

INFOCUS

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HKUST ENGINEERING FALL 2019

Light Fantastic

The Transformational Discovery of OLEDs



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Future directions

It has been an extraordinary year for the School of Engineering in many different ways. In education, we further expanded our comprehensive provision, celebrating our first cohort of almost 60 MSc in Financial Technology students. This pioneering program, jointly run by the Schools of Engineering, Business and Management, and Science, addresses the demand for fintech skills and is the first of its kind in Hong Kong and Mainland China. In research, the Department of Chemical and Biological Engineering is set to steer the city's first Institute of Synthetic Biology, following a HK\$500 million donation from the Li Ka Shing Foundation.

In line with HKUST's drive to deliver social impact from its research endeavors, the School has also been highly active in establishing laboratories with industry. These include partnerships with WeBank Co. Ltd. (2019) in the fintech area and Chiaphua Industries Ltd. (2018) for environmental health technologies, among others. Such a move is a win-win strategy for faculty, industry, and society. Our academics gain greater understanding of practical needs. Industry benefits from novel ideas and applications for products and services to enhance people's lives.

The development of the Greater Bay Area and HKUST's new state-of-the-art Guangzhou campus, with plans for 400 more faculty and 4,000 graduate students by 2026, will only strengthen such directions. As most of the new

campus's research thrust areas have engineering elements, our School is particularly well placed to grow.

All are part of a reshaping of our engineering education and research to enable students to see beyond technical fundamentals and gadgets to the ethical, human, and societal implications of what they are doing. It's a whole new lens for engineering: an education in what matters, the context in which it matters, and how to work across areas in a team. As this spirit of enquiry gains ground among leading engineering educators globally, the School is starting to explore links with liberal arts institutions to enhance our students' experience.

Meanwhile, the challenging situation in Hong Kong over the second half of 2019 will require optimism and in-depth communication between different voices to fathom how to reach mutual understanding. However, Hong Kong is robust, where East meets West, and will continue to open up jobs and great opportunities. We need to look to the future, and have faith in that future.

Prof. Tim CHENG Kwang-Ting
Dean of Engineering

Vision and leadership



Provost Prof. Lionel Ni: guiding HKUST's academic strategy into the future.

In May 2019, HKUST welcomed back Prof. Lionel NI, a former Head of the School of Engineering's Department of Computer Science and Engineering (CSE), who returned to take up the post of Provost following a worldwide recruitment exercise.

Prof. Ni is well recognized for his academic accomplishments and administrative experience. Prior to re-joining HKUST, he was Vice Rector (Academic Affairs) and Chair Professor in the Department of Computer and Information Science at the University of Macau. Before going to Macau in 2015, Prof. Ni had served in senior roles at HKUST for more than a decade. He was Head of CSE from 2002-08 and Dean of HKUST Fok Ying Tung Graduate School and Special Assistant to the President from 2010-14.

President Prof. Wei SHYY said he was confident Prof. Ni would "provide vision and leadership in setting the University's overall academic strategy and priorities, and overseeing HKUST's core mission in advancing learning and knowledge".

Prof. Ni earned his BS degree in Electrical Engineering from National Taiwan University; and his MS and PhD in Electrical and Computer Engineering from Wayne State University and Purdue University in the US respectively. Before his initial employment at HKUST in 2002, Prof. Ni was a full Professor in Computer Science and Engineering at Michigan State University in the US.

HK\$91M for landslide warning project

With the ever-increasing threat of unpredictable climate change, a pioneering cross-university project, led by a School of Engineering academic, is set to provide a multi-tiered landslide early warning system to safeguard Hong Kong in the face of more frequent heavy rainfall.

The eight-year project, proposed by CLP Holdings Professor of Sustainability Prof. Charles W. W. NG, Associate Vice-President for Research and Development and Chair Professor of Civil and Environmental Engineering, received HK\$91.85 million in funding under the Research Grants Council's Areas of Excellence Scheme 2018/19. Among its core objectives is a world-leading interdisciplinary Centre for Slope Safety to deliver a comprehensive extreme weather and landslide warning system that can increase the forecast lead time of heavy rainfall from three to six hours.

HKUST, Chinese University of Hong Kong, University of Hong Kong and Hong Kong Polytechnic University are involved. The Hong Kong Institution of Engineers and government departments, including the Geotechnical Engineering Office and Hong Kong Observatory, are also taking part, together with the Hong Kong Jockey Club Disaster Preparedness and Response Institute, and overseas experts.

The multidisciplinary team is seeking to create a real-time weather prediction system and unique multi-source stereoscopic landslide monitoring system using artificial intelligence and machine learning technology. The researchers hope the system will be adopted by other countries and regions.



Project members Prof. Charles Ng (front right), Prof. Clarence Choi (front left), Ms. Eva Lam (second row, left) and Ir. W. K. Pun, and HKUST's unique centrifuge environmental chamber developed to simulate effects of extreme weather on slopes.

Campus transformed into a ‘living lab’



Looks familiar: developing a digital twin platform can ascertain what is and can happen to physical assets now and in the future.

The School of Engineering (SENG) is taking a significant role in a front-running HKUST endeavor to turn the University's campus into a showcase for creative and practical solutions to sustainability.

The Sustainable Smart Campus as a Living Lab initiative, launched in 2019, is transforming the campus itself into a “lab” and testing ground for new approaches to address real-world challenges in our current way of life.

With a pledge of HK\$50 million over three years, the University aims to identify and implement sustainable, smart, and cross-disciplinary HKUST projects using the campus as the platform to see results. Ideas combine sustainability principles with smart and innovative approaches to solve problems and are being collaboratively developed by faculty, staff, students and alumni. SENG-related projects total 10 out of the 15 in the scheme to date.

HKUST President Prof. Wei SHYY said that the endeavor would help advise on ways that people can move to a future that is greener, more livable, and human-centric, pointing out that “universities are microcosms of society”.

The initiative sought to be a springboard for testing new ideas and approaches, President Shyy noted. “Projects need not include cutting-edge technologies, nor do they need to succeed on the first try,” he said. “But by turning our campus into a ‘living lab’, we hope to instill a culture of learning from failure and self-initiated changes, which will eventually spread to a larger community beyond our campus.”

Turning to sustainable living

Some of the SENG-related Living Lab concepts. Project leaders in brackets.



Smart Mini-grid: demonstration of a 100% renewable energy power system, comprising solar panels and an innovative e-fuel energy storage system. (Prof. T. S. Zhao)



Indoor Navigation and Bus Queue Analytics: wi-fi sensing technology to navigate inside HKUST buildings and analytics to learn about queues at campus bus stops. (Prof. S. H. Chan)



Blockcerts: applying blockchain to student transcripts to underpin development of tools for students' CVs. (Prof. Q. F. Chen, S. K. Kwan & J. Prince)



Digital Twin for HKUST Campus: replicating physical assets and systems digitally to assist facilities management. (Prof. C. P. Cheng)



Internet of Tree Things: efficient method to maintain and monitor trees, adding to sustainability. (Prof. Y. H. Wang)

More details of all the Living Lab projects at ssc.ust.hk/projects

Hi-tech joint labs drive knowledge transfer

In an important boost for University-industry partnerships and the longer-term economic development of Hong Kong and the Greater Bay Area, HKUST has established three joint research laboratories with Mainland China companies involved in key hi-tech areas.

The **HKUST-WeBank Joint Laboratory** will include collaborations on AI, big data, and blockchain, together with financial and regulatory technologies. WeBank is China's first private digital bank and the pioneering agreement with HKUST marks the first joint banking lab project between Guangdong and Hong Kong.

The joint lab is seeking to drive development of fintech algorithms and novel technologies, being open-source and collaborative in reaching out to all types of potential partners, according to WeBank Chairman and CEO David KU.

HKUST President Prof. Wei SHYY said that he hoped the joint lab would leverage the strengths of both partners to develop new banking technologies with social impact. The lab will be headed by Dean of Engineering Prof. Tim CHENG.

The **HKUST-Xunlei Joint Laboratory on Blockchain Technology** is seeking to develop blockchain technologies applicable to different industries and advance a high-performance blockchain ecosystem in the Greater Bay Area. Xunlei Ltd. is an innovator in shared cloud computing and blockchain technology, providing a wide range of products and services across cloud acceleration, blockchain, shared cloud computing, and digital entertainment. The two parties will work together to improve existing consensus algorithms and explore new models while establishing an overall blockchain system with a higher security level.

In addition, the **HKUST-Xiao-i Joint Laboratory on Machine Learning and Cognitive Reasoning** has been set up together with Shanghai Xiaoi Robot Technology Co. Ltd., a leading developer of AI technologies and industry application platforms with its applications serving more than 800 million users. These technological strengths, together with HKUST's world-class research capabilities in AI and big data, are expected to generate novel AI advances. This is Xiao-i's first collaboration with a university in Hong Kong. The lab will conduct fundamental AI research to build AI systems with high cognitive capabilities.

Eminence recognized

Three more School of Engineering (SENG) senior academics, all from the Department of Electronic and Computer Engineering, have been recognized for their achievements with named professorships.

Prof. Khaled BEN LETAIEF has been named New Bright Professor of Engineering while Prof. CHAN Man-Sun has been awarded the Alex Wong Siu Wah Gigi Wong Fook Chi Professorship and Prof. LI Zexiang has been appointed to the Colin Lam Ko Yin Professorship. They join seven other SENGL named professors to bring the School's total to 10.

All of the new appointees are outstanding educators and researchers. Prof. Ben Letaief specializes in novel wireless communications of the future, including 6G and Internet of Everything; Prof. Chan is a semiconductor technology expert, who has contributed to record-breaking new device



Three more School of Engineering faculty have been appointed to named professorships: (from left) Prof. Khaled Ben Letaief, Prof. Chan Man-Sun, and Prof. Li Zexiang.

structures and improvement of integrated circuit manufacturing processes; Prof. Li focuses on robotics and manufacturing solutions related to smart automation and is a co-founder of global drone giant DJI.

Named professorships are established through the support of donors and are regarded as a significant honor for distinguished faculty. Further details are available at np.ust.hk/en/top_minds.php.

Aerodynamic lift for Olympic cyclists

HKUST's Aerospace Engineering researchers are setting out to enhance the performance of Hong Kong's elite cyclists, including stellar racer Sarah Lee, at the Tokyo Olympics in 2020 through support from the Hong Kong government, and a cooperative venture with the Hong Kong Sports Institute and a Hong Kong donor to deepen the effectiveness of sports science through leading engineering insights.

The A. Kwok Sports Aerodynamics Science Initiative Project, led by Prof. ZHANG Xin, Swire Professor of Aerospace Engineering and Chair Professor of Mechanical and Aerospace Engineering, is using a unique aerodynamic research platform combining an advanced aero test rig with computational fluid dynamics based on Formula One racing car technology to assist Hong Kong's Olympic cycling athletes adopt the best riding posture and manufacturers to develop equipment to optimize performance. A donation of HK\$6 million from Mr. Adam KWOK Kai-Fai, Sun Hung Kai Properties Executive Director, is providing support for the exciting project, in addition to more than HK\$6 million from the Hong Kong government. The funding is enabling wind tunnel tests for athletes and equipment.

Hong Kong's cycling team, featuring Lee, Wong Kam-Po, Jamie Wong, and Marco Kwok, is already one of the world's finest. However, Prof. Zhang also noted that "a combination of technology and traditional training can help cyclists make small tweaks to their positions in return for crucial



Prof. Zhang Xin prepares to test the aerodynamic design of an athlete's body suit for drag reduction.



Optimization of riding posture: smoke visualization of an athlete using the aerodynamic test platform.

gains in time". He added: "In all top-level competitions, the time difference between medal positions may only be a matter of seconds or milliseconds."

In December 2019, Lee told *Sing Tao Daily* that her New Year wishes included being able to use the technology provided by HKUST and the Institute to prepare for top races, including the Japan Olympics. The tests are expected to reduce physical exertion, with the additional resources this gives the cyclists used to boost speed. In addition, test data can help to improve techniques to handle wind resistance, enabling team members to pedal faster.

Welcoming the collaboration, Dr. Trisha LEAHY, Chief Executive of the Hong Kong Sports Institute, explained: "The application of sports science has become a must-do for all sports powerhouses if they want to stay at the forefront in today's sports world." Meanwhile, Mr. Kwok said he was looking forward to the tripartite endeavor helping the Hong Kong team members make history again.

HKUST is also working with the Hong Kong Sports Institute to build dual career pathways through facilitating academic study alongside the sports training that elite athletes require. The Institute can nominate full-time elite athletes for admission to undergraduate programs, with the University offering flexible learning arrangements that can accommodate training schedules.

Dual master's degree boost for power engineering

The School of Engineering has commenced Hong Kong's first joint academic and industry-run dual master's degree program in power engineering to widen the professional pool in the field and promote innovation and technology research in the power industry.

Offered in partnership with CLP Power Hong Kong Limited and the University of Strathclyde, Scotland, the part-time Dual Master's Degree Program in Future Energy and Power System Operation and Management is setting out to deepen the knowledge of existing and aspiring power industry engineers, with a combination of academic research and professional practice. It also includes

application of big data analytics, internet-of-things technology, and artificial intelligence.

The first cohort of nine students began their course in September 2019, with classes being conducted in a traditional classroom setting and through online distance learning. Students will benefit from the world-class expertise and facilities at HKUST, University of Strathclyde, and the CLP Power Academy. Thesis projects will be guided by academics and local industrial mentors, and graduates will be awarded both a Master of Philosophy degree from HKUST and a Master of Science degree from the University of Strathclyde.

CLP Power Vice Chairman Mrs. Betty YUEN said that the company hoped that the research projects by students would enhance the spirit of innovation in the power industry, "helping us move together toward a smarter, greener Hong Kong". Prof. Tim CHENG, Dean of Engineering, also welcomed the pioneering program, noting that it would serve as a trailblazer for future collaborations in other engineering disciplines.

Students on the city's first joint academic and industry-run master's power engineering program will earn an MPhil from HKUST and MSc from the University of Strathclyde in Scotland.



First direct mainland funding

In a cross-border development to boost research support, Prof. Patrick YUE, Electronic and Computer Engineering, has become the first academic at a university in Hong Kong to receive direct research funding from Mainland China. This follows the 2018 directive from the Ministry of Science and Technology and Ministry of Finance, allowing Hong Kong universities and institutes to apply for earmarked Mainland research funds for research carried out in Hong Kong.

The HK\$3.53 million grant will support the design of a new generation of optical electronic chips to increase the efficiency of 5G wireless infrastructure. The project will be carried out in collaboration with South China University of Technology and Southern University of Science and Technology. The funding has been awarded by the Department of Science and Technology of Guangdong Province under the Guangdong Provincial Key R&D Program.

Prof. Yue is an eminent researcher in visible light communication and optical fiber communication system-on-chip design. He was recently elected a 2020 Fellow of The Optical Society (OSA) for his contributions to the global field.



Prof. Patrick Yue: setting the pace in optical electronics.

Technology academy to accelerate regional industry

In an enterprising move, the HKUST-Academy for Continuing Education is to be established in the Futian Bonded Zone in the Shenzhen-Hong Kong Special Collaborative Demo Zone to provide technological education support to industry.

The Academy, based in the landmark Chang-Fu Commercial Building, will be under the School of Engineering but offer a platform for all HKUST departments and offices to engage with tertiary education providers and industry in Hong Kong and Mainland China.

The self-financed Academy will deliver high-quality learning opportunities with an international focus, serving as a professional training center for executive education and knowledge-sharing on the latest technology and industry developments. It will host short courses, workshops, seminars, and support joint initiatives, research, and industrial collaborations.

Funding has been obtained from the Futian district government and School of Engineering, with Prof. CHAN Man-Sun, Electronic and Computer Engineering, appointed Founding Director.

The Academy will be located on the supertall building's 37th floor, one of three floors provided to HKUST in an agreement between Futian district government and HKUST Shenzhen Research Institute. On the 40th floor, HKUST will open labs for data science, fintech, robotics, and automation, among others, while the 41st floor will provide incubation space and support services for the University's entrepreneurship community.

High hopes: interior of the HKUST-Academy for Continuing Education (below) located in the dramatic Chang-Fu Commercial Building.



Automated lip reader to assist hearing-impaired

A remarkable artificial intelligence (AI)-based lip-reading device, designed by a School of Engineering student team, has brought fresh hope of greater social interaction for the hearing-impaired, along with a series of accolades for its two creators.

The team, comprising students Padmanabhan (Paddy) KRISHNAMURTHY (Year 3, Computer Science) and Amrutavarsh Sanganasappa KINAGI (Year 3, Computer Science and Mathematics) have developed "Helen", the first wearable accessibility device of its kind, under the supervision of Prof. Brian MAK.

Named after Helen Keller, the blind and deaf American author and educator, the technology is based around a compact camera, automated lip reading, and deep learning. The camera takes images of a speaker that are streamed to a remote device that can translate the feed into text to generate a transcription of what has been said.

In October 2019, the team came up with an outstanding presentation on the innovation to win the global final of the Institution of Engineering and Technology (IET) Present Around the World Competition in London.

Other recognitions have included runner-up in the Hong Kong regional contest for the James Dyson Award 2019, and winning HKUST's prestigious President's Cup 2019, a University-wide competition to highlight leading undergraduate achievements in research and innovation.



Undergraduates Padmanabhan Krishnamurthy (right) and Amrutavarsh Sanganasappa Kinagi (left) at work on their novel "Helen" automated lip-reading technology.

Rising stars of computer vision

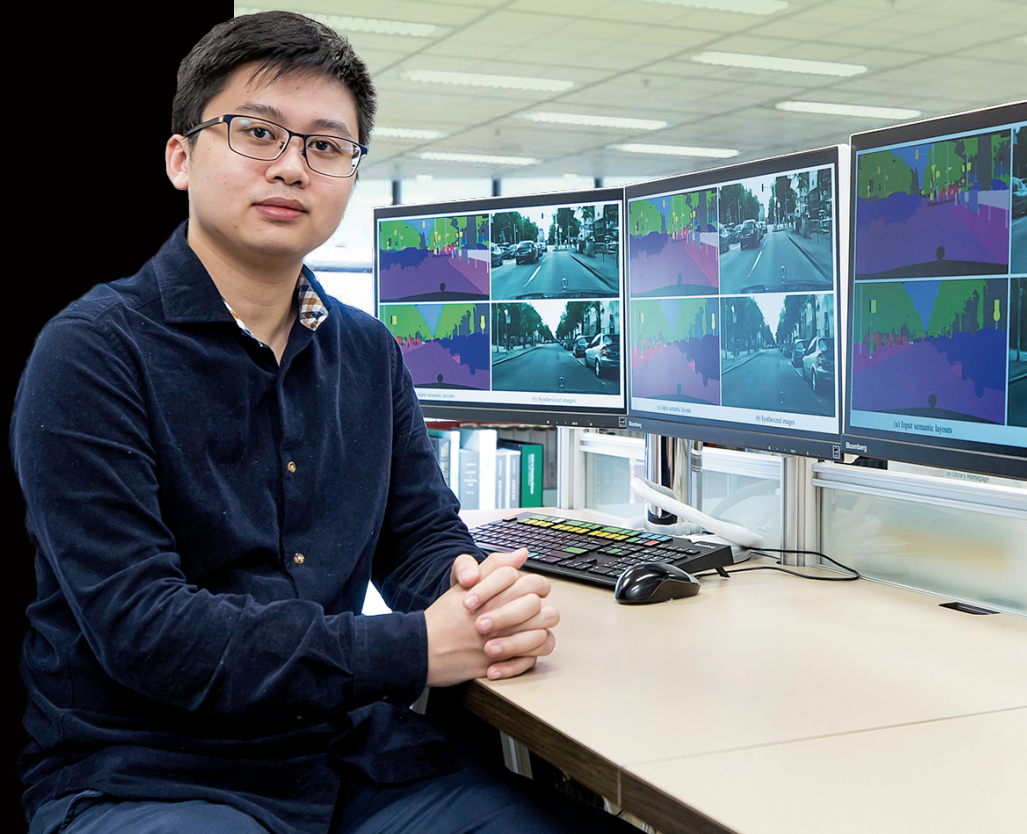
Two young faculty discuss how the future will look and ways to inspire the next generation

Prof. Chen Qifeng is researching how to create frames and synthesize a video simply by inputting descriptions into a computer.

When Associate Professor YEUNG Sai-Kit and Assistant Professor CHEN Qifeng returned to their alma mater to join the School of Engineering (SENG) in 2018, they were both driven by the belief that engineering can change the world. In particular, they foresaw that knowledge and applications related to computer vision – where researchers seek to enable computers to visually sense the world like human beings – are soon going to alter many aspects of our lives. They wanted to contribute to this exciting future as well as enthuse others through their research and teaching.

The talented young academics are jointly appointed to two different SENG units. Sai-Kit is based in the Division of Integrative Systems & Design and Department of Computer Science & Engineering while Qifeng calls both the Departments of Computer Science & Engineering and Electronic & Computer Engineering home. Being sited across areas in this way helps them, and their fellow faculty members, widen and combine their own vision about research and teaching as well as broaden their students' perspectives. Both are also affiliated with the HKUST Robotics Institute.

Qifeng's current research focuses encompass how to utilize artificial intelligence (AI) to analyze computer graphics so that one day we could simply use our imagination to create frames and synthesize a video. "Hopefully, some day you will be able to produce a video based on whatever



you imagine simply by inputting text or descriptions into a computer,” Qifeng said. If developed, this technology could herald the dawn of a new art medium, making it possible for stars from the past to be cast in today’s films.

Wider views

Born in Guangdong and interested from a young age in using programming to solve problems, Qifeng became keen to join HKUST for his undergraduate studies after being introduced to the institution by a friend already studying at the University. “I fell in love with it,” he said. “Even though Tsinghua University had offered me a place as early as Secondary Three, I decided to come to HKUST instead.”

Having graduated from HKUST with a BSc in Computer Science and Mathematics in 2012, he then set his sights on a PhD at Stanford University, where he came up with an approach to synthesize photographic images using semantic layouts. The demonstration video on YouTube attracted around 100,000 views and media coverage in the US, France, and China.

However, he was happy to return to the University to pursue his longer-term career dreams following the awarding of his Stanford PhD in 2017. “HKUST has a strong research base and I am familiar with this. In addition, the development of the Greater Bay Area will offer tremendous opportunities,” he said.

For Sai-Kit, who was born in Hong Kong, HKUST has also played a seminal role in his life. He completed his BEng in Computer Engineering in 2003, MPhil in Bioengineering in 2005, and PhD in Electrical and Electronic Engineering in 2009 all at HKUST, before heading to the University of California, Los Angeles (UCLA) for postdoctoral research. HKUST was also his entry to the world of computer vision and computer graphics, in particular 3D content (scene and shape) understanding and modeling, as well as computational design using AI techniques, a visual realm that has captured his attention ever since.

Prof. Yeung Sai-Kit is focused on 3D content understanding and modeling, as well as computational design using artificial intelligence.

“My family expected me to study medicine but I liked computer engineering because it would equip me with the skills I needed to achieve something great in the future,” he said.

“Two or three people couldn’t build a plane or rocket, but could invent a software or platform that has a big impact or even change the world.”

Entrepreneurial insights

Prior to returning to HKUST, Sai-Kit worked from 2011-18 at the Singapore University of Technology and Design and founded the Vision, Graphics, and Computational Design Group. There, together with his PhD students, he extended a novel visual technology – Make It Home – that he and a partner had first devised while at UCLA to help people plan room layouts. From homes, the Singapore team expanded the software to shopping malls, theme parks, and school campuses.

In parallel, Sai-Kit founded start-up SKY Optimum Technology in 2015 to advance commercialization of the Make It Home software and immersive visualization. It proved another learning curve but a useful one. “While trying to commercialize the software, we faced a lot of challenges, from business modeling to technical issues, which I had never tackled as a researcher.”



Now the company has a clear business model, mainly providing software solutions to clients. These customers include the Singapore government, even leading to an assignment to redesign the prime minister's office! Sai-Kit also hopes to eventually extend the software's reach beyond those well-equipped with IT know-how. "In the longer run, I hope we can develop an interface that will allow people who are not tech-savvy to use it," he said.

Qifeng has undertaken entrepreneurial ventures of his own. In 2015, he was involved in a start-up that specialized in applying AI to unmanned aerial vehicles. "However, there wasn't much market demand. From that experience, I realized that the approach that is needed to conduct research is totally different from running a start-up," he said. "The former is focused on solving technical problems, while the latter requires you to identify a market need."

Then, in 2017, Qifeng co-founded a company called Lino with Stanford and Berkeley alumni partners to build "a YouTube on blockchain", a decentralized livestreaming platform using blockchain technology. Headquartered in Silicon Valley, the company raised US\$20 million from leading investors and now has 20 full-time employees.

Meaningful mentorship

Although Sai-Kit and Qifeng no longer play major roles in their companies in order to focus on their university positions, they still offer advice and support on technical aspects and believe their hands-on experience as entrepreneurs has enriched their teaching and research.

Knowing how their own formative experiences at HKUST served as a springboard for the future, both also recognize the importance of mentorship and making the time to foster the mindset and spirit for learning and applying knowledge among their students.

"I had very good mentors here, who gave me solid training, helped me to develop collaborative thinking, and to build my mental strength," said Sai-Kit, naming Prof. SHI Pengcheng, Prof. TANG Chi-Keung (C. K. Tang), and former president Prof. Tony F. CHAN as being particularly influential in guiding his aspirations.

Prof. Tang was also an important figure in developing Qifeng's interest in research. "The research environment is very strong here," Qifeng said. "After I participated in the Undergraduate Research Opportunities Program, one of

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Qifeng in the spotlight at the Innovators Under 35 award ceremony.



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China

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Innovators
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China





Qifeng and Sai-Kit both feel their teaching and research have been enriched by their entrepreneurial experience.

my research papers was published in the *Proceedings of IEEE Conference on Computer Vision and Pattern Recognition*, a rare and precious opportunity for an undergraduate student.”

In 2018, Qifeng was recognized by two prestigious global accolades. He was chosen as one of the “35 Innovators Under 35” (China region) by *MIT Technology Review*, which spotlights leading young creative talents annually in fields such as biotechnology, communications, and the internet, being one of seven selected in the “visionaries” category. He was also a recipient of a Google Faculty Research Award, which funds world-class technical research in computer science, engineering, and related fields. That year, the international program received 910 proposals, with 158 receiving funding, including Qifeng’s machine perception project to solve low-light imaging difficulties.

Valuing mentorship: Sai-Kit and PhD supervisor Prof. Tang Chi-Keung.

Looking to the next generation

As a guiding light himself now, as a teacher and mentor, Qifeng believes students’ recognition of the value of the knowledge and skills they learn at HKUST is just as important as grades. In line with this, he is now leading a student team in a collaborative project with HKUST’s Library and Information Technology Services Center to set up facial recognition applications in connection with library services under HKUST’s Sustainable Smart Campus as a Living Lab initiative (see P5). “I want to nurture students and guide them to explore a greater variety of topics,” he explained.

Meanwhile, Sai-Kit is keen to share his experiences from the US and Singapore, and to bring home to students how studying engineering offers numerous possibilities and promising career paths. He is also very much enjoying being back on the inspirational Clear Water Bay campus. “I missed the beautiful campus here,” he said. “When a position opened up at the new Division of Integrative Systems and Design, I jumped at the chance. Working abroad offers you the opportunity to test yourself but contributing to the place where I was born and grew up is more meaningful.”





Seeing the light

Key scientific papers

March 1985, *IEEE Electron Device Letters*

Two-layer organic photovoltaic cell

C. W. Tang

Research Laboratories, Eastman Kodak Company, Rochester, New York 14650
(Received 28 August 1985; accepted for publication 31 October 1985)

A new thin, two-layer organic photovoltaic cell has been fabricated from copper phthalocyanine and a perylene tetracarboxylic derivative. A power conversion efficiency of about 1% has been achieved under simulated AM2 illumination. A novel feature of the device is that the charge-generation efficiency is relatively independent of the bias voltage, resulting in cells with fill factor values as high as 0.65. The interface between the two organic materials, rather than the electrode/organic contacts, is crucial in determining the photovoltaic properties of the cell.

Two-layer organic photovoltaic cell

C. W. Tang and S. A. VanSly

Research Laboratories, Corporate Research Group, Eastman Kodak Company, Rochester, New York 14650
(Received 12 May 1987; accepted for publication 20 July 1987)

A novel electroluminescent device is constructed using organic materials as the emitting elements. The device has a double-layer structure of organic thin films, prepared by vapor deposition. Efficient injection of holes and electrons is provided from an indium-tin-oxide anode and an alloyed Mg:Ag cathode. Electron-hole recombination and green electroluminescent emission are confined near the organic interface region. High external quantum efficiency (1% photon/electron), luminous efficiency (1.5 lm/W), and brightness (>1000 cd/m²) are achievable at a driving voltage below 10V.

what you use in a solar cell, and with
when you see the light coming out.

Prof. Tang Ching-Wan reveals how one research project that didn't go to plan led to his world-changing OLED discovery, a US\$25 billion dollar industry, and transparent televisions

Prof. TANG Ching-Wan is today considered the “father of Organic Light Emitting Diodes” (OLEDs), now widely used in tablets, televisions, and smartphones.

Since his groundbreaking discovery in the 1980s, the IAS Bank of East Asia Professor and Chair Professor in the Departments of Electronic & Computer Engineering, Chemistry, and Physics, has spent years working on applied research and commercialization to improve OLED performance, leading to highly fruitful results, including 80 patents as well as many honors for his work on organic electronics. Global accolades encompass being the first Chinese recipient of the Wolf Prize in Chemistry in 2011 and, most recently, the first ethnic Chinese to receive the Kyoto Prize in Advanced Technology from the Inamori Foundation in Japan in 2019.

“I remember, some years ago, seeing neon signs of Panasonic, Toshiba, Hitachi, NEC, and Pioneer across Victoria Harbor and thinking, wow, they have all engaged in OLED research,” Prof. Tang said.

Today, OLEDs – electronic devices that use organic semiconductors as the emitter and can efficiently produce visible light of almost any color – are poised to displace liquid crystal display (LCD) as the major display technology. OLEDs are being used in 50% of the world's mobile phones. The industry, now standing at US\$25 billion a year, is expected to generate US\$50 billion annually within three to five years. China alone has invested US\$100 billion in OLED technologies.

“OLEDs have the advantage of the ‘form factor’ – they can be displayed on surfaces that are rolled up or have curved edges, which is a differentiating factor, enabling mobile phones and other devices to have futuristic and fashionable designs,” Prof. Tang said. “They can also be completely turned off to produce a perfect black, and display different levels of black much more subtly.”

The result has been the arrival of curved television screens, rollable TVs, and now even transparent televisions that can be viewed from either back or front.

There are still improvements in OLED technologies to be made, though. These include price and cost-effectiveness as well as lifespan, particularly for the blue emitter, Prof. Tang noted. "OLED lifespan may not be as critical for manufacturers as in the past. However, as researchers, we try to overcome every challenge, particularly the more difficult challenges," he said. "When I look at cell phones, I see beyond the screen. I see luminescent molecules. I would like to see them glow as long as possible, if not forever."

Whereas earlier technologies such as plasma display panels and liquid crystal display took many decades to develop, OLEDs have grown much faster in comparison. Looking back, Prof. Tang said he felt "humbled" by the way events had unfolded. "I feel good that I have invented something for people to use... I have been a lucky person."

Following an industry research career at Kodak Research Laboratories in the US, then a further career in academia at the University of Rochester, where he is an Emeritus Professor, Prof. Tang was happy to return to Hong Kong in 2013 to join HKUST's flagship global academic research hub, the HKUST Jockey Club Institute for Advanced Study (IAS), as the first IAS Bank of East Asia Professor.

"My roots are in Hong Kong and it was natural for me to return home where I spent my first 20 years. HKUST offered me opportunity," he noted. As such, he is seeking to contribute to the city, with his HKUST research aiming to develop high-performance OLED materials and devices as well as alternative OLED fabrication processes to reduce manufacturing costs. "I hope to build a research group and further improve the performance of OLEDs." Hong Kong is also a good location from which to visit labs in Mainland China, Taiwan, Korea and Japan, he said.

From failure to achievement

Prof. Tang could never have imagined this would be his life story as a village boy from Yuen Long in the New Territories, revealing that his discoveries actually sprang from failure.

Prof. Tang Ching-Wan receives the Kyoto Prize in 2019 for his pioneering contributions to OLEDs.

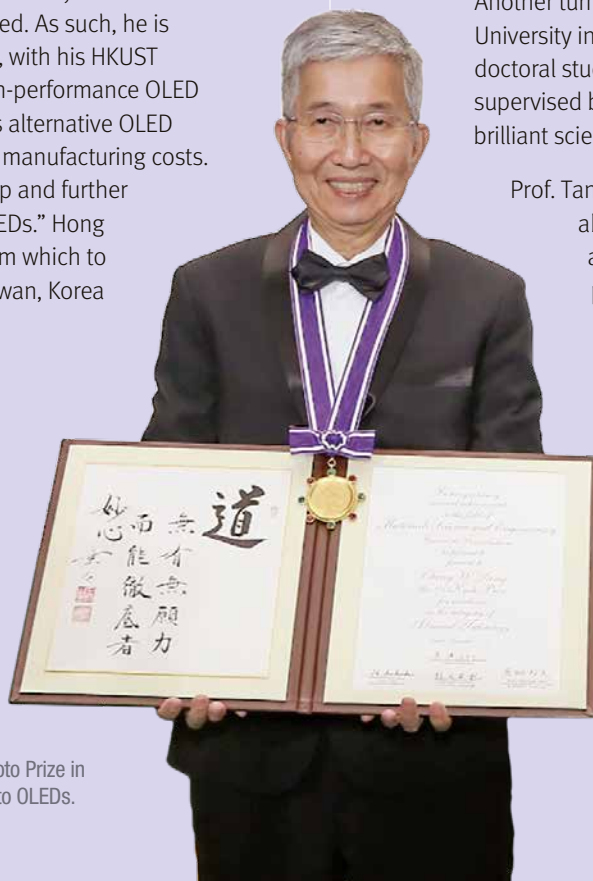
Born in 1947, just after the Second World War, he went through an "utterly unmemorable" primary education in Yuen Long, only recalling that after six years he failed the public entrance examination for secondary school and had to leave Yuen Long at the age of 12 for a private secondary school in Kowloon. Four years later, through his father's connections in the Yuen Long community, he gained admission to Yuen Long Public Middle School to begin the last two years of his secondary school education.

Once there, everything changed. He was surprised to find himself in a class of hardworking students. He was ashamed he did poorly in the first quiz he took in his physics class – ranking at the very bottom. That was a wake-up moment, the last chance to make up for past failures and to do better. He developed a keen interest in science subjects and ended up one of the best in his class by the time he graduated. He also passed the Secondary School Certificate Examination.

His success enabled him to attend King's College on Hong Kong Island in 1965 for matriculation, where he had to work even harder just to keep up with his fellow students. "They were so much smarter," Prof. Tang said. These efforts paid off two years later when he was offered a place at the University of Hong Kong. However, he eventually chose to go to Canada to study chemistry at the University of British Columbia, in part due to the turbulence of the Hong Kong riots in 1967.

Another turning point was attending Cornell University in the US for his PhD. There, the young doctoral student in physical chemistry was supervised by Prof. Andreas C. ALBRECHT, a brilliant scientist.

Prof. Tang recalled he and his advisor talked about almost anything, from sciences and humanities to current events and politics. He found these talks highly inspirational and they helped shape his research activities as well as his progressive tilt in dealing with everyday life. In research he learned how to find a worthwhile problem and to solve it independently. "It requires capability, curiosity, drive, perseverance, and critical thinking," Prof. Tang said. He was grateful for the way that Prof. Albrecht enabled him to develop these attributes. "He gave me space and left me alone to do



research.” In dealing with social issues, he was attracted to his advisor’s liberal worldview, and addicted to reading *The New York Times*.

Bright ideas

After obtaining his PhD from Cornell in 1975, Prof. Tang joined the Eastman Kodak Company as a research scientist at its Research Laboratories in Rochester, NY. To tackle the energy crisis in that era, he was tasked with developing low-cost solar cells using organic materials. “Since organic materials are not known for being good for solar cells, people working on them were either crazy or courageous,” he said. While the research did not achieve its original goal, the work did lead to his world-changing discovery.

“Solar cells were about turning light into electricity. When I made solar cells that performed poorly, but somehow generated light, it was actually a failure,” Prof. Tang said. “Yet my Cornell experience taught me to venture out and look deeper into the generation aspects and how to make the device more efficient. Along the way, I discovered the organic bi-layer P-N junction, a key device structure for producing high-efficiency organic solar cells as well as organic light emitting diodes – OLEDs.”

After his discovery, Prof. Tang abandoned organic solar cell research and focused solely on OLEDs. However, by the mid to late 1980s, after almost a decade spent on OLED research, Kodak’s interest in developing the technology had subsided, due perhaps to lack of progress or perceived commercial value. “I decided I needed to write a paper about our work on OLEDs before the project was terminated,” Prof. Tang said, explaining the rationale for writing his 1987 *Applied Physics Letters* paper, “Organic electroluminescent diodes”. This paper triggered so much excitement that it not only revived the OLED program at Kodak, it created a lot of research activities around the world. It also went on to become the most cited paper in the history of the journal, an unexpected achievement.

“I consider the 1987 OLED paper, the 1986 *Applied Physics Letters* paper on organic solar cells, and the 1989 *Journal of Applied Physics* paper on color electroluminescence to be my fundamental contribution to the field of organic electronics,” Prof. Tang said, “and it is really satisfying to know that thousands of scientists have been working in this field ever since.”

Tips for the top

Now a Member of the US National Academy of Engineering, Founding Member of the Hong Kong Academy of Sciences, Fellow of Hong Kong Academy of Engineering Sciences, Fellow of the American Physical



Looking deeper at the unexpected: Prof. Tang and his HKUST research team are seeking to further improve OLED performance.

Society, Fellow of the Society for Information Display, as well as Director of the State Key Laboratory of Advanced Displays and Optoelectronics Technologies at HKUST, how did Prof. Tang manage to combine multiple disciplines to achieve success?

“I didn’t do too well in any subjects early in my life, so in school I was not pigeonholed into any particular subject,” he said. “The only thing I remember from high school was being taught how to think logically, which is important for life and work. A good knowledge of physics is essential in understanding other disciplines, including chemistry and electrical engineering. With an adventurous spirit, I was open to learning things.”

And his advice to young people aspiring to pursue science?

“Learn the skillset you need so you can be good at what you do. Do well in school and don’t be afraid to take difficult subjects so you can learn more. Work hard. Follow your passion and be broad-minded.

“Be prepared to deal with failures as they are likely to be more frequent than successes. You can always do better and the climb from the bottom is always up. My own experience at Kodak helped me to look beyond a failed solar cell project to find unexpected success with OLEDs only many years later. A lot of scientific discoveries are like that. When things don’t work out, you look further, keep working, and do the best you can to come up with a solution. And the solution might very well be a great invention.”



Prof. Khaled BEN LETAIEF is New Bright Professor of Engineering and Chair Professor of Electronic and Computer Engineering. He is an internationally recognized leader in wireless communications and networks, with research interests in 5G systems and beyond, tactile internet, internet of things, big data analytic systems, and artificial intelligence. He is currently President of the IEEE Communications Society, the world's leading organization for communications professionals.

A look behind 5G

By Prof. Khaled Ben Letaief

The world we are about to enter with the arrival of 5G is set to move us beyond “connecting humans” to the new paradigm of “connecting things”. It signals the dawn of the age of mobile intelligence, the emergence of autonomous vehicles and large-scale machine-to-machine communications, along with virtual/augmented reality.

What does this entail? Speed. Using 3G, downloading a movie might take 24 hours. For the same movie with 5G, it will be there in a couple of minutes.

Faster speeds open up new possibilities. 5G could thus see the introduction of the “tactile” internet, a linking of physical and cyber realms that breaks down time and space barriers in controlling the physical world. In such an existence, a surgeon in Hong Kong might operate on a person in the United States, making virtual cuts that are transmitted to a US-based robot, which replicates the exact incisions on an actual patient. Indeed, potential tactile technologies are huge, across different sectors and industries.

“5G could see the introduction of the ‘tactile’ internet, a linking of physical and cyber realms”

Prepare also for the internet of vehicles that can sense, compute, and communicate with other machines; and for exponential growth of the internet of things, connecting more users, more devices, and even more sensors.

Achieving this will place fresh demands on our telecommunications networks. Today, cloud computing are the buzzwords for connectivity, with systems currently moving from mobile phone to base station, on through the backbone and up to the cloud for processing. All of which takes vital time.

One way to solve this is to shorten the distance from user to infrastructure to improve the “latency”, the interval or delay between an input into a system and the response. Bringing base stations closer to users and enabling these stations to carry out computation, rather than sending them to the cloud, reduces latency considerably. Here, HKUST is helping to pioneer the way, with its leading work on mobile-edge computing, a key breakthrough technology for providing such ultra-low latency communications and computation-intensive computing.

Given the predictions of billions of connected devices as a result of 5G now, and artificial intelligence-based 6G in around 10 years, power consumption and energy efficiency are at the forefront of concerns to be addressed. One of our recent focuses has been how to combine energy harvesting – capturing energy from the environment in which a system works, such as solar, wind, or kinetic energy – with mobile-edge computing.*

It’s exciting work for an exciting new social landscape. One that promises not an evolution but a revolution in the way we work and lead our lives.

* Prof. Khaled Ben Letaief’s paper, “Dynamic Computation Offloading for Mobile-Edge Computing with Energy Harvesting Devices” (*IEEE Journal on Selected Areas in Communications*, 2016), co-authored with former PhD student Mao Yuyi and Adjunct Assistant Professor Zhang Jun, recently received the IEEE Communications Society & Information Theory Society Joint Paper Award for outstanding papers published in the two societies’ publications in the previous three years.

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More details



Winning ways for Robotics Team



Making a splash globally: the Remotely Operated Vehicle Team and (right) the machine they created.



2019 proved another successful year for the HKUST Robotics Team. The Remotely Operated Vehicle (ROV) Team was crowned All-Around Champion in the MATE International ROV Competition in Tennessee, US, in June 2019. The global contest brought together 25 regional winners to compete under the theme of “Innovations for Inshore: ROV Operations in Rivers, Lakes, and Dams”. Twenty-one HKUST undergraduates from different disciplines participated. Their victory marked the second time that the University had received the overall championship, winning for the first time in 2017. HKUST remains the only Asian team to achieve this to date. The team was also named Engineering Presentation Champion. In addition, the Humanoid Team, comprising five engineering students, won the sports dance category of the Intelligent Robot Contest 2019 in Seoul, South Korea, becoming the first from Hong Kong to win in this category. The students had to program two humanoid robots to dance to a song.

Novel table tennis trainer

A Mechanical and Aerospace Engineering undergraduate team was among the winners of the 2019 International Contest of Innovation (iCAN) in Berlin for their Table Tennis Robot. The innovative device, featuring digital sound sensors, a special robotic mechanism, an open-source Arduino MCU and a control program, adaptively shoots table tennis balls to train players. Team members (from left) CHIU Chak-Yan, CHAN Kin-Fung, CHENG Yuk-Tong and LEE Ki-Lok competed against 18 other student teams from 11 countries and regions to secure one of the top prizes.



Shooting for the top at iCAN, held in Germany.



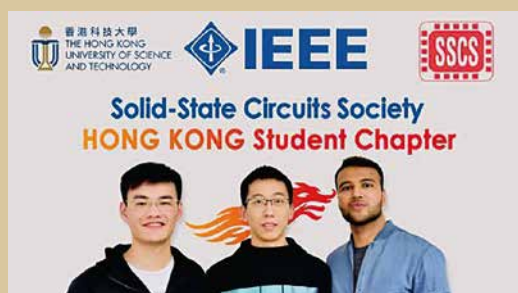
Zhang Hongming (right): one of 12 MRSA 2019 awardees out of 101 applicants.

Microsoft Research Asia Fellowship

Computer Science and Engineering doctoral student ZHANG Hongming received a 2019 Microsoft Research Asia (MSRA) Fellowship. Hongming was among 101 PhD candidates from 31 universities and institutions who applied for the fellowship, with 12 awarded at MSRA Academic Day 2019 in Beijing. The program aims to empower PhD students in the Asia-Pacific region to realize their potential in computer science-related research. In line with this, recipients receive a three-month visiting research opportunity offered by Microsoft, as well as a cash award.

Student chapters make their mark

Two HKUST-based engineering student chapters of professional organizations have had their enthusiasm and excellence recognized with accolades. HKUST's American Institute of Chemical Engineers (AIChE) Student Chapter was selected as an Outstanding Student Chapter for 2018-19. Its cabinet consists of 10 Chemical and Biological Engineering undergraduates, with faculty member Prof. Tom LUO serving as advisor. The IEEE Solid-State Circuits Society (SSCS) Hong Kong Student Branch Chapter received the SSCS Outstanding Chapter Award 2018. Formed in 2016, and based at the University's Integrated Circuit Design Center, the Chapter has organized a number of distinguished lectures and seminars for members.



Standing out: AIChE cabinet members at HKUST and (left) student organizers of the University's IEEE Solid-State Circuits Society branch.

Gold for smart facility management

A Civil and Environmental Engineering postgraduate and undergraduate team won the Gold Award in the 2019 International Facility Management Association (Hong Kong Chapter)'s Inter-Institutional Competition for Best Facility Management Project Presentation. The team, comprising PhD students CHEN Keyu, CHEN Weiwei (first left) and Helen KWOK Hoi-Ling (first right), and undergraduates CHAN Sum-Chau (second right) and Sampriti DWIVEDI (second left), triumphed with their Smart Facility Management for Smart Campus project. They were supervised by Prof. Jack CHENG.



Speaking up: four members of the victorious Civil and Environmental Engineering team celebrate their award-winning project presentation.



Outstanding performance: Electronic and Computer Engineering PhD graduate Dr. Yu Xianghao (center).

Research excellence

Dr. YU Xianghao (2018 PhD in Electronic and Computer Engineering) received the School of Engineering PhD Research Excellence Award 2018-19 for his work on millimeter-wave multi-input multi-output (mm-wave MIMO) communications and application of stochastic geometry in wireless network analysis. His research on hybrid precoding for mm-wave MIMO systems has been cited over 200 times. He also received a 2018 IEEE Signal Processing Society Young Author Best Paper Award. Dr. Yu is now a postdoctoral fellow at Friedrich-Alexander-Universität Erlangen-Nürnberg (FAU) in Germany, where he is supported by a Humboldt Research Fellowship. Dr. YAO Quanming, Computer Science and Engineering, and Dr. JIANG Haoran, Mechanical and Aerospace Engineering, both 2018 graduates, were first runners-up.

From computerized dreams to reality

From playing video games as a child in Mainland China to the opportunity to learn from the world's IT global giants via doctoral degree studies at the School of Engineering, Computer Science and Engineering postgraduate WEI Lili is leading the way for women seeking to become a driving force in a key business sector of today and tomorrow.

Lili's primary research goal is to help computer engineers produce reliable, high-quality software. To do so, she has been sorting out compatibility issues for Android apps, with the tools she has devised having already found 185 issues in different Android apps. Almost 90 have now been fixed.

As Lili (Class of 2020) explained, the need for her work has arisen because many smartphone manufacturers, including mega-firms such as Samsung and Huawei, have chosen to build their device models based on Android with systems customized to meet their own needs. "This results in many Android versions, which can make an Android app behave inconsistently on different Android device models, or have what we call 'fragmentation-induced compatibility issues'," she said.

Her success and passion for her chosen career path has also led to her selection for two prestigious stepping stones to the future: a Microsoft Research Asia (MSRA) Fellowship and a Google PhD Fellowship (see box).



Lili at the Microsoft Research Asia (MRSA) award ceremony.

- 2018 Microsoft Research Asia Fellow: the only female among 11 fellows chosen from over 100 nominated PhD candidates in Asia Pacific
- 2018 Google PhD Fellow in Mobile Computing: one of just six fellows from universities in East Asia; among 57 recipients globally



Wei Lili: originally the only female computer engineer in her research group, but now joined by three more.

MSRA PhD fellows are invited to join its annual Computing in the 21st Century Conference. Lili attended in 2018, which was also MSRA's 20th anniversary. The conference drew many famous computer scientists, enabling her to meet several Turing Award winners, including Prof. Andrew YAO, Prof. Raj REDDY, and Prof. Yoshua BENGIO. The program also includes a three-month internship at MSRA.

Google's one-year mentorship program involved quarterly meetings with an advisor, who shared many interesting ideas with the younger researcher. She also attended the annual Google summit at the company's main US campus in summer 2019, where Google researchers presented their latest studies and findings. "This was a great experience," she said.

In terms of changing times for women computer engineers, she uses as an example her small student group, where initially she was the only one. "In fact there are many female engineers these days," she said. "The gender gap is improving and there are now three more women in our group."

She is also in no doubt about her longer-term career direction: "I would like to find a faculty position to share my own enthusiasm for research with students."

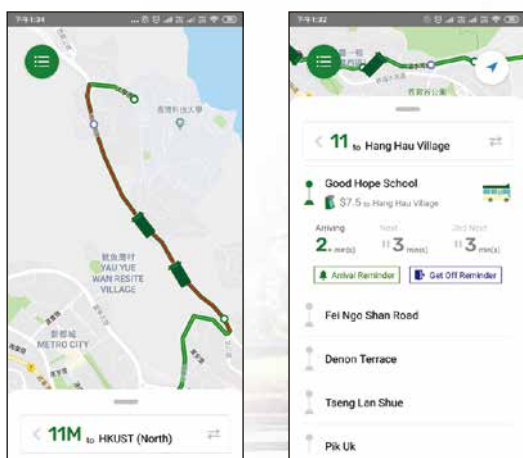
Timely app for smarter travel

An app designed by three alumni is making traveling to and from the campus more convenient by enabling visitors to HKUST and the campus community to track arrival times of several minibus lines and related traffic information.

UStansit, launched in September 2019, is the brainchild of Simon TSANG Pak-Kin (2018 BEng in Computer Engineering), Gash TSUI Cheuk-Leong (2019 BEng in Computer Science) and Jason YUEN Lok-Haang (2018 BBA in Marketing and Operations Management). Its arrival was well received, with over 7,000 downloads in the first two weeks of operation.

The trio met through the University's Entrepreneurship Center, with their start-up, SOCIF, launched in 2018 and valuable lessons learned along the way. For example, when the minibus company testing the trio's prototype said it was satisfied with the results but decided not to adopt the tool, the team realized that despite the app's usefulness for passengers and reasonable cost of a few hundred dollars, minibus operators were unlikely to spend that extra money unless it helped improve operational efficiency. This led the young innovators to add further features. "For example, we developed a dashboard for the operators so they can check the roster of drivers and status of payrolls, which helped the management in various areas," Simon said.

A year after launching SOCIF, the team had attracted clients ranging from the University, their first customer, to the corporate sector. They have also been invited by Microsoft to be an official partner.



UStansit app creators: School of Engineering alumni Simon Tsang (left) and Gash Tsui (right) and School of Business and Management alumnus Jason Yuen (center).

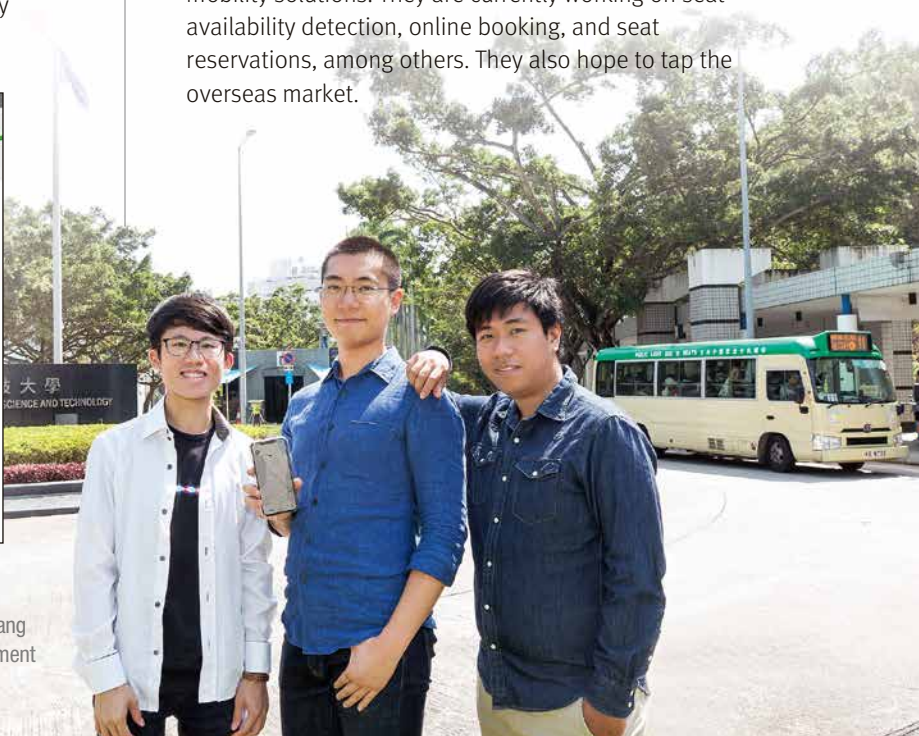


Learning about minibus operations to develop practical applications to help travelers and transport companies.

HKUST's strong encouragement and support proved a turning point for the start-up. At the outset, the trio used a co-working space offered by the Entrepreneurship Center to develop their ideas, ahead of gaining a place in the Hong Kong Science Park incubation program. "The Center also recommended we joined many exhibitions and competitions for start-ups," Gash explained.

In 2019, the team's information and communications technology (ICT) was recognized with a Student Innovation silver award in the Hong Kong ICT Awards. The University's public relations team gave further assistance by drawing outside attention to the team's work through media coverage.

In the future, the alumni plan to deliver more smart mobility solutions. They are currently working on seat availability detection, online booking, and seat reservations, among others. They also hope to tap the overseas market.



Robo-lawyer to the rescue as divorce cases rise

Hong Kong's divorce rate more than doubled in the 25 years up to 2016, along with increased demand for family mediation. By summer 2018, the trend and challenging workload it brought led Albert SO (2002 BEng in Computer Science [Information Engineering]), chair of the Hong Kong Mediation and Arbitration Centre, to reach out to his alma mater for assistance.

The lawyer's quest went on to become a research and development project for undergraduate CHEN Ziyi (Year 4, BEng in Computer Engineering), and then students NGAI Ching-Pang (2019 BEng in Computer Engineering), LIU Shuyue and ZHANG Fangzhou (both 2019 BEng in Computer Science), resulting in the city's first smart contract generator, with a chatbot specialized in divorce agreements. In addition, it can help with employment contracts.

The HKUST "robo-lawyer" is not only able to save time and money but also paves the way for the wider application of artificial intelligence (AI) technologies in the legal sector.

The robo-lawyer's primary task is to sort out essential elements for an agreement in light of the user's responses to a series of questions. Sentiment analysis also helps identify the respondent's feelings and mood. In divorce

cases, the user can only retrieve an agreement if they can answer all 20 questions, showing they have considered the most significant issues, such as custody of children and alimony. The robo-lawyer even tries to make couples think twice before finally going ahead with the divorce.

Although AI had been part of the students' foundation studies, they still had to fathom natural language processing from scratch to develop the chatbot. Even tougher was the lack of divorce-specific data preventing the team from building a more complex deep learning program, according to project supervisor Prof. SONG Yangqiu, Computer Science and Engineering and Associate Director of the WeChat-HKUST Joint Lab on Artificial Intelligence Technology.

As divorce cases are kept confidential, the team had to adopt a ready-to-use open source platform and fine-tune the program to serve its specific purposes. However, when the program is widely used in practice, big data processed by the chatbot could also be used to plan social policy. "The divorce rate is on the rise in Hong Kong and the chatbot program could provide an analysis of the pattern of causes and resentments behind divorces. It would thus be able to help the government and service providers

come up with suitable measures," Ziyi said.

While the robo-lawyer needs further refinement and training before it can be deployed, Albert hopes it will soon benefit divorcing couples, saving thousands of dollars in legal fees and allowing lawyers to focus on more value-added duties.

Student developers, together with alumnus Albert So (second left), project supervisor Prof. Song Yangqiu (third left), and the smart contract generator that saves time and money on divorce agreements.





Environmental youth leader Samantha Kong: supporting others to follow in her footsteps.

‘All-round’ scholarship

In a fillip for awareness-raising on the benefits of an all-round education, alumna Samantha KONG Wing-Man (2014 BEng in Chemical and Environmental Engineering) has set up a local undergraduate scholarship program focused on youth leadership and sustainable development.

The Samantha Kong Scholarship in Global Youth Leadership and Sustainable Development is a result of Samantha’s earlier decision to donate proceeds from the sales of her book titled “誰說Engineering是水泡科” (“*Who Says Engineering is Second Best*”) published in 2015 to HKUST in recognition of the University’s support in nurturing all aspects of her potential, not only her academic ability.

The annual scholarship awardee will be a post-Year 1 student in the School of Engineering or on Dual Degree programs. Among the criteria for selection, applicants must have demonstrated contribution through community service to the scholarship’s two areas of focus. The awardee will also need to complete an unpaid eight-week internship at an NGO promoting environmental health and literacy in New York. The NGO should have consultative status with the United Nations (UN), allowing them to participate in UN work.

New appointments

Administrative

Prof. Lionel NI

Appointed Provost
Chair Professor, Computer Science and Engineering

Prof. Ricky LEE

Appointed Dean of HKUST Fok Ying Tung Graduate School
Chair Professor, Mechanical and Aerospace Engineering

Prof. PONG Ting-Chuen

Appointed Senior Advisor to the Provost and
Acting Director of Center for Education Innovation
Professor, Computer Science and Engineering

Prof. SUN Qingping

Appointed General Director of HKUST Shenzhen
Research Institute and General Manager of HKUST
Research & Development Corporation (Shenzhen) Limited
Professor, Mechanical and Aerospace Engineering

Prof. Albert CHUNG

Appointed Associate Dean of Engineering
(Undergraduate Studies)
Professor, jointly by Computer Science & Engineering and
Chemical & Biological Engineering

Prof. YEUNG Dit-Yan

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

Prof. Ben CHAN

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

Faculty Members

Prof. JIANG Wei

Assistant Professor, Industrial Engineering and Decision Analytics
PhD – National University of Singapore

Prof. KIM Yoonseob

Assistant Professor, Chemical and Biological Engineering
PhD – University of Michigan

Prof. LI Sen

Assistant Professor, Civil and Environmental Engineering
PhD – The Ohio State University

Prof. QIU Jishen

Assistant Professor, Civil and Environmental Engineering
PhD – Nanyang Technological University

Prof. SHAO Qiming

Assistant Professor, Electronic and Computer Engineering
PhD – University of California, Los Angeles

Prof. Axel THALLEMER

Professor of Engineering Practice, Division of Integrative Systems
and Design

Prof. YOU Wei

Assistant Professor, Industrial Engineering and Decision Analytics
PhD – Columbia University

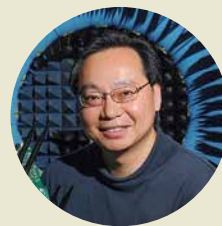
Prof. ZHANG Tong

Chair Professor, jointly by Mathematics and Computer Science &
Engineering
PhD – Stanford University

Faculty awards & achievements

External honors

Chair Professors **GAO Furong** (left), Chemical and Biological Engineering, **Vincent LAU** (center), Electronic and Computer Engineering, and **Lionel NI** (right), HKUST Provost and Computer Science and Engineering, have been honored with Natural Science Awards (Second Class) in the 2018 Higher Education Outstanding Scientific Research Output Awards (Science and Technology). The accolades are among China's top awards for science and technology.



Prof. **Joseph LEE**, Senior Advisor to the President and Visiting Professor, Civil and Environmental Engineering, has been elected President of the International Association for Hydro-Environment Engineering and Research (IAHR), becoming the first Chinese scholar to lead the IAHR since its founding in 1935.



Chair Professor **Ricky LEE**, Mechanical and Aerospace Engineering, received the 2019 Outstanding Sustained Technical Contribution Award from the IEEE Electronics Packaging Society for his work in multiple technical fields over two decades.



Cheong Ying Chan Professor of Engineering and Environment and Chair Professor **ZHAO Tianshou**, Mechanical and Aerospace Engineering, was elected to the Chinese Academy of Sciences. He becomes the fifth faculty member at HKUST to be accorded the Chinese government's highest academic recognition for science and technology research.



Prof. **WANG Gang**, Civil and Environmental Engineering, received the 2018 Mao Yisheng Youth Award for his work in geotechnical earthquake engineering and soil dynamics.



Prof. **Richard LAKERVELD**, Chemical and Biological Engineering, was included in the 2019 Class of Influential Researchers, selected by *Industrial & Engineering Chemistry Research*, a leading journal in the field.



Prof. **SUN Fei**, Chemical and Biological Engineering, was chosen as one of the Royal Society of Chemistry's 2020 Molecular Systems Design & Engineering Emerging Investigators, and featured in the Society's "themed collection", which showcases work from leading early career scientists.



Prof. **Anthony LEUNG** (left), Civil and Environmental Engineering, and Prof. **WANG Jiguang** (right), Chemical and Biological Engineering, were named 2019 Excellent Young Scholars by the National Natural Science Foundation of China.



Visiting Professor **KWOK Hoi-Sing**, former Chair Professor, Electronic and Computer Engineering, received the prestigious 2019 Jan Rajchman Prize from the Society for Information Display. The honor recognizes outstanding research on flat panel displays.



Prof. **HUI Pan**, Computer Science and Engineering, has been elected to the Academia Europaea (Academy of Europe) for his contributions to informatics.



HKUST

The School of Engineering (SENG) Research Excellence Awards 2018-19 recognized Prof. **Khaled BEN LETAIEF**, New Bright Professor of Engineering and Chair Professor of Electronic and Computer Engineering, with the prestigious Distinguished Research Excellence Award for his influential international contributions to broadband wireless communications. Prof. **FAN Zhiyong**, Electronic and Computer Engineering, received the Research Excellence Award for his outstanding work on nanomaterials and devices while Prof. **WANG Jiguang**, Chemical and Biological Engineering, was selected for the Young Investigator Research Award for the application of data science to cancer medicine, and computational biology.

Four faculty were honored in the SENG Teaching Excellence Appreciation Awards 2018-19. Prof. **Desmond TSOI**, Computer Science and Engineering, received the top Distinguished Teaching Award. Prof. **CHAN Man-Sun**, Alex Wong Siu Wah Gigi Wong Fook Chi Professor of Engineering and Chair Professor of Electronic and Computer Engineering, Prof. **Jack CHENG**, Civil and Environmental Engineering, and Prof. **Richard LAKERVELD**, Chemical and Biological Engineering, were presented with Teaching Awards.

Prof. **Thomas HU**, Civil and Environmental Engineering, was honored with the annual University-wide Common Core Teaching Excellence Award 2018 for his Civil Engineering and Modern Society course.

In remembrance

The School of Engineering is deeply saddened to report the passing of Prof. Mitchell M. TSENG on October 21, 2019. As the inaugural Head of the School's then Department of Industrial Engineering and Engineering Management (IEEM) in the early years of the University's founding, Prof. Tseng steered the Department (now Industrial Engineering and Decision Analytics) from 1993 to 2001, playing a pivotal role in building its strong foundation and international reputation. In 2014, he was granted Emeritus Professor status at HKUST.

Prof. Tseng, born in Taiwan, was an expert in mass customization, manufacturing systems design, and service systems engineering. Ahead of joining HKUST, he had gained both academic and substantial industrial experience in the United States at the University of Illinois at Urbana-Champaign, MIT, Xerox Corporation, and Digital Equipment Corporation.

As recalled by a long-time collaborator at Stanford University, who also served on IEEM's first Advisory Committee in 1993, Prof. Tseng was a visionary institutional builder, making teaching and research relevant to and impactful on industry, and building a network of relationships with industrial enterprises in Hong Kong and Mainland China.

In his role as educator and mentor, he was an inspiring innovator as well as a friend, and coach to many. He recognized early the need to develop students' global vision, teamwork capabilities, and adaptability to different cultures, realizing this, for example, in the IEEM-Stanford Joint Global Manufacturing Program in which students from each university worked together to solve a real-world problem set by a company. He also initiated HKUST's Logistics and Supply Chain Management Forum, an academic/industrial consortium, and championed industrial engineering as a discipline in the Mainland.

Prof. Tseng's dynamism, resourcefulness, and enthusiasm will be greatly missed by alumni and colleagues. He is survived by his wife, Jennifer, and two daughters, Sophie and Angie, who are fundraising to set up the Dr. Mitchell M. Tseng Memorial Scholarship Fund to continue his work to enable more young people to gain an education. Details at <https://uk.gofundme.com/f/dr-mitchell-m-tseng-memorial-scholarship-fund>.

Guangzhou campus moves forward

A groundbreaking ceremony in September 2019 and a pilot scheme to recruit postgraduate students have moved plans for HKUST's innovative, purpose-built campus in Guangzhou off the drawing board and into the initial stage of implementation. The advances follow approval from the Ministry of Education for the University to proceed with establishment.

The Hong Kong University of Science and Technology (Guangzhou) (HKUST (GZ)) in Nansha will work synergistically with the Clear Water Bay campus to deliver a state-of-the-art education for the 21st century, including a new approach to engineering education combining research, education, technology transfer and societal impact.

The campus has been established under a tripartite agreement between HKUST, the Guangzhou Municipal Government, and Guangzhou University. The first phase of construction is expected to be completed by mid-2022.

Those attending the groundbreaking ceremony at HKUST (GZ)'s site included Mrs. Carrie LAM, Chief Executive of the HKSAR Government; Mr. Li Xi, Party Secretary of Guangdong Provincial Committee; Mr. MA Xingrui, Vice Party Secretary of Guangdong Provincial Committee and Governor of Guangdong Provincial Government; Mr. WANG Zhimin, Director of the Liaison Office of the Central People's Government in Hong Kong; Mr. HUANG Liuquan, Deputy Director-General of the Hong Kong and Macao Affairs Office; Mr. Andrew LIAO Cheung-Sing, Chairman of the HKUST Council; and Prof. Wei SHYY, President of HKUST.

In addition, HKUST has launched a pilot recruitment scheme at the Clear Water Bay campus, with 106

Image: KPF



Impression of the HKUST (GZ) campus.

postgraduate students enrolled in programs and related research areas proposed by HKUST (GZ).

The 1.13 square-kilometer new campus will take a cutting-edge approach to nurture talent and facilitate collaboration between Hong Kong, the Greater Bay Area (GBA), and beyond, creating an institutional powerhouse to drive forward knowledge transfer in the GBA.

There will be no duplication of existing HKUST programs, with the focus on cross-disciplinary thematic programs to complement those in Clear Water Bay. The curriculum will be designed around four transdisciplinary hubs: information, function, system, and society. Research areas will cover data science, robotics and automation systems, artificial intelligence, advanced materials, and other emerging and frontier fields.

Proposed masterplan of HKUST (GZ).

- Laboratory Space
- Staff Quarters
- Student Hostel
- Canteen
- Performing Arts Center
- Amenities
- External Test Facilities
- Supporting Space
- Indoor Sports
- Outdoor Sports
- Cultural Facilities
- Library
- Classroom
- Admin & Faculty Offices
- Water
- Facilities Infrastructure