in unison. As our viewers continued chatting about and operating our MemoTV, I looked at my teammates and saw they knew it was a job well done.

Looking back, this has to be my favorite course to date. Not because of the grade but because it gave me confidence. It convinced me that I could make somebody smile, and has been the highlight of my university life as it unlocked so much untapped potential.

Now I am in my final year and my working life is right around the corner. I hope I will find another opportunity to experience what true engineering is in the future.

Urvil Sheth and his nostalgic MemoTV for seniors.



Alexander Yu Tse

MPhil in Mechanical Engineering (2019)

BEng in Mechanical Engineering (2017)

I have loved robots since I was a child and often dreamed of building one myself. This aspiration made me choose Mechanical Engineering at HKUST, first as an undergraduate, now as a research student.

When I was growing up, my father's business took him – and me – around the world, which means I am always open to new adventures. In Year 2 of my bachelor degree, I met Dr Feng Ni, then a PhD student. He introduced me to “soft” robots, machines made of silicone rubber and plastics. This concept immediately fascinated me as I had previously only imagined robots to be metallic, as in *Star Wars*.

First, I worked with Dr Ni and an MPhil student to develop and refine a “soft finger” actuator – a component responsible for moving or controlling a mechanism. Following this, I joined the Smart Soft End Effector team, a group of final year undergraduate mechanical engineering students who wanted to apply robotics knowledge to solve real-life problems. Our aim was to leverage the soft finger actuator, add a smart close loop control to broaden its potential applications, and develop a soft robotic gripper that could grasp a variety of objects.

As the soft robotics field is only just emerging, we had to do most of the background research ourselves as information wasn't yet available in textbooks. Such self-study, teamwork, and the intensive discussions required to develop the gripper proved brilliant training. After several generations of experiments using pressure and flex sensors, under the guidance of Profs Lilong Cai and

Alexander Tse and the smart soft robotic gripper invented by his undergraduate final year project team.

Michael Wang, we succeeded in creating a gripper capable of grasping objects of different shape, sizes and texture. Even a foodstuff as delicate as tofu!

My teammates (Chenxi Feng, Chunli Jiang, Zihang Zhang, Peng Zhou) and I were all very proud to win the President's Cup 2017 and the Gold Award in the ASM Technology Award 2017 for our innovation. During development, we also sought to raise interest among the business sector and even went to the CES consumer electronics show in Las Vegas. We believe that in the future this smart effector could be highly useful in caring for the elderly and children, and industries such as food packaging and automated farming. The project has already fundamentally changed our own lives.



Activating an education that moves with the times

By Prof Ting Chuen Pong

In the 21st century, higher education must continuously adapt to the needs of an ever-changing world. For most of my 35-year teaching career, course syllabi and content have dominated how knowledge is taught. In recent years, though, pedagogical research has led to a paradigm shift from teacher-centered teaching to learner-centered learning, placing a greater emphasis on active and experiential learning – and a clear departure from the traditional, passive, lecture-style approach. HKUST has been at the forefront of revolutionizing the pedagogy of higher education in Hong Kong.

Lectures have often been criticized for being ineffective. Some studies have shown that the long-term retention rate of learners from this style of teaching is normally less than 10%. While the rate can be improved with the help of audio-visual aids or demonstrations, it appears only to increase to above 50% if students are actively involved in the learning process. This is why HKUST is devoting resources to developing active learning pedagogies.

In the School of Engineering's Center for Engineering Education Innovation (E²I), we are developing experiential learning strategies to promote active engagement and participation in a classroom setting and to connect the process of engineering design with real-world problems. A report* published by the US National Academy of Engineering also recommends that design, build, and test processes should be introduced at the earliest stage of an engineering curriculum rather than waiting until a later stage of a student's four-year undergraduate program.

“We are developing experiential learning strategies... to connect the process of engineering design with real-world problems”

In Fall 2017, the First Year Cornerstone Engineering Design Project Course was offered as a regular course for the first time. This was created together with Prof Ben Y B Chan, Associate Director of E²I, fully incorporates active and experiential learning, and was developed specifically with HKUST engineering freshmen in mind. It seeks to expose such students to knowledge and skills from different engineering disciplines before deciding on their majors. Faculty from different departments teach discipline-specific knowledge through online delivery to allow first-year students from a variety of backgrounds to learn at their own pace. Students have opportunities to work collaboratively on a design project by applying the knowledge they have acquired and to gain hands-on experience of different emerging technologies, including drones, 3D printing, Arduino programming, and mobile app development.

E²I's intention in adopting this innovative approach is to enable students to acquire a more versatile technical skill set while developing the essential soft skills to be successful in their future careers. Ultimately, the course is designed to stimulate students' interest in engineering and to lay the foundation for solving the engineering grand challenges of the 21st century.

* “Educating the Engineer of 2020 – Adapting Engineering Education to the New Century”, <https://www.nap.edu/read/11338/chapter/1>



Prof Ting Chuen Pong, Computer Science and Engineering, is Director of the School of Engineering's Center for Engineering Education Innovation and Senior Advisor to HKUST's Executive Vice-President and Provost (Teaching Innovation and E-learning).

Just try it!

Experiential learning takes many forms at the School of Engineering. Two undergraduates discuss contrasting opportunities to combine knowledge and practical skills



Jocelyn enjoys a hands-on way to learn about food science.

Food for thought

Jocelyn

BEng in Chemical and Biomolecular Engineering (2019)

I am Jocelyn from Indonesia, and, yes, that is my full name. I am ethnic Chinese yet don't speak or read the language very well. Given this background, I had never really thought of studying in a city such as Hong Kong until my final year of high school. I decided to join HKUST as its programs are taught in English, the University is internationally recognized, seemed to provide a global learning atmosphere on campus, and offered a variety of learning and research opportunities. Moreover, HKUST is the only university in Hong Kong to offer a degree in Chemical Engineering, a subject I had decided to pursue when still at school.

At HKUST, I found that chemical engineering is not all about oil, nuclear power, or specialty chemicals, but also the food and drugs we consume, water treatment, and more. Courses have been more challenging than expected

but at the same time more engaging and rewarding. For example, I undertook a common core course about food science and technology, run by my department and taught by Prof Marshal Liu. I enrolled mainly because I have always been keen on nutrition and health. The course comprised lectures along with lab experiments, a plant visit, and a food design project, making it fun to attend as well as useful.

To carry out the experiments and project, we had to actually make food ourselves while still learning the science. I had never even fried an egg properly before. However, I managed to bake my first cookies in a chemistry lab (and they tasted fine!). With the majority of students coming from other disciplines for that course, I also learned how to work well in a group of people with diverse backgrounds and to learn from others.

I thought this was a great introductory course to food science, processing technologies, and further studies in these areas. Or simply to help with deciding whether to have salad or oatmeal for breakfast!

Diving into action

Gian Miguel Del Mundo

BEng in Computer Science (2019)

I am now a third-year engineering student and so proud to have been part of the HKUST team to win the global Marine Advanced Technology Education (MATE) ROV 2017 competition (see also P4). ROV stands for Remotely Operated Vehicle, an unmanned underwater vehicle used for a gamut of purposes, such as exploring deep sea environments, decommissioning oil rigs, and retrieving objects from the seabed. The HKUST ROV team, encompassing 15 engineering students from different departments, specializes in creating machines to take part in the MATE competition. I first joined the team in my freshman year in 2015-16 because I felt underwater robotics was an interesting area awaiting further exploration, especially in Hong Kong. It also gave me the perfect opportunity to apply my own technical knowledge in a practical way.

When I joined the team, I took up the roles of chief technical officer and software engineer. I recall feeling nervous about the workload after hearing that our pool tests would be held from 9.30pm-12.30am twice a week and have a debriefing afterwards! How would I survive with all the other work required in a regular semester? I also knew more hours would have to be spent developing our ROV in the lab. The fear disappeared after seeing Orca, the initial ROV I worked on, move underwater for the first time. The robot was only a frame comprising essential hardware and thrusters at that



2017 ROV team CEO Gian Miguel Del Mundo.

point, but it was immensely exhilarating to see how input from different team members could create a working machine.

This was just the beginning of a long line of sleepless nights at the pool and in the lab. It was all worth it, though, when we won the MATE regional championship. We then moved forward to the 2016 international contest held at NASA in the United States. We ended up in fourth place out of 32 teams – motivating us to believe we could aim for the championship.

A year later, with a new 2017 team roster, I was chosen as chief executive officer and software engineer. We again reached the international competition, held in Long Beach, California this time, with our Beluga ROV. On the day of the result, I remember the tension as the top three teams were being announced, the silent anticipation, and how time seemed to stretch forever. When our team's name was called in first place, we immediately started to cheer. We were all so happy that all the hours and effort we put into the competition had finally paid off. It was a feeling I will never forget.

Working together on Beluga, HKUST's prize-winning underwater robot.





Reaching for the skies

A student simply uses hand gestures to control the up-to-the-minute DJI drone as it takes off, flies around, takes photographs and videos, and lands.



With a wave of her hand, a Hong Kong secondary school student learns to control a leading-edge drone from DJI, the world's market leader in consumer unmanned aerial vehicles, on the HKUST campus.

The fun event was part of an eventful DJI Spark Pilot Test day, organized recently by the Academy for Bright Future Young Engineers under the School of Engineering, to let young people know the creativity, innovation and entrepreneurial mindset that lies behind modern engineering and the different ways that engineers today seek to provide better solutions and products to impact people's lives. A good example is DJI Founder Frank Wang, an alumnus of the School of Engineering.

The Academy, funded by a generous donation from Prof Roy Chung, Founder and Chairman of Bright Future Charitable Foundation, was established in 2016 to develop secondary school students' innovation, spark their enthusiasm in engineering, and build a positive public perception of engineering through hands-on projects. Engineering students at the School also have the opportunity to act as mentors and engage with the school students.



Sending out fresh signals

Ingenious applications by postgraduate students at the HKUST-NIE Social Media Lab are ready to take forward cutting-edge communications.

A battery-less bluetooth low energy beacon developed by Electronic and Computer Engineering PhD student Kang Eun Jeon is set to facilitate communication with Internet of Things (IoT) devices, such as smartphones. Beacons can send out regular bluetooth signals allowing mobile phones to interact with the physical environment. When a customer passes a beacon in a department store, for example, information can be sent to that person's phone.

Beacons are fast becoming a key component in many social and IoT infrastructures, Kang Eun said, noting that over 10,000 beacons had been installed at Hong Kong International Airport recently to assist travelers with indoor navigation through their smartphones. However, the majority of bluetooth low energy beacons in the world are battery-driven, he explained. As batteries need to be regularly replaced or recharged, they require a lot of manpower for maintenance resulting in high labor costs. The HKUST luXbeacon can harvest and store energy from solar and indoor lighting, eliminating the need for batteries.

When fully charged, the HKUST luXbeacon can run for eight hours if broadcasting messages every second and up to 32 hours when broadcasting every 10 seconds. "The benefits of battery-less beacons are huge," Kang Eun said. "If all the batteries used in all the beacons by 2018 are stacked up, they will reach a height of 22.5km or over 2.5 times the height of Mount Everest." A reduction in battery use can help prevent global warming significantly, he added.



PhD student Ming Cheung (left), supervised by Prof James She, has created a recommendation technology that can detect new social signals from images.



PhD student Kang Eun Jeon demonstrates his compact (5cm x 6cm x 1cm) high-performance battery-less beacon.

Kang Eun's research is being carried out under the supervision of Prof James She, Director of HKUST-NIE Social Media Lab. Prof She said the Lab intended to make the beacon's design, firmware source codes, circuit and component design accessible through open-hardware and an open-source University licensing process. The aim was to encourage widespread adoption by other inventors, developers, entrepreneurs and smaller companies and make a larger global impact.

In addition, PhD student Ming Cheung, also supervised by Prof She, has analyzed 11 million images shared on social media from 150 countries/regions using big data analytics to ascertain new social signals that can guide smart recommendations on daily living. While existing "object recognition" only recognizes objects without making further sense of the images, the HKUST technology can detect social signals from the images for more accurate connection discovery.

For example, if a user uploads a large number of pictures of Korean architecture, films and fashion, it seems to indicate a love of Korean culture. Thus, when the user searches online for a place to eat, he or she would be recommended a Korean restaurant, Ming explained. If another user uploads pictures of Hong Kong, the recommendation might be a dim sum restaurant. Clothing and travel recommendations can also be made in a similar way. An application for a patent on the technology has been filed.

Linking women tech high flyers



Korean postgraduate Nayeon Lee, MPhil in Electronic and Computer Engineering, enjoyed an immensely fruitful learning and networking gathering as a selected participant in the 2017 Google Women Techmakers Scholars Program in Asia Pacific. The HKUST 2017 BEng in Computer Science and Engineering graduate, who is now exploring machine learning and artificial intelligence under the supervision of Prof Pascale Fung, joined fellow high-flying female technology scholars from around the region and Google mentors on a six-day retreat in Seoul, Korea.

The program involved a discussion on gender issues in the tech industry, a coding challenge, a panel discussion and sharing session by Googlers, and encouraged participants to network with each other. For Nayeon, the networking proved especially rewarding, being “motivational and inspirational to talk to people who were full of passion for technology”.



Top and above: MPhil student Nayeon Lee found the Google Women Techmakers Scholars Program for Asia Pacific “inspirational”.

Competition headliners

Shaking up earthquake research

A Civil and Environmental Engineering postgraduate team won the championship and two other awards at the Introducing and Demonstrating Earthquake Engineering Research in Schools (IDEERS) Competition 2017 in Taiwan. The team received the top prize in the Postgraduate Division, Innovation Award of Seismic Isolation and Energy Dissipation and Best Presentation Award. The team comprised PhD students Srinivas Mogili, Michele De Filippo, Bence Kató and MPhil student Hoi Yin Yung. The students hailed from India, Italy, Hungary, and Hong Kong, with civil engineering specialties including structural, geotechnical and wind engineering, enabling multiple different areas of expertise and viewpoints to be incorporated into their building design. More than 500 participants and 100 teams in total competed in the contest’s high school, undergraduate and postgraduate divisions.

Bright idea for solar panels

Electronic and Computer Engineering postgraduate students took the championship at the 3rd GCL Cup International College Student Green Energy Science and Technology Innovation & Entrepreneurship Competition 2017 in Suzhou, China. PhD student Kwong Hoi Tsui and MPhil students Wing Yi Chak and Lei Tang pitched a business idea based on nanostructured antireflection films for solar panels. They competed against 70 teams from top universities in Mainland China, Singapore and Taiwan. The team members were previous winners of the HKUST One Million Dollar Entrepreneurship Competition.

Recovering scarce resource from sludge

Civil and Environmental Engineering doctoral students Sen Lin, Weiqi Xue, Feixiang Zan and MPhil student Qian Zeng received the gold award at the 2017 TECO Green Tech International Contest in Taiwan for creating a technology that recovers an in-demand resource from sewage sludge. The School of Engineering innovation was awarded the top prize for enabling sulfated polysaccharides, a scarce pharmaceutical intermediate, to be recovered from sludge in an energy-efficient and novel way. The final competition included 40 teams from Mainland China, Taiwan, Japan, Singapore, Russia and the US as well as Hong Kong.

Recent graduate Michelle and investor-mentor Simon Law come from different generations of School of Engineering alumni but share the same entrepreneurial outlook.



Sweet smell of success

Support from fellow alumni has given a young engineering graduate the opportunity to advance her smart aromatherapy diffuser start-up

Michelle (2017 BEng in Logistics Management and Engineering) is on a roll. In 2016, the then School of Engineering undergraduate from Indonesia, who goes by a single name, launched Aromeo, a start-up centering on a novel automated aromatherapy diffuser. Assistance from School alumni helped Michelle and her team fathom the business world. Recently, as recognition of the success of such inter-cohort support, she received seed funding from the Hong Kong X Technology Fund, part of the Hong Kong X-Tech Startup Platform that promotes an entrepreneurial culture in Hong Kong, to take her “Nespresso for aromatherapy” concept to the next level.

Already an aromatherapy enthusiast when a student at HKUST, Michelle said the idea for her business arrived when she found herself having to stop what she was doing to replenish the water and essential oil in her manual diffuser. During a Year 4 cross-border program on global product development, Michelle undertook market research

on her automated diffuser concept with fellow students from HKUST, Seoul National University and Beihang University. The team confirmed there was a demand for such a product, then went ahead with the product design. The result was aromatherapy pods that could be inserted into the smart diffuser, controlled through an app that allows users to schedule a time for it to run and adjust the oil blends being used.

Michelle was later introduced to Simon Law, a School of Engineering alumnus (2003 Master of Technology Management in Global Logistics Management) and Managing Director of Excel Technology Management Ltd. Simon had been instrumental in setting up the Master of Technology Management (MTM) Alumni Association and later founded Excel with MTM alumni and Industrial Engineering and Decision Analytics senior academic Prof Fugee Tsung to invest in projects employing technology developed at universities to help solve daily-life problems.

Simon was impressed by Michelle's use of everyday components to deliver a unique product. He was also struck by her momentum and attention to detail. He recalled she had a notebook in which she wrote everything down. "My partners and I were inspired by her. She made us remember our younger days."

Excel decided to support the start-up financially. In addition, Simon, who was already active in mentoring young engineers at the School, added the Aromeo team to his list of mentees, advising the young entrepreneurs in areas ranging from opening a bank account to guiding them on best practices in business, when to launch the product in the market, and on the need to find the right distribution channel. Such assistance was invaluable, according to Michelle.

The highly supportive culture on campus was another plus. While Michelle had initially chosen to take her bachelor

degree at HKUST because of its young, dynamic and entrepreneurial image, she was surprised and happy to learn through actual experience how willing people were to lend a hand. "The night before we had to demo our product, it broke down," she said. "I put out a call for a wi-fi module at 1am and a research student from one of the labs brought it over. It didn't work. So at 2am I went down to the seafront canteen and looked for an engineering student to help. The electronic engineers who happened to be there helped out."

The young go-getter is now adding to her business understanding by undertaking an MPhil in Technology Leadership and Entrepreneurship at the School. In the future, maybe it will be Michelle who is in a position to help out the University's engineering students and fellow alumni.

Condolence

Dr Bo Gao

The School of Engineering is greatly saddened to report that alumnus Dr Bo Gao passed away on July 24, 2017, aged 33.

Dr Gao earned his bachelor degree at Tianjin University and his MPhil and PhD in Mechanical Engineering at HKUST in 2007 and 2017 respectively. He was an expert in Internet of Things (IoT) and radio frequency identification (RFID) and an outstanding academic researcher, contributor to his areas of specialization, and entrepreneur.

His HKUST supervisor Prof Matthew Yuen, Professor Emeritus of Mechanical and Aerospace Engineering, remembers Dr Gao as a truly gifted and kind young man, who possessed exceptional versatility and whose first patent achieved the rare distinction of going through the US Patent and Trademark Office without a single question asked.

Dr Gao presented academic papers at eminent international conferences, including the IEEE International Solid-State Circuits Conference, IEEE Electronic Components and Technology Conference, and IEEE Electronics Materials and Packaging Conference. He served as

a peer reviewer for *IEEE Transactions on Industrial Electronics*, *IEEE Antennas and Wireless Propagation Letters*, and *Scientific Reports*, among other renowned journals.

His research achievements in RFID tags and cost-effective CMOS RFID chips were widely applied in the RFID industry and he held several patents in China and overseas. In 2012, Dr Gao was among the award-winners at the prestigious China Technology and Entrepreneurship Competition for Overseas Talents. The same year, he co-founded Zhejiang Laxcen Information Technology Inc Limited. He went on to make tremendous contributions to the company's development, establishing its core technology, nurturing the research team, and setting key business strategies for both China and overseas markets.

An outstanding member of the HKUST engineering community, Dr Gao always gave his best in pursuit of his dreams in both his studies and the business world and served as a wonderful role model to others. We extend deepest sympathies to his wife, our Electronic and Computer Engineering alumna, and to other family members.

Up and running

More than 300 School of Engineering alumni, faculty, students and staff enjoyed a “moving” reunion at the Standard Chartered Hong Kong Marathon in January, as they tested their stamina, caught up with old friends, and generated happy memories.



- 1 Off to a good start: let's go, go, go...
- 2 Team spirit: the Dean, Associate Dean (second and third left) and two alumni prepare to take part.
- 3 Fit and ready to join in.
- 4 Rising to the challenge.
- 5 Alumni spirit races forward.
- 6 All smiles: what a day to remember!



Prof Tim Woo (center) and RTHK program hosts Harry Wong (left) and Micky Wong at the recording studio.

A taste of engineering for the young

While many still think of a university professor as confined to an ivory tower, there are now many academics who reach out to society at large to make a contribution. In the School of Engineering (SENG), one of the greatest champions of the “engineering in the community” concept is Prof Tim Woo.

An Electronic and Computer Engineering alumnus who gained his BEng, MPhil and PhD degrees at HKUST, Prof Woo is Associate Professor of Engineering Education and Director of the Center for Global & Community Engagement. He recently appeared in a kid-oriented TV program to communicate the message that engineering improves numerous aspects of our lives, and can also be simple and fun to learn.

The program, titled *Harry哥哥好鄰居II (We Are Good Neighbors 2)* and broadcast in Cantonese on Hong Kong’s RTHK 31, featured “Dr Tim” in eight weekly episodes in January and February 2018.

Prof Woo said: “While the traditional image of an engineer is one wearing a helmet and a reflective vest with a spanner in his hand doing all the dirty work, I would like to project the image of today’s engineers, who create and innovate to make the world a better place to live.”

Prof Woo is passionate about connecting up engineering concepts and initiatives with both the younger generation and underprivileged members of the community. In recent years, he has organized an underwater robot competition for Hong Kong primary and secondary schools so the students can gain an early appreciation of what engineering can do. This endeavor involves cross-campus

HKUST input, encompassing the Schools of Engineering, Science, Business, Humanities and Social Science, and Interdisciplinary Programs Office, along with students from other local tertiary institutions, such as Hong Kong Polytechnic University, Education University of Hong Kong, and Lingnan University.

“We have taken this robotics competition into the community, and welcome participation not only from mainstream students, but also students with special educational needs, ethnic minorities and the underprivileged,” Prof Woo said.

“This year we had 54 competing teams, and we were delighted that one group of special educational needs students and another group of hearing-impaired students won in their respective heats with a near-perfect score!”

That’s awesome!

Prof Tim Woo’s captivating television topics introducing engineering to youngsters:

1. Loud speaker used as a light switch
2. Underwater robots for teenagers and children
3. Interactive pedestrian traffic light
4. Intelligent fish tank
5. Computer keyboard used as a musical instrument
6. Ferris wheel and the virtue of slow motion
7. Disc-tossing robot
8. Unmanned automated vehicle

View these episodes at <http://bit.ly/2IW7EfP> or scan the QR code (Cantonese only).



Faculty awards & achievements



Prof Ching W Tang, IAS Bank of East Asia Professor and Chair Professor of Electronic and Computer Engineering, has been inducted into the US National Inventors Hall of Fame for his ground-breaking research on organic light emitting diodes (OLEDs). His seminal research has enabled the advancement of flat-screen displays in computers and televisions, among others. Prof Tang is also the recipient of the 2011 Wolf Prize in Chemistry and 2017 IEEE Jun-ichi Nishizawa Medal.

Prof Mansun Chan, Electronic and Computer Engineering, received the 2017 IEEE Electron Devices Society (EDS) Education Award. IEEE is the world's largest technical professional organization for the advancement of technology and the award is EDS's highest accolade for contributions to electron and ion-based device education. What makes a great educator? "Instilling the desire to learn," according to Prof Chan.



Prof Guanghao Chen, Chair Professor of Civil and Environmental Engineering, has become an inaugural recipient of the National Innovation Pioneer Award, established by the Chinese government in 2017. Prof Chen has invented a series of cutting-edge water management and wastewater treatment technologies, including membrane-enhanced primary treatment, seawater-based urine phosphorus recovery, and sulphate reduction, autotrophic denitrification and nitrification integrated processes. He also leads projects using saline water as an alternative water resource. Prof Chen was the only awardee from Hong Kong.

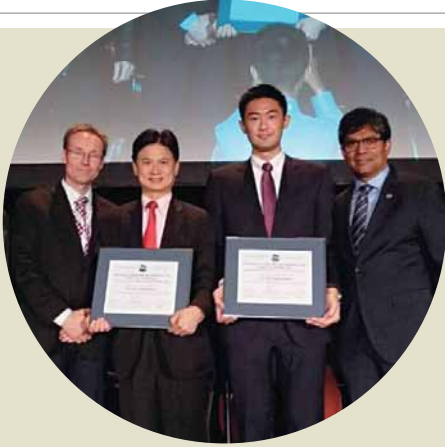
Prof Pascale Fung, Electronic and Computer Engineering, was presented with the 7th Outstanding Women Professionals Award from the Hong Kong Women Professionals and Entrepreneurs Association. The triennial honors recognize high-achieving women in Hong Kong who have made significant contributions to their professions. Prof Fung is an expert in artificial intelligence and a long-time advocate for women's rights and diversity in academia and society.



Prof Pan Hui, Computer Science and Engineering, has been elected a 2018 IEEE Fellow for his contributions to social-based opportunistic networks. The award is the world-leading technical organization's highest grade of membership. There are now 40 School of Engineering academics in total holding IEEE Fellowship.

Prof Kei May Lau, Fang Professor of Engineering and Chair Professor of Electronic and Computer Engineering, received the IEEE Photonics Society Aron Kressel Award, which recognizes individuals who have made important contributions to opto-electronic device technology. Prof Lau was cited for her research into compound semiconductor materials and devices, which has had "a major and singular impact on today's high-performance and energy-saving photonics technologies, ranging from lasers for ubiquitous communication to energy-efficient displays and lighting".





CLP Holdings Professor of Sustainability and Chair Professor of Civil and Environmental Engineering **Prof Charles W W Ng**, **Prof Clarence Choi** from the same department, and two different teams of PhD students and government collaborators have been honored with two Best Paper Awards from leading international geotechnical journals. They were the first teams comprising all Hong Kong members to receive these awards. One team's paper on "Large-Scale Successive Boulder Impacts on a Rigid Barrier Shielded by Gabions" received the Prix R M Quigley Award (Honorable Mention) 2017 from the Canadian Geotechnical Society. The second team's paper titled "Coarse Granular Flow Interaction with Slit Structures" received the Telford Premium Award 2017 from the Institution of Civil Engineers, UK.

Prof Fugee Tsung, Industrial Engineering and Decision Analytics, has been elected a 2017 Fellow of the American Statistical Association. The Association is the world's largest community of statisticians, with members in over 90 countries, and only one-third of 1% of its membership gain a fellowship. Prof Tsung is globally known for his contributions to quality and data analytics research and education.



New appointments

Administrative

Prof Wei Shyy

Appointed President of HKUST (effective Sept 1, 2018)
Acting President
Chair Professor, Mechanical and Aerospace Engineering

Prof I-Ming Hsing

Appointed Head of Department of Chemical and Biological Engineering
Professor, Chemical and Biological Engineering

Prof Dit-Yan Yeung

Appointed Acting Head of Department of Computer Science and Engineering
Professor, Computer Science and Engineering

Prof Jingshen Wu

Appointed Acting Head of Division of Integrative Systems and Design
Professor, Mechanical and Aerospace Engineering

Prof Gary Chan

Appointed Director of Entrepreneurship Center
Professor, Computer Science and Engineering

Prof Chih-Chen Chang

Appointed Director of Center for Education Innovation
Professor, Civil and Environmental Engineering

Prof Robin Lok Wang Ma

Appointed Director of Center for Industry Engagement and Internship
Assistant Professor of Engineering Education, Mechanical and Aerospace Engineering

Faculty Members

Prof Anthony Kwan Leung

Assistant Professor, Civil and Environmental Engineering
PhD – The Hong Kong University of Science and Technology

Ms Luisa Mok

Lecturer, Integrative Systems and Design
PhD – Aalto University (expected in 2018)

Prof Hongyu Yu

Associate Professor, Mechanical and Aerospace Engineering
PhD – University of Southern California

Research Faculty

Prof Bo Sun

Research Assistant Professor, Civil and Environmental Engineering
PhD – Harbin Institute of Technology

Adjunct Faculty

Prof Aviva Chow

Assistant Professor, Chemical and Biological Engineering
PhD – The Chinese University of Hong Kong

HKUST

Established	1991
-------------	------

School of Engineering
School of Science
School of Business and Management
School of Humanities and Social Science
Interdisciplinary Programs Office
HKUST Fok Ying Tung Graduate School
HKUST Institute for Public Policy

Total student enrolment (as of Sept 2017)

Undergraduate	9,754
Postgraduate	5,053
Total	14,807

Total faculty (as of Jun 2017)

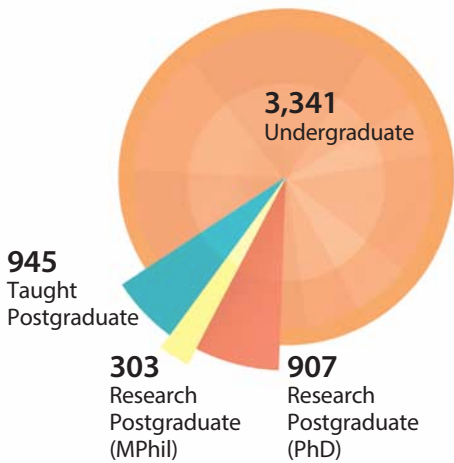
Regular	641
Visiting	53
Total	694

School of Engineering

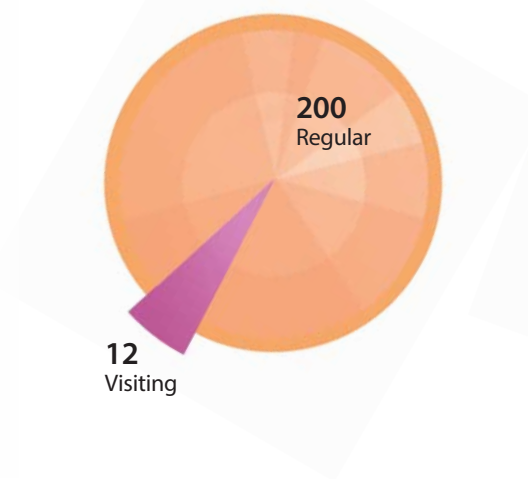
Departments and units



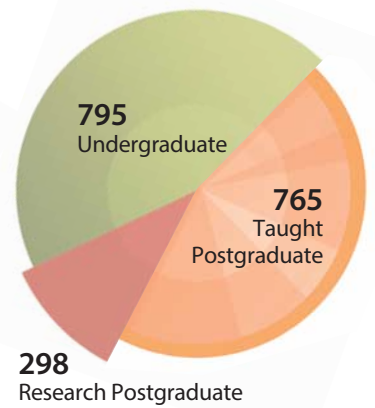
Student enrolment (as of Sept 2017)



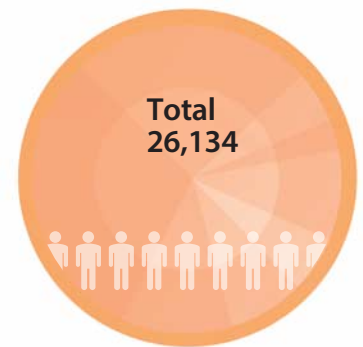
Faculty (as of Jun 2017)



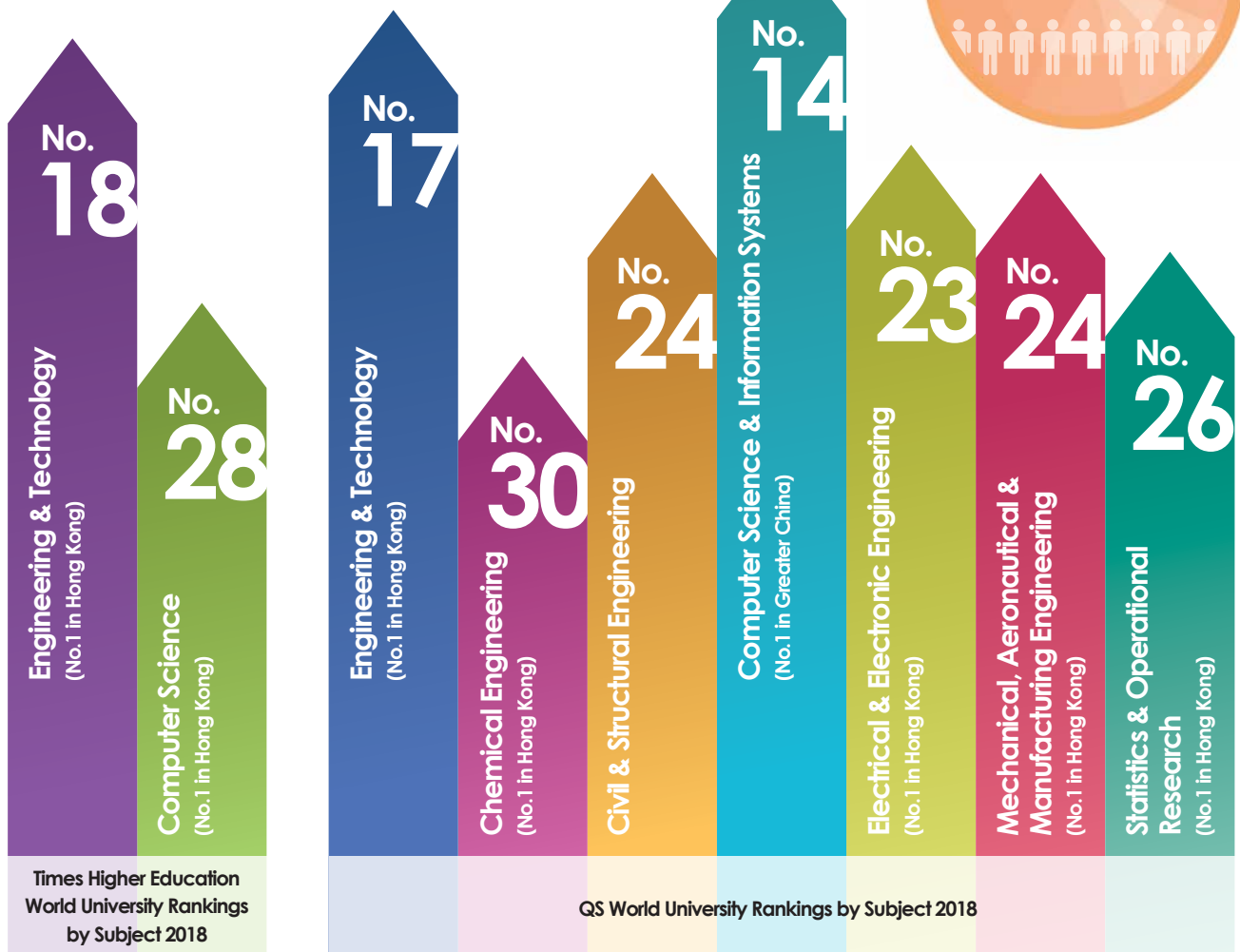
Graduates (2017)



Alumni (Mar 2018)



Global rankings





Asian Deans' Forum 2018

THE RISING STARS

Women in Engineering Workshop

4-7 OCT 2018 | HKUST, HONG KONG

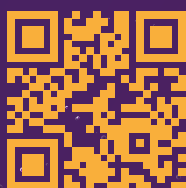
A Transformational Journey for Rising Stars in Academia

Organized by Asia's top engineering schools, this workshop aims to bring together young female professionals in engineering disciplines from around the world, including scholars, researchers and engineers interested in exploring and advancing careers in academia, for scientific and career-oriented discussions relevant to the development of women academic leaders in Asia.

**Becoming
a Faculty
Member**

**Thriving in
Academia**

**Individual
& Society**



**Nominate
Your Friends**

**Application Deadline
30 APRIL 2018 (GMT+8)**

risingstarsasia2018.ust.hk



Apply Now