



## Faculty of Engineering The University of Hong Kong

Pokfulam Road, Hong Kong

Tel: (852) 2859 2803

Fax: (852) 2546 9142

E-mail: [enggfac@hkucc.hku.hk](mailto:enggfac@hkucc.hku.hk)

Website: <http://engg.hku.hk>

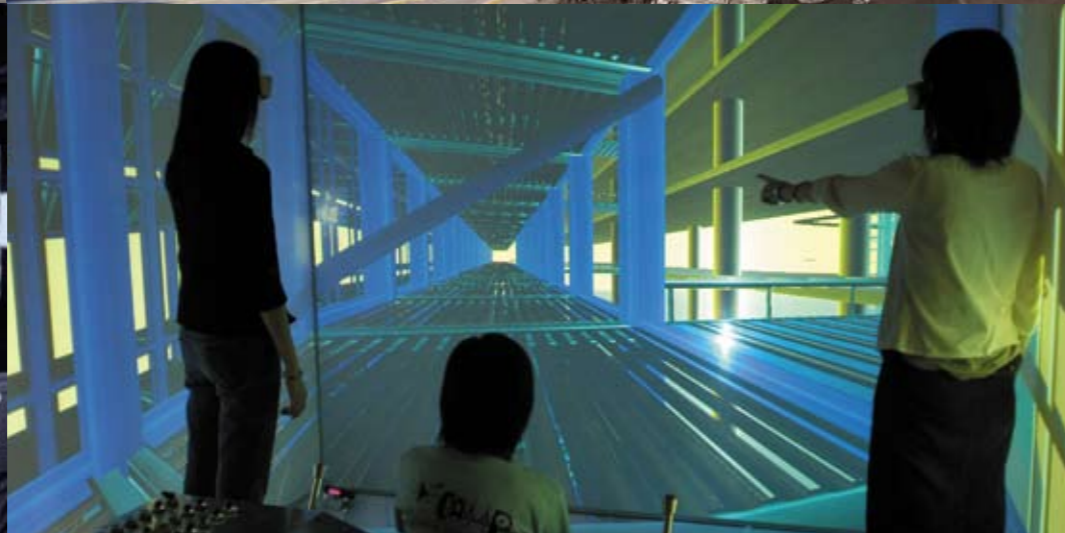
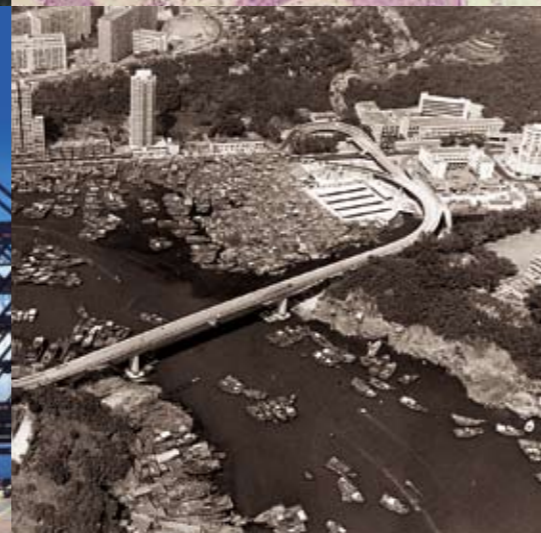
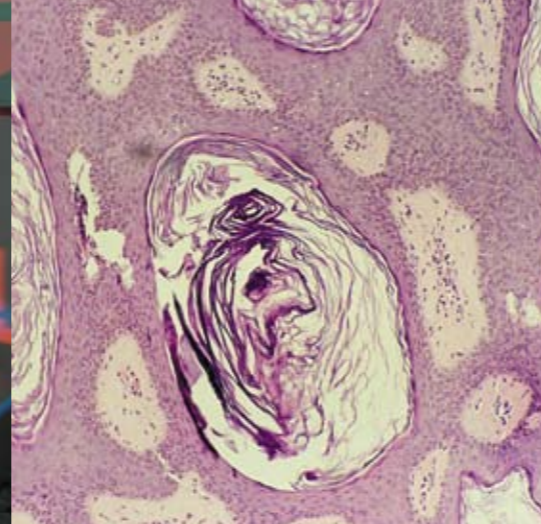


# ENGINEERING THE FUTURE

**Faculty of Engineering**  
The University of Hong Kong



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## A MESSAGE FROM THE DEAN

This brochure highlights some of the best reasons to study Engineering at the University of Hong Kong. As the oldest and most well-established Faculty of Engineering in the territory (and one of HKU's two founding faculties) we have long remained pioneers in education. We were the first to practice problem-based learning and still place great emphasis on project-centred education offering a stimulating, up-to-the moment curriculum that can lead to multiple career options.

We care very much about teaching at HKU. And in Engineering in particular we care about how we transfer knowledge to students. After all this University was first established to train graduates for Hong Kong, China and South East Asia and that tradition is still strongly maintained. So even though we've evolved into a research university, you'll find that the first priority of our staff is teaching. Quality assurance is very important to us.

Again, if you look at our research performance, in terms of research funding and publications per staff members, we are ahead of all the other institutions in Hong Kong.

There may be a misconception that a degree in engineering limits a graduate's career options to the field he or she has studied. But it might surprise you to learn that our graduates are sought after by an impressive array of companies, including financial institutions, law firms, utilities and logistics companies and the telecommunications industry.

As you will see from this brochure some of our alumni hold leading positions in government and industry, while our academics work closely with companies like DHL, the MTRC and KCRC and are also involved in many government projects that benefit the people of Hong Kong.

What we have learnt is that large international companies are most interested in recruiting students who are mature, well-rounded individuals able to think rationally and independently.

So we train our engineers to be logical thinkers who solve problems in a practical way and see a project through to implementation despite physical and financial constraints. We train students to overcome real-life obstacles in their work and the skills they acquire in the process can be adapted to multiple industries.

Every year in all disciplines, students are required to complete a project – this could be as diverse as a design project or one to build a robot. They are also encouraged to take part in local, regional and international competitions like the Robocon and the solar car competition, which gives them plenty of hands-on experience.

Furthermore, the Faculty's own close working relationship with industry means that many of our students gain first-hand experience of working with big companies through internships and final-year projects. Several of them then go on to be recruited by our industrial partners.

In recent years our graduates have been employed by telecommunication giants like Hutchison Whampoa and PCCW, financial consultants like Morgan Stanley and GE Finance and banks like HSBC. Many mechanical engineers work for ASM Pacific – the semi-conductor bonding machine manufacturer – while Thames Water, in London, regularly recruits Faculty graduates.

Add to this the opportunities available in government departments, like geotechnical engineering, the Works Department, Electrical and Mechanical Services and Information Technology services and you'll see that the opportunities offered by a career in engineering are wider than you may think. We don't just train engineers, we produce leaders.

I hope that *Engineering the Future* gives you a further insight into our Faculty and the broad-based education we offer. I believe that the way we train our undergraduates – to think practically as well as theoretically – will prove to be the education of the future.

Professor T.S. Ng



# DELIVERING DOWN THE DECADES

As one of the founding Faculties at the University of Hong Kong, Engineering has formed an important part of the backbone of the University. For almost a century it has also played a crucial role in the development of the city it was established to serve, and has embodied the pioneering nature of Hong Kong. During the pre-war years it provided both Hong Kong and mainland China with first-rate engineers.

In the wake of the war years its Faculty of Civil Engineering played a significant role in re-building the city and, as Hong Kong has flourished, so has the Faculty. Today, it is one of the largest at the University, accepting about 1,100 students annually. Its five departments serve every aspect of industry from manufacturing to information technology.

The luxuries – taken for granted today – of convenient road and rail transport, clean water at the turn of a tap and electricity at the flick of a switch are thanks to the innovations of generations of engineers and scientists.

In Hong Kong, we live and work in high rise buildings with every modern convenience, and the prosperity we enjoy from business, commerce and tourism is due largely to the infrastructure that HKU engineering graduates have helped provide.

As we look ahead, the 21st century promises to be one of continued globalisation, with increased expectations of high living standards alongside demands for a solution to the environmental impacts of modern life. There is little doubt that the skills and innovative thinking we have demanded of our engineers down the decades will continue well into the future. In fact our very safety and continued prosperity rely on it.



# OUR STUDENTS

*The Faculty of Engineering attracts the best students in Hong Kong and we aim to provide them with opportunities and experiences that add value to their classroom education. Academically, students learn the best international practices and get hands-on, practical experience. They are also encouraged to work with industry, enter local and regional competitions and go abroad on exchange. Our goal is to ensure students have both the hard and soft skills to become leaders in their field.*



**Suen Tsz Yin**, *M.Phil, Electrical and Electronic Engineering*

Suen Tsz Yin won the Dare to be Digital scholarship that took him to Scotland to take part in a video game development competition.

“Most importantly” he says, this competition let me broaden my horizons. I’ve learnt that one’s geographical position shouldn’t limit one’s talent. Hong Kong is strong in business, but Dundee is strong in the game industry. You should find a suitable place to show your talent and make your dream come true.

“I’ve made friends with Indians, Canadians, Chinese and Scots, and it’s been very interesting to see how other people live. I’ve also learnt to face difficulties. The software program, language and social environment are all new to me. I’ve found that confidence, plus time, can solve every problem.”

Tsz Yin’s role on his team was as an AI programmer. “I created an AI aircraft which searches for the target character on the ground, follows it and fires on it,” he says. “Our game is called Glitch, a 3D fast-paced platformer. The player controls a robot moving around a destroyed city re-connecting the power nodes. The robot has a magnetic ball for its locomotion. The player needs to control the strength of the magnets in order to travel through some geometric puzzles in between. For example, the robot may need to travel on the ceiling. The player can enjoy a new experience, as if it is inside the robot.”

**Peggy Lau**, *recent graduate, Industrial and Manufacturing Systems Engineering*

“At HKU students have more freedom of choice in their studies and they are respected. I felt a sense of belonging here. I designed my courses so I could study Spanish and statistics outside my regular degree work. In my second year I was the General Secretary of the HKU Industrial Engineering Association and I gained experience organising events.

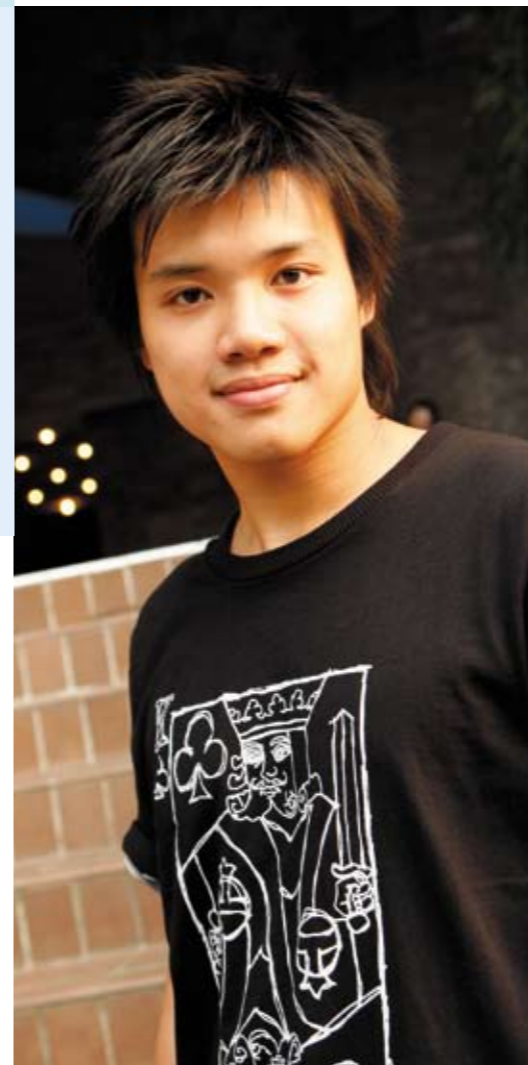
“I’ve gained knowledge about different aspects of logistics and industrial engineering and I’ve also had many chances to meet with people in industry. Industry representatives came to seminars organised by the department to talk about what’s happening, and there were also site visits. In my final year I did a project on container terminals and I got to work directly with the operators of a container terminal.”



**“The network of our graduates will be able to provide you with valuable assistance in your career development in future. In the past nine decades, degrees from HKU have been so well recognised internationally that its graduates have been admitted to the very best institutions abroad, such as Cambridge, Harvard, MIT and Oxford.”**

**Mr Billy Ma**,

*HKU graduate and Project Manager Representative within Engineering at Thames Water, London.*



**Keith Wong**, *recent graduate, Mechanical Engineering*

“HKU is a truly international place. I’ve met students and professors from all over the world. The professors in my department were very helpful. When they found out I was interested in academic research, they gave me many opportunities to work as a research assistant with them. Their excellent teaching has provided a springboard for my career. Without them, I don’t think I would have received the great offers to study abroad that have come my way.

“Hall activities were also important to me. I met many different kinds of people, from different backgrounds and academic majors, and these interactions helped me get to know more about the world. Hall life is also fun and the inter-hall sports competitions were a good way of making friends and cultivating a sense of belonging.”



## A SCHOOL BUILT BY STUDENTS

*Undergraduates design and supervise construction of a school in rural China*

A unique opportunity for undergraduate students to help the less fortunate and put their classroom skills to work was realised in Da Lang Village, in Guangxi province.

Twenty-one students designed and supervised the construction of a new school for the village, which was funded by Faculty of Engineering alumnus, Dr Nicolas Yeung, who made student involvement a condition of his donation.

The students were in charge of all aspects of the school's construction, from interviewing villagers about what facilities they needed, to conducting land surveys, securing approval from the Mainland authorities, preparing tender documents and overseeing construction.

Along the way, the students had to learn about earthquake resistance, lightning rods, drainage, and architectural and other

building-related requirements in order to obtain approval for their design from the Mainland government.

The final result, built on a flattened hillside, incorporates a pitched roof to blend in with the village. The main building contains four classrooms, two teacher residences and offices and a multi-purpose hall. There is also an eco-friendly latrine block.

The project helped students to fulfil a course requirement for eight weeks of industrial training. More significantly, it gave them a wonderful sense of accomplishment.

Student Chung Hon Ting explains: "This has been a rare experience for us to understand the whole process of building construction, especially when there is a lack of technological support. I have also met different people and experienced a different culture, which has broadened my horizons and enriched my learning."



▶ **Wong Hon Wai**, 1st year, Department of Civil Engineering

Wong Hon Wai, an early Admissions Student (EAS), is the first recipient of the Western Harbour Tunnel Scholarship, which will cover his tuition fees throughout the undergraduate curriculum.

He says it was his passion for mathematics and physics that attracted him to Civil Engineering and he chose HKU because "it's the most prestigious university in Hong Kong. I like the hall atmosphere here. Even though I'm not in halls myself, all my fellow students seem to have a good time there and study together.

"As I'm an EAS and my secondary school classmates are now doing their A-levels, they've been asking me what department they should choose at HKU. I've told them that the programme offered by the Civil Engineering Department is well organised, taught by good professors and lecturers and it's easy to adapt to the different atmosphere. So, yes, I would recommend it."

**Liu Chi Man**, 3rd Year BSc, Computer Science

Liu Chi Man was part of the team that won 19th place in the world final of the ACM International Collegiate Programming Contest. He says: "Teamwork is very important. I was very excited to be part of a team that did so well. We were ranked higher than many prestigious universities in other countries. This shows that HKU students are as competent as those from other top universities."



▶ **Victor Fung Dat Fai**, recent graduate in Mechanical Engineering, now pursuing a Master's degree in France

"I chose to go on a degree-awarding exchange because I wanted to learn more about other parts of the world and to gain some international exposure. I'm pursuing the equivalent of a French master's degree.

"I arrived here alone, speaking only broken French. This experience has enabled me to gain confidence, even in difficult situations, and I think I'm stronger internally and more independent than I used to be. I have also learned to ski.

"My experience at HKU, where I completed a Bachelor's degree in mechanical engineering, has given me a very good perspective in comparing how future engineers are educated in two different countries. Some things that appear simple to my colleagues might not be that obvious to me, and vice versa. Nevertheless, my training at HKU has provided me with a good foundation to integrate into their courses and I'm very grateful for that."



**Yannick Dutertre**, *exchange student from France*

“I wanted to spend one or two semesters studying engineering abroad, preferably outside Europe. Among all the universities that I considered, I finally settled on the University of Hong Kong’s Faculty of Engineering because of two things: they have high standards of teaching, being one of Asia’s best, and also all classes are taught in English. Many Asian universities only provide English classes in the Business Faculty.

“I was able to choose my courses in a much more flexible way than in my home university, which is one big advantage for exchange students here. In the end I learnt what I wanted and more, so this experience was, academically – speaking, a success.

“My most memorable moments came from interacting with local students. The amount of effort they put into organising special student meetings and activities is just mind-boggling, and that’s a huge understatement. Nothing can prepare a Western student for the level of investment that these students have in their activities, clubs, and societies throughout the university.”



**April Chow**, *PhD candidate, Medical Engineering*

“I learned many things in my three years of undergraduate studies at HKU that have given me a very good foundation for climbing higher. My professors are very experienced – they have done a lot of collaborative work with other famous researchers in medical engineering – and they have been supportive of me. I also learned more about working with others in a group. Every person has their own strength and we need to try to utilise those strengths to try to come up with the best “product”.

“I chose to do a two-month internship overseas, in Boston, and it was an impressive experience. I gained a global perspective of how bioengineering can help people. I also attended an international conference. I met many famous people in the field and I was given the chance to submit an abstract of a project I was working on, on the factors affecting the quality of coronary magnetic resonance angiography.”

“From an employers’ perspective, we are not just looking at academic results. We look at the whole person, how they present themselves and whether they are fast learners. Overall, University of Hong Kong students have good soft skills. Their English is better and they seem to be more outspoken than students from other universities, perhaps because of their training. A person can be very good in their work, but if they are not able to present themselves they can be at a disadvantage. So it’s important for students to think clearly what message they would like to convey.”

**Steve Lau**, *Vice President, J P Morgan Securities (Asia Pacific) Ltd*



**Helen Li Wai-ming**, *2nd year Civil Engineering and Law and exchange student to Toronto*

“Before I went on exchange, I paid too much attention to my grades. However, my attitude changed after being with students in Toronto. They enjoyed studying much more than Hong Kong students. In the lab, they would spend time trying to discover the principle behind what they were doing, even though they could produce a report without it. They enjoyed the process of learning very much. After seeing their attitudes, I found studying to be more enjoyable. And the most important thing was that with a different attitude, I found my work could improve.

“I also made friends with a group of other students from Hong Kong. Most of them were not in my department and they are the first group of friends that I have who are not my classmates. We still hang out together. Going on exchange has helped me to become a more outgoing person.”

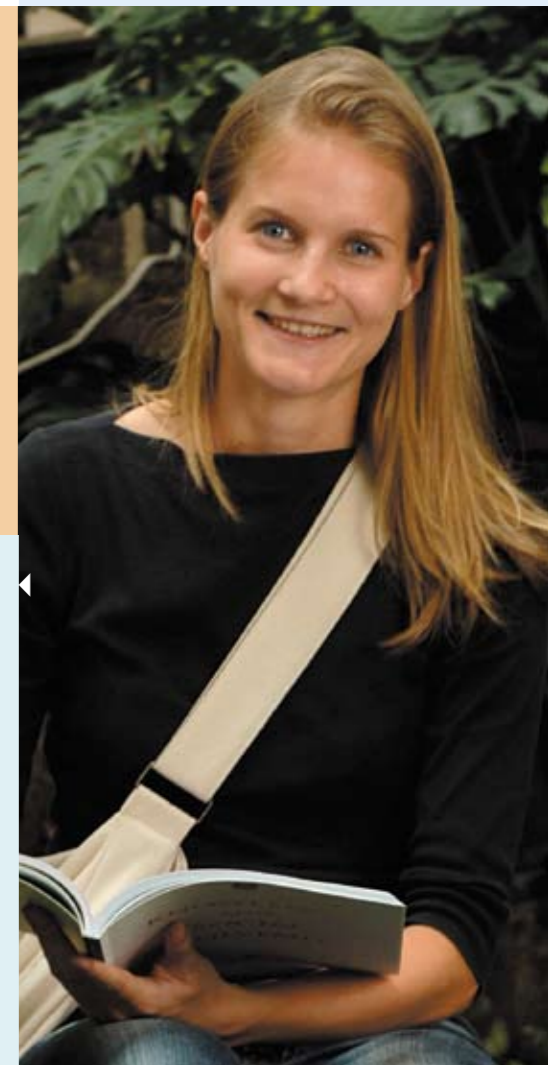
“I would recommend HKU to new students for its excellence in academic achievements and tradition, and its ability to keep abreast of modern developments and world trends in its own way.”

**Mr Mak Chai Ming**,  
*System Operation Manager, CLP*

**Annika Gumhalter**, *exchange student from Austria*

“The Faculty’s reputation was well known at my home university and so it was highly recommended for an exchange program. I found the professors to be very sympathetic. For example, I was working on a complicated project regarding the airline industry. My professor always took time to answer my questions and helped me to initiate new ideas through his explanations and hints.

“We worked on real cases with companies and this helped me to understand how to put theory into practice. Furthermore, I had to work in groups with other students to solve various tasks together and this was instructive and lots of fun as well. During my time at HKU, I discovered my personal strengths and weaknesses. I learned not only about another culture, but also myself.”





## I N T H E C O M M U N I T Y

*The Faculty has contributed engineering solutions to Hong Kong and the region, in such areas as medical engineering, container traffic, harbour waves, computer systems and landslips.*



## SHORING UP HONG KONG'S HILLSIDES

*A new solution to landslips is kinder on the eyes and the environment*



Hong Kong's hillsides can turn into treacherous avalanches of mud and rocks in heavy rain unless remedial action is taken. Since the 1950s the Faculty of Engineering has been the leader in developing techniques to make slopes safe. Most recently it has devised a new way of shoring up slopes that not only prevents landslips, but is also more environmentally attractive.

"Soil nailing" involves inserting thin steel poles 10 metres to 30 metres long into potentially unstable hillsides. The poles act as a scaffold that supports the soil when wet so it does not slip. Grass, trees and other vegetation can then be grown over top to make the hillside more attractive and ecologically useful.

The technique replaces concrete spraying, which creates a layer of concrete to prevent the soil from becoming saturated and softened by rainwater. The concrete solution had been criticised for being ugly.

The Department of Civil Engineering developed the soil nailing technique through extensive laboratory and field trials that tested its safety, reliability and environmental impacts. The results have been published internationally and soil nailing has been adopted in several locations in Mainland China, such as Guangzhou, Chungking and the Three Gorges.

Chair Professor and Pro-Vice Chancellor C F Lee led the team that developed soil nailing. He believes there is scope for new graduates to refine slope stabilisation techniques further so as to enhance the environment, as well as protect people and property from landslips.

"The soil nailing method has been proven without doubt to be safe and reliable, and we've also shown that an engineering solution can be environmentally-friendly too," Professor Lee says.

## TRACKING PORT ACTIVITIES

*Researchers help to make Hong Kong's busy port more competitive*

The quick and efficient movement of goods is Hong Kong's economic lifeblood. As one of the world's busiest container ports, the pressure is on to stay ahead of competitors.

The Department of Industrial and Manufacturing Systems Engineering has made important contributions here by developing tools to transfer containers onto ships and trucks faster and more accurately.

Tens of thousands of containers are shipped through Hong Kong every day and operators must keep track of each container to ensure they reach the correct destination.

Our scholars have developed a tracking method that uses the global positioning system (GPS), a satellite-based technology, to determine the position of the cranes that handle the containers and immediately send the information to the port operators so they can plan for the best deployment of their resources.

"We've used GPS to improve the efficiency and accuracy of container handling," explains Professor K L Mak.

"Efficiency is very important because this is a competitive industry. Hong Kong is competing with Singapore and even ports in China."

The department has also devised computer models that let container terminal operators test out new systems and practices without having to conduct on-site trials that would disrupt operations.

Most intriguingly for students and visitors to the department, researchers have also created a 3-D virtual reality system that enables you to get behind the controls of a giant crane.



The system, called the imseCAVE, has three floor-to-ceiling screens plus a screen on the floor. On the wall screens are images of a container yard, on the floor screen are trucks waiting to be loaded with containers. Users manipulate controls to pick up a container and drop it accurately on a virtual truck. The system helps students to appreciate the operations of typical logistics businesses such as port container terminals, air cargo hubs and modern distribution centres.

Students in the department get a chance to man the controls and gain hands-on experience in container terminal operations – useful for those who may choose to work in this important industry.



## COMPUTING A SOLUTION

*New methodology that helps computers 'talk' to each other is a global hit*



Professor David Cheung



Computers make work and the exchange of information faster and more efficient. But that efficiency can be eroded when large volumes of data are being exchanged between two or more organisations – for example, when a medical authority is updating hospitals, doctors and colleagues about the spread of an infectious disease.

Until recently, when a file was sent through a number of systems, each file may have had to be “translated” to a format rec-

ognisable by the receiving system at each connection point. This wasted a lot of time for larger organisations, such as governments and businesses with many different departments and operators.

Now, a new methodology has been developed at HKU to overcome this problem. The Department of Computer Science has developed an XML schema design method that standardises the computer data so it is easier for information to flow along a chain between multiple receivers.

Professor David Cheung has been leading the development of an XML schema design method since 2002.

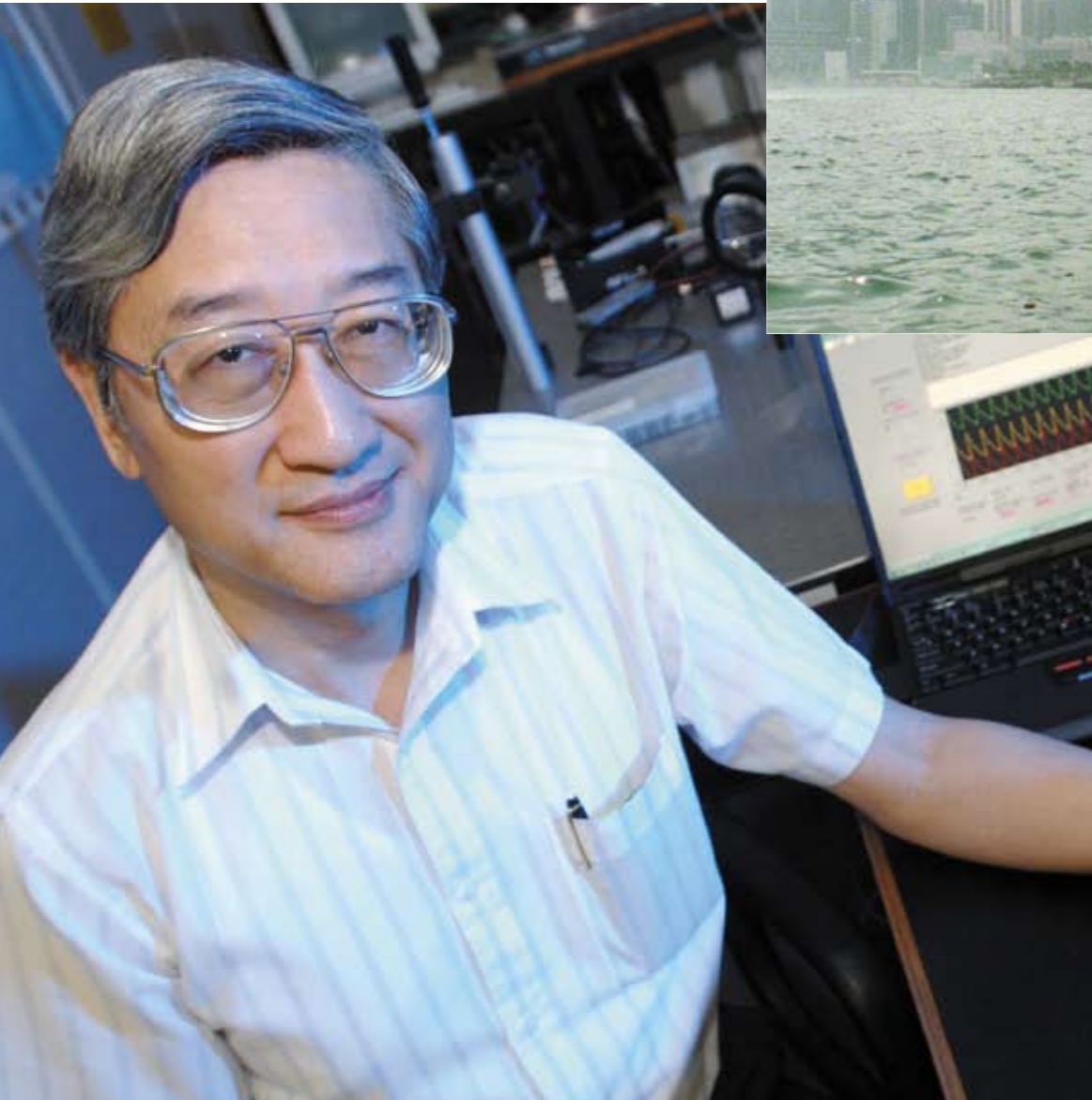
“Everyone has different computer systems. For example, you might store information in Excel and send it to a Unix system, but it won’t recognise what you send. We have standardised information so all computers in a chain can interoperate with each other without the additional ‘translation’ steps needed,” he says.

The Department of Health is one of a number of organisations that have adopted the XML schema. It is using it to monitor and transmit information on 28 infectious diseases such as SARS, tuberculosis and meningitis. Another user is the e-logistic hub of the Digital Trade and Transportation Network, which has adopted the XML schema to standardise 60 trade related electronic documents for nine industries.

“Users in more than 80 countries have also downloaded our software and are using it. We’ve received a lot of attention, grants and awards for our work on XML. This technology is very specific to the University of Hong Kong and the Department of Computer Science,” Professor Cheung says.

## CALMING HARBOUR WATERS

*New sea wall design reduces choppiness of harbour waves*



Professor Allen Chwang

If you've noticed that riding the Star Ferry is not quite the stomach churning experience it used to be, you can thank Professor Allen Chwang of the Department of Mechanical Engineering.

He is the man who has calmed the choppy waters of one of the world's busiest harbours.

Recruited by the government's Civil Engineering Department ten years ago to investigate the reason for the rough marine cli-

mate in Victoria Harbour, Professor Chwang concluded that there was both an active and a passive cause for the problem.

"The active cause is the wake made by ships travelling through the waters," he explains. "At that time we had more than 4,000 ships a day passing through the harbour, making Hong Kong the busiest port in the world."

"The passive cause, on the other hand, was due to the reclamation which had changed the geography of the harbour and redistributed the water's energy. But this was not a root cause."

Asked to come up with a solution to the problem, Professor Chwang designed a unique system for dissipating the increased energy in the water.

By simulating the problem, using a laboratory model, he found that the wave energy hardly dissipated at all when crashing against the solid sea walls. So he designed a porous wall, with holes that allowed waves to enter and their energy to be reduced through a process known as reflection and dissipation.

The result is a new sea wall that absorbs waves and dissipates 50 per cent of their energy and thus vastly reduces the choppiness in the harbour.

His design has been tried, tested and adopted by government and is now also being used in Yau Ma Tei and Tsing Yi Island.

"It looks like the government intends to use this design in all new sea wall construction," says Professor Chwang. "For this applied research you can see the result which gives you a sense of achievement. So I am very happy."

## PROBING CHANGES IN THE ELDERLY BRAIN

*Studying brains using the latest hi-tech equipment could reveal the roots of memory loss*

osing your car keys, forgetting to pick up the dry cleaning or simply not knowing what day of the week it is might all be signs of getting old. But science has revealed that not all ageing is equal.

Why do some people suffer from dementia and Alzheimer's disease while others remain healthy and alert long into old age? This is the question that Professor Edward Yang, Chair of Micro-electronic Engineering, and his team are hoping to answer using the latest hi-tech equipment.

The Department of Electrical and Electronic Engineering's MRI Centre has installed a 3T Magnetic Resonance Imaging (MRI) machine with funding from the Hong Kong Jockey Club and the University Development Fund.

Professor Yang has used the machine to scan the brains of elderly people as part of a longitudinal study in collaboration with Drs Cliff Jack and Ronald Petersen of the Mayo Clinic in the US, Drs Edwin Yu and Karen Wat of Kwai Chung Hospital and Dr David Dai of the Hong Kong Alzheimer's Disease Association.

"Research shows that about 10 per cent of Americans over the age of 65 have Alzheimer's disease and 47 per cent over 85 are

affected," he says. "We all have to face this and that's why it's so important to look at what's going on in older people's brains.

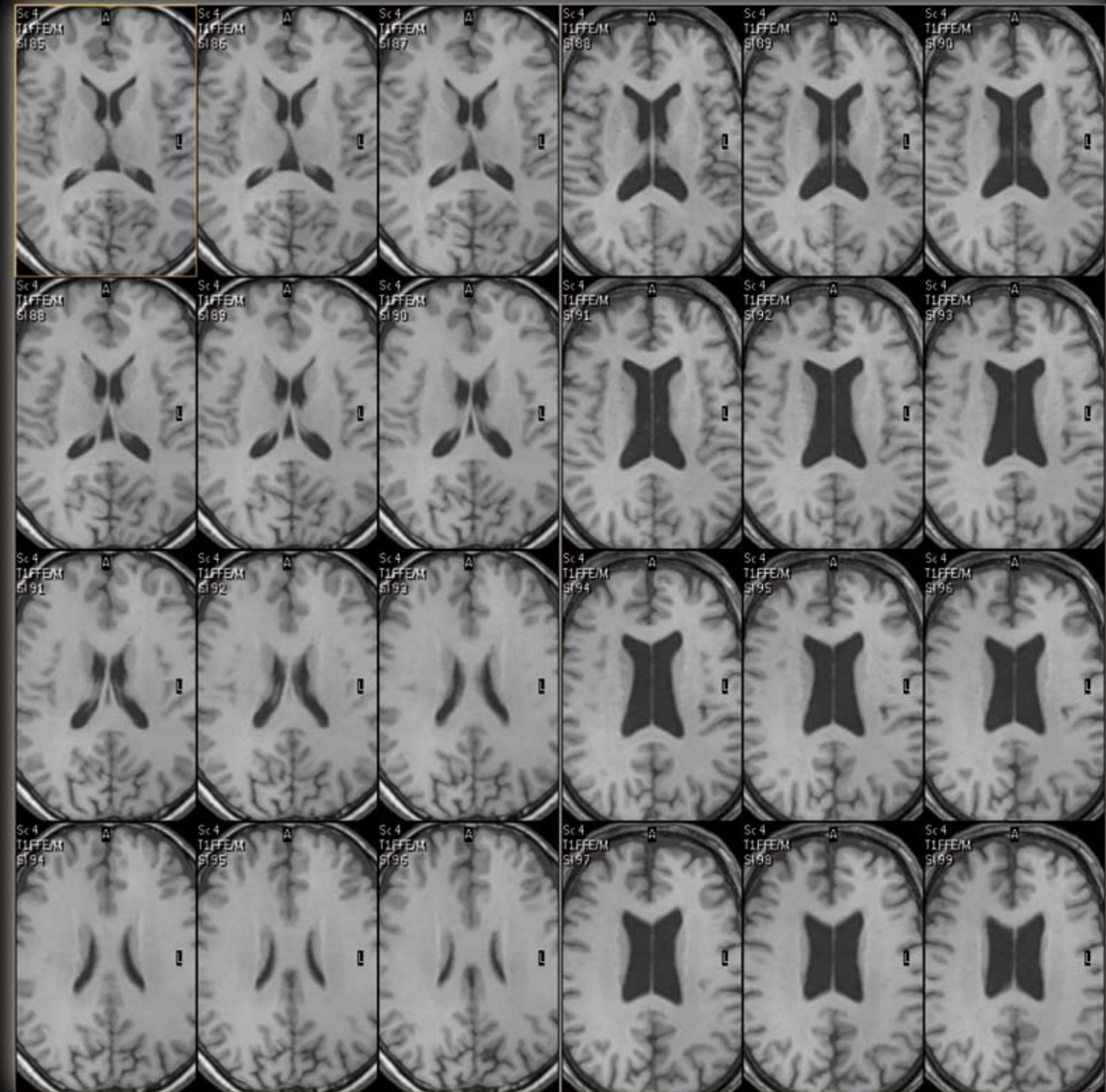
"By using the MRI machine we can find out a great deal about the anatomical features inside the body," he explains. "In our case we are trying to use MRI to measure what is happening in an old person's brain."

Professor Yang recruited 110 local citizens between the ages of 60 and 80 years old and ran psychological, memory and cognitive tests on them. The group was then given an MRI scan which measured brain volume, chemical composition – using spectroscopy - and diffusion imaging.

After eliminating unsuitable candidates and those who showed signs of Alzheimer's disease, he divided the subjects into two groups – normal, and those suffering mild cognitive impairment – and conducted a double-blind study.

All the subjects have been given a daily vitamin supplement and will be tested again in 12 months time to see what changes have occurred. Another follow-up will be conducted 12 months later. Techniques in pulse sequence design, signal processing and statistical analysis will be employed by engineering students in the study.

The young brain (on the left) and the older brain (right).





## WORKING WITH INDUSTRY

*Collaborating with industry is a central part of our work. Our researchers devise solutions and new technologies to make industries more efficient and effective. Industrial partners, in turn, bring staff and students into the field where they gain insights into the daily application of engineering.*

## DELIVERING THE GOODS

*HKU experts help an international express and logistics company forecast growth.*

When DHL wanted to know whether they should expand their Central Asian Hub they turned to the University's Department of Industrial and Manufacturing Systems Engineering (IMSE).

In 2004 the courier company, commissioned the Department to develop a simulation study, or computer model, that would represent their internal operations. This would allow the company to plan for future expansion.

"We helped them do a series of 'what if' studies," says Dr Henry Lau, of the IMSE Department. "For example, what if the machine breaks down, what if we have extra orders coming in, should we work 24 hours a day? Should we increase manpower?"

"In this simulation study DHL wanted to look at when their business grows over the years. They wanted to know if they should deploy more people, reconfigure their systems or expand their operations. So we were helping them to forecast their operation planning."

That forecast suggested the time was ripe for expansion and in October 2005 DHL announced plans to build a superhub at Chek Lap Kok airport.

Now the HKU team has been brought on board to develop a new simulation model that will forecast manpower requirements at the multi-million dollar expansion.

Another DHL project, in 2004, was to design a virtual real-

ity model for visualization. As Lau explains: "It's like a 3D model, or stereoscope. We can put on glasses and look at the computer model and walk freely around the hubs to see typical operations in full force."

The model is now used for operator training as well as marketing and a brand new one is being developed for the new superhub.

The Department's close working relationship with DHL has resulted not only in internships for students, but also exciting career opportunities for graduates.

"Part of the Department's emphasis is on industrial collaboration which provides us with good case studies for teaching and learning.

We are a teaching department but we are constantly seeking opportunities for students to be exposed to industrial operations. And these contracts with DHL emerged from an initial design project that students did in their final year. So you can see that it's a win-win situation."

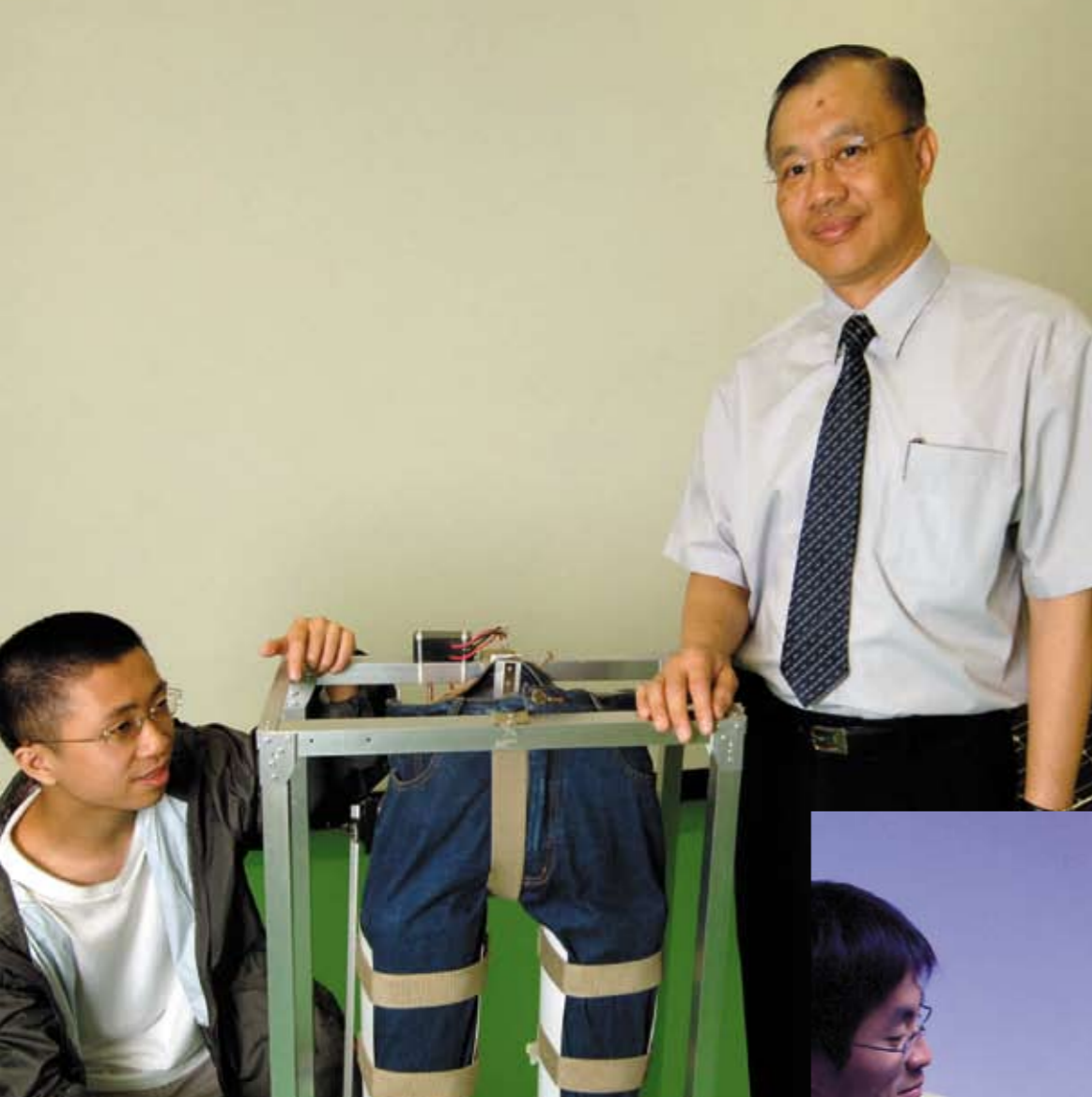


Dr Henry Lau



## DESIGNING THE LEADERS OF TOMORROW

*Students work with industry to solve design problems*



Dr K. W. Chan with one of the design projects



Students in their final year get a chance to hone their problem-solving skills, and get an inside look at the outside world of work, by collaborating on industry-based projects.

The compulsory, activity-based, course places great emphasis on design skills. Sponsored by an external organisation, the course is divided into two parts: lectures and a team-based project to solve an engineering problem.

Dr K. W. Chan, of the Department of Mechanical Engineering, says students thoroughly enjoy the course. "It gets them out of the classroom and talking to people in industry."

In recent years students have worked alongside engineers from the MTR, KCR and Towngas. They have also completed a project for an elderly-care home and a manufacturing company.

Working with such a diversity of employers encourages students to apply their engineering design skills to real-life problems. It also gives them an insight into the way different companies work.

Dr Chan adds: "It gives them a chance to work in a business-like environment before they graduate. They build up a good relationship with the real world and we encourage them to work like a professional. That way when they go out into the workplace they know what to expect."

Last year students helped Fong's Industries Co., Ltd. design a special device to prevent a salt-conveying machine, used in garment dyeing, from seizing up when not in use. The new student design was considered such a success that it has since been adopted by the company.

Indeed, engineers at Fong's were so pleased with the design that the company has presented the students with a prize and has awarded the Faculty an annual \$100,000 for scholarships and project prizes. They have also employed two graduates from the engineering programme.

"Many graduates get employed by the company they have worked with on their project," says Dr Chan. "So this is a very important feature of the undergraduate curriculum."



## CRACKING THE PROBLEM

*HKU researchers help the government build better homes*

Cracks appear in many concrete buildings in Hong Kong, causing concern to the general public. But according to experts in the Department of Civil Engineering, at HKU, most of these are harmless, although they do cause serviceability and durability problems.

The general public however, has grown so worried that the government's Housing Authority engaged Peter Lee, Albert Kwan and Francis Au of the Department of Civil Engineering, at HKU to investigate the cause and find a solution.

"Structurally speaking, most of these cracks are not a major concern," says Peter Lee, Head of the Department of Civil Engineering. "If they're small and not due to external loading, then there should be no safety problem. But if they're due to overstress or foundation movement, then it's a big problem."

Albert Kwan adds that buildings in Hong Kong have been designed in accordance with the relevant codes of practice and thus should have sufficient capacity to carry the external loading. "However, apart from external loading, the restraint against thermal and shrinkage movement of the concrete might also cause cracking. Although such restraint-induced cracks would not lead to any immediate safety issue, they could cause aesthetic, water leakage and steel corrosion problems," he says.

"What we have been trying to do is to look at the serviceability and durability problems," explains Lee. "Water on the con-

crete surface seeps through the cracks to the floor below causing water leakage and if this happens over a period of time, the steel reinforcement in the concrete will corrode thereby affecting the durability of the building.

"We have identified that the problem comes from two aspects. The first aspect is the material. The concrete produced locally tends to have a larger drying shrinkage than those produced elsewhere. The other aspect is the structural design. If the shrinkage movement of the concrete has not been properly allowed for, the lateral stiffness of the shear walls and columns restraining the shrinkage movement of the beams and slabs will cause cracking of the floors," says Lee.

In order to resolve these problems, the research team has conducted extensive tests on the drying shrinkage of locally produced concrete and developed a computer program for analyzing the tensile stresses induced by restraints against the shrinkage movement of the concrete. "With the data and analytical tool so provided, design engineers in Hong Kong can now predict much more accurately the extent of restraint-induced cracking and evaluate the effectiveness of various means of allowing for the shrinkage movement," says Kwan.

"It is hoped that future concrete buildings would have fewer cracking problems and Hong Kong residents can sleep soundly, knowing that their homes are safe and durable," concludes Lee.

## SIZEABLE SOLUTIONS

*Engineers make electronics smaller and more efficient*

Shrinking a 15-centimetre electronic filter component to the size of a fingernail tip is all in a day's work in the Department of Electrical and Electronic Engineering.

Scholars there have obtained more than 20 US patents for their inventions which are focused on making smaller, more efficient power supply appliances for a whole range of consumer and industrial electronics, such as computers, mobile phones and televisions.

The appliances, properly called 'switching power supplies', convert electricity from the mains into a useable form. For instance, a desktop computer needs only 2-3 volts but there are 210 volts at the mains. The power supply acts as a regulator and contains high-speed semiconductor power devices that switch on and off at a rate undetectable to consumers.

Dr Bryan Pong has been leading R&D work in the switching power supply field, including developing a tiny electronic replacement for the 15-centimetre filter mentioned above. All power supplies contain filters to suppress electromagnetic interference, but these can take up quite a lot of space. The new product, which took several years to develop, uses a semi-conductor and is a fraction of the size of a filter.

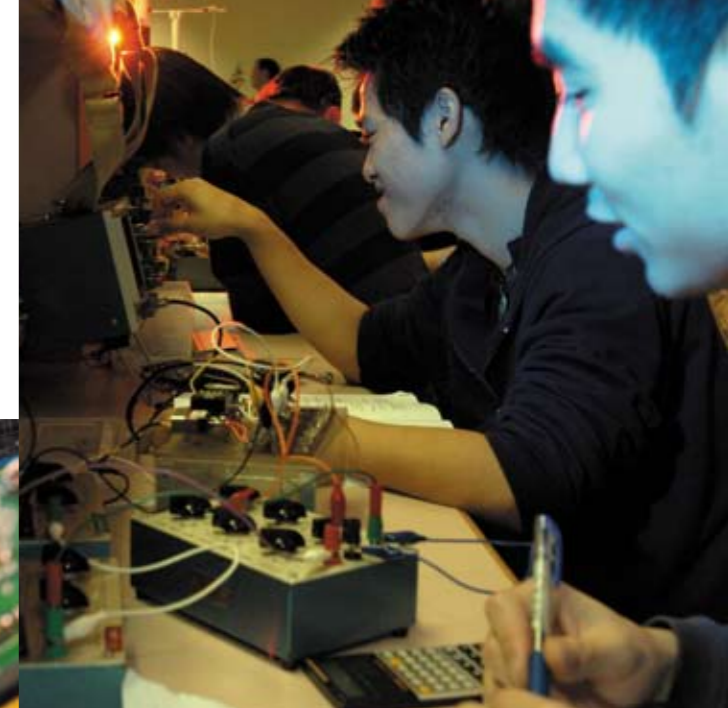
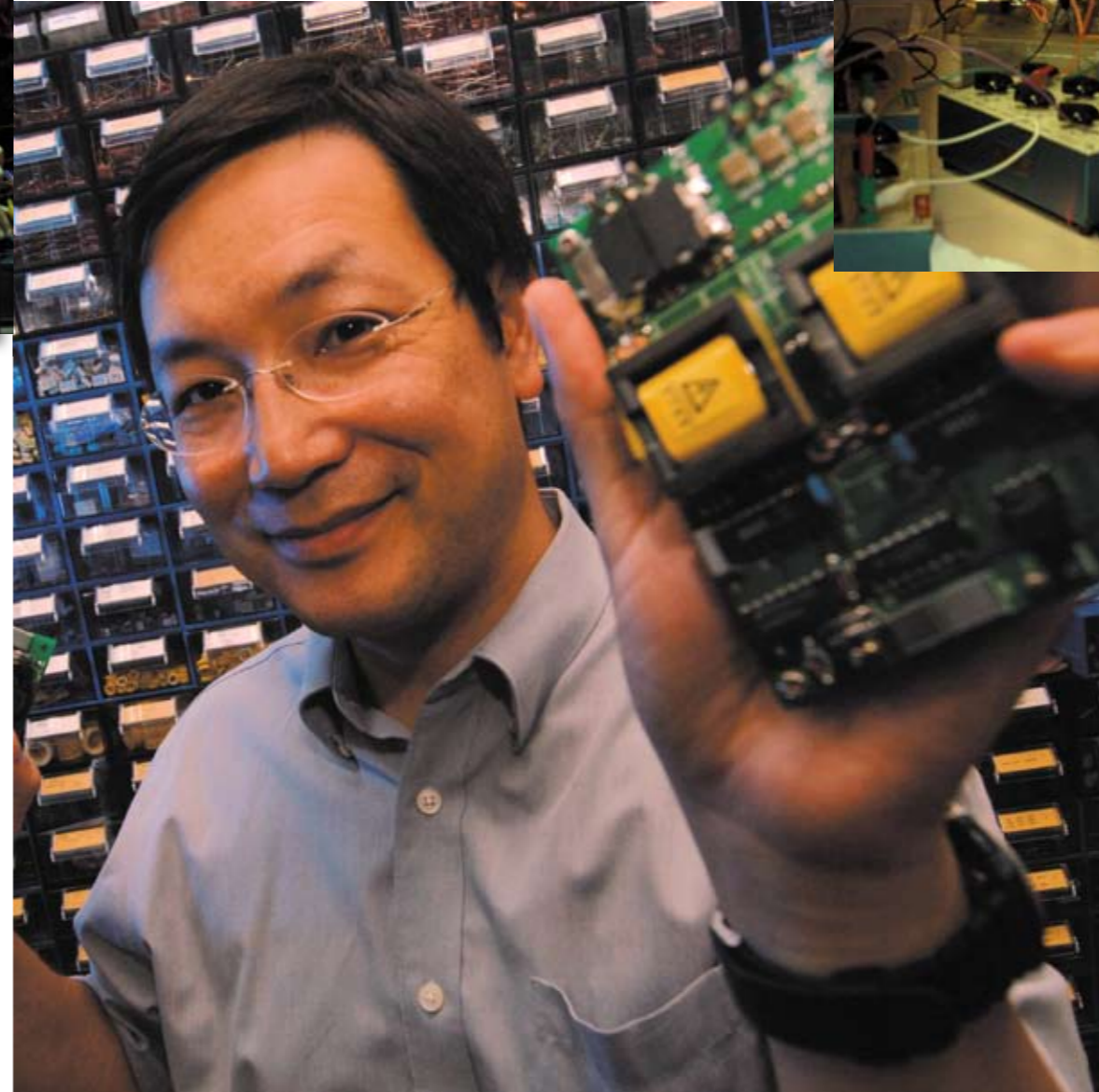
For industry, that's good news.

"This new product is not much more expensive than a filter, in fact there can be considerable cost savings if the filter is big. The bigger the system, the greater the savings," he says.

Another area of application the department is working on is LED lamps, which last at least 10 times longer than conventional bulbs and are not hot to the touch. The devices are small and need power supplies to match, which is where Dr Pong's team comes in. They have developed a handy-sized power supply for the lamps.

The department works closely with industry on its inventions. A lot of companies seek their help in solving specific problems and making products more efficient or smaller. The department also carries out government-funded research, such as the filter replacement, which has broad application for a number of companies.

"Strategically, switching power supply is quite important because 70-80 per cent of the world's supplies are produced in China, in particular the Pearl River Delta and Shanghai," adds Dr Pong.



Dr Bryan Pong

## HKU HELPS COPS BEAT CYBER-CRIME

*New software is helping police track down computer criminals*

Computer whiz, Dr Lucas Hui, has joined the fight against electronic-crime by developing state-of-the-art software to help police forensics experts recover deleted files and documents.

The Digital Evidence Search Kit, or DESK, was created by the University of Hong Kong's Centre for Information Security and Cryptography in collaboration with the police force.

Designed to help officers search and document evidence held on a computer system, DESK is the latest in several collaborative projects between the Department and the Commercial Crime Bureau.

The software allows officers to clone a computer disk if it contains suspicious files. They can then check the clone's hard disk image for incriminating evidence to be used in court.

Associate Professor Hui explains: "The software will search all the files on a computer for a particular word like 'drugs'. So instead of

doing the search manually, which could take days, this system can do the work much faster."

But DESK is more than a simple search programme. It also protects officers from accusations of planting evidence on seized computers by allowing them only to read the information on the system. They are unable to tamper with files or add anything to them.

And although software search systems are already available – like the US-developed ENCASE – this is the first advanced tool developed to read files with Chinese characters.

"We are able to search for the files even if they have been deleted," says Dr Hui. "The file image will remain on the computer disk and we'll be able to trace it with this software."

An added benefit to the design is an open platform approach which allows the Department to use the tools for teaching. The area of computer forensics is a new and fast-developing field, providing trained graduates with opportunities to work as computer forensic consultants to lawyers and audit firms as well as the police force.

"We've had a very good response to the open platform approach," says Dr Hui.

"Both local and overseas universities have bought the software to train their students in computer forensics."

Dr Lucas Hui





## LEADERS IN THE FIELD

*Our academics are internationally recognised and maintain close ties with top universities around the world. Their research has yielded important new findings and technology for Hong Kong, China and the world. At the same time they are committed teachers who seek to educate our students to the highest international standards.*

## PROMOTING SUSTAINABLE ENGINEERING

*Engineers in future will need to balance technical skills with care for the environment*

Chair Professor and Pro-Vice-Chancellor C F Lee is an eminent member of the Faculty of Engineering who has worked on massive civil engineering projects such as the Three Gorges dam and advised international bodies such as the United Nations Development Plan and the World Bank.

His dedication to civil engineering is matched by a deep sense of social responsibility that is evident in his many charitable activities and his concern for the environment – a concern he is keen to instil in students.

“Increasingly, environmental challenges are becoming more and more important and good engineers have to balance engineering principles with sustainable development. I try to encourage students to take a broader view of the projects they work on so they can be prepared to strike that balance.”

The demand for greater environmental sensitivity applies to projects in Hong Kong and elsewhere in the region. Civil engineering opportunities are booming in Mainland China, Southeast Asia and the Middle East, all places where recent graduates have secured jobs.

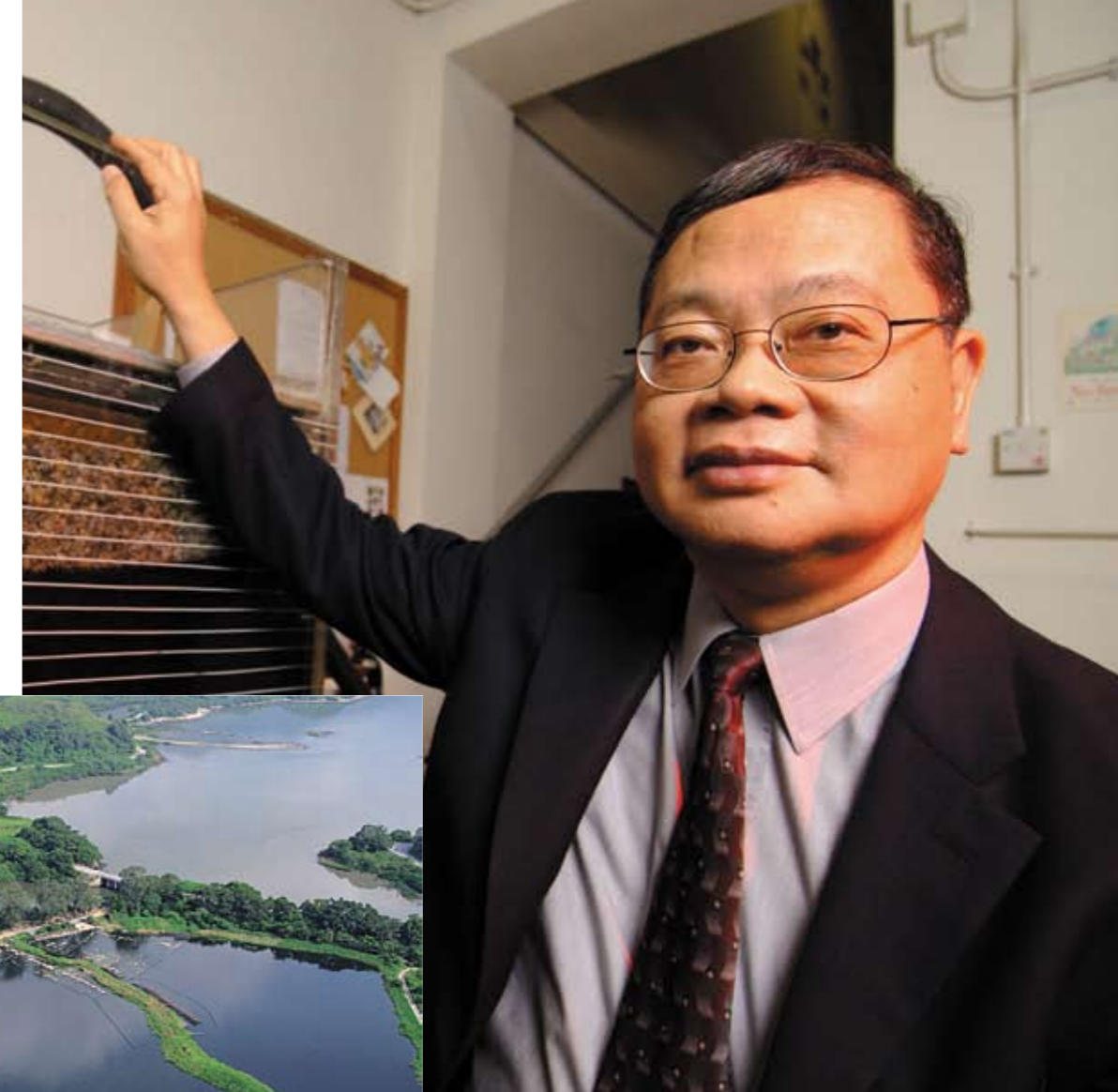
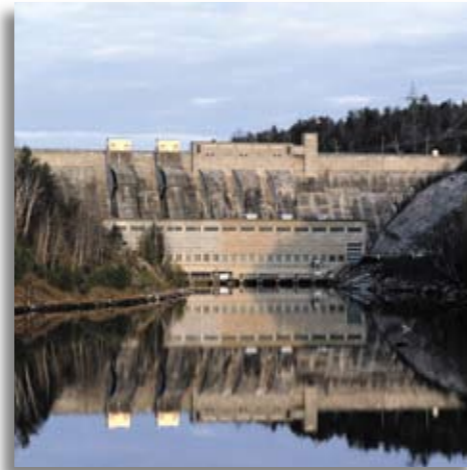
The exciting thing about environmental challenges is that they provide an opportunity to be creative and come up with new solutions. Professor Lee has had to do this in such areas as local landslide prevention and nuclear power plant and dam design in China and Canada. He has been recognised for his work, being awarded

the K Y Lo Medal in 2000 by the Engineering Institute of Canada and elected the Academician of the Chinese Academy of Engineering in 2004 in recognition of his contributions to the engineering profession.

As both a professor and an alumnus of the University of Hong Kong, he is aware of how important it is for graduates to be prepared for the new demands being placed on them. An education that emphasises best international practices and English-language proficiency gives them a competitive advantage.

“In essence it is the best of two worlds at the University of Hong Kong. You have a Western education and you can apply it in an expanding market,” Professor Lee says.

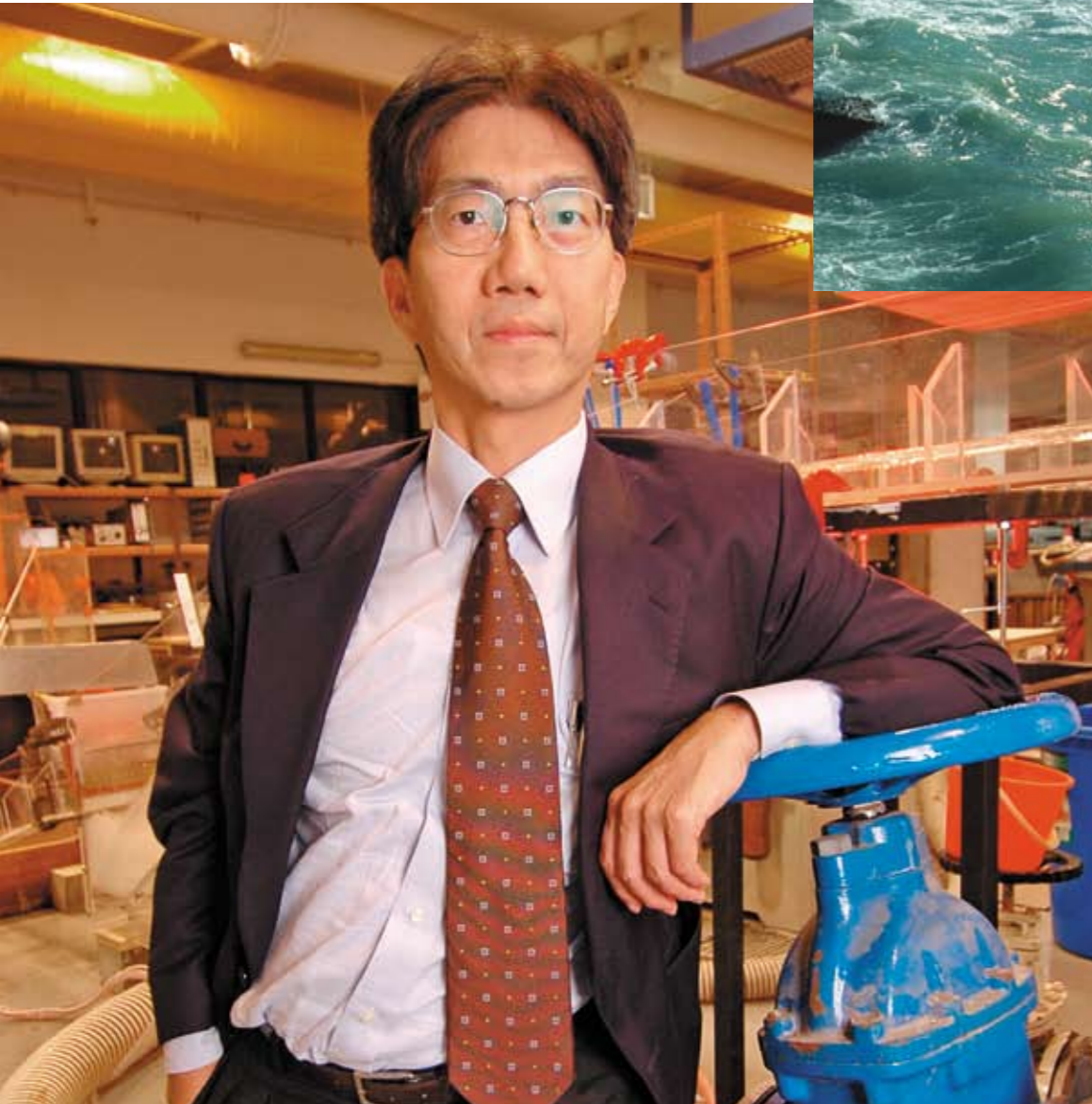
“Many employers hire our graduates because they have international exposure, they have English as a working language and they can bring these experiences to bear on regional projects. Wherever they work, sustainable development and environmental sensitivity will also be important.”



Professor C F Lee

## HOLDING BACK THE FLOOD

*Chair Professor Joseph Lee uses hydraulics to solve environmental problems*



Professor Joseph Lee

Like a modern-day Noah, Professor Joseph Lee has been fighting floods and helping to protect the environment for most of his career as a civil engineer.

The Redmond Chair of Civil Engineering, and Director of the Croucher Laboratory of Environmental Hydraulics, Lee is an expert in hydraulics, the science of water flow. His passion is the use of hydraulics to solve environmental problems.

In this capacity he has participated in several major flood control and water quality management projects in Hong Kong over the last decade.

These include the innovative Yuen Long Bypass Floodway, which diverts excess water from this densely populated urban area, as well as the West Kowloon Drainage Improvement Works scheme, and the Tai Hang Tung Storage scheme.

But Lee, who has served as an advisor to international consultants as well as working with the Hong Kong Government, has not restricted his expertise to flooding alone. He has also been called upon to study the dynamics of algal blooms and red tides on Hong Kong's coastlines and to design an environmentally sustainable sewage outfall system for the Hong Kong Harbour Area Treatment Scheme (HATS). The methods for prediction of fate and transport of pollutants that he developed are used for environmental impact assessment world wide.

He also happened to make engineering sound like one of the most exciting fields of study available to students today.

"There's a misconception that engineering is a rigid discipline," he says. "But it requires enormous creativity, analytical

thinking and a rigorous mastery of fundamentals like maths.

"The discipline required does not come easily and we offer a first-rate curriculum without watering down standards. We have been highly praised internationally for still insisting on fundamentals. And we refuse to compromise on this."

If one considers the leaders in Hong Kong society today, he says. "You'll see that a lot of them are our graduates. Quite simply we turn out leaders."

The Department's leadership is reflected in its programmes. It was the first Department in Hong Kong to offer a Civil and Environmental Engineering degree back in 1990. The department also recently pioneered the Civil Engineering and Law degree and HKU's Faculty of Engineering is still the only Faculty with a professionally accredited Medical Engineering programme.

Since 1980 the Faculty has demanded problem-based learning because it is essential to training engineers for the workplace. "Our teachers have both research and practical experience," he said. "And engineering needs a combination of new thinking and other areas of strength. This is why problem-based curriculum is so important."

He describes engineering as the art of approximation. "It is the ability to simplify a very complicated problem and to solve it in practical terms."

And in his capacity as Pro-Vice-Chancellor for Staffing Lee says: "We have a high percentage of international staff. We recruit and retain the best talents in the world."

## SOLUTIONS FOR OUR FUTURE

*Engineers can resolve conflict between rising energy demand and environmental degradation*

Environmental damage caused by the voracious consumption of fossil fuels will be the central challenge facing the world over the next 100 years. The solutions to this dilemma could very well lie in technology and engineering, says Felix Wu, Chair Professor of Electrical Engineering and an international expert in power management.

Developing countries are of greatest concern because they are seeking to advance their economies by following the paths of developed countries. However, the world cannot afford to see China or India match the energy consumption and pollution patterns of the West and Japan.

Advanced technologies, on the other hand, offer hope of enabling developing countries to achieve better living standards without ruining the global environment.

"It is coming to the point where we cannot ignore the seriousness of the issues any more. People talk about conservation and we need all that, but it's not enough. The problems were created by technology from the Industrial Revolution onwards and the solutions will have to be driven by technology."

Engineers have the training to develop the cleaner technologies that will be needed in future. Already, the Faculty is applying

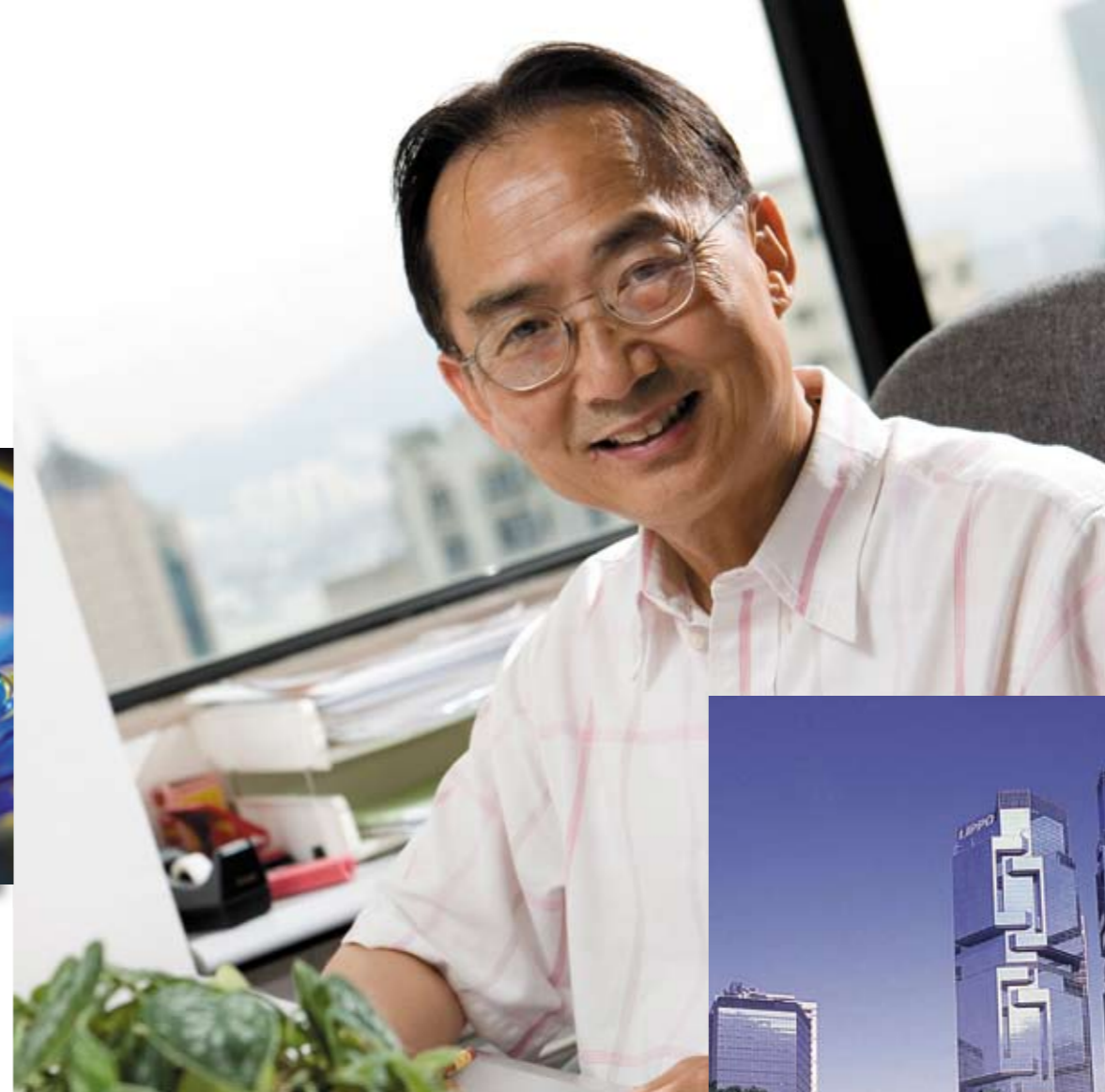
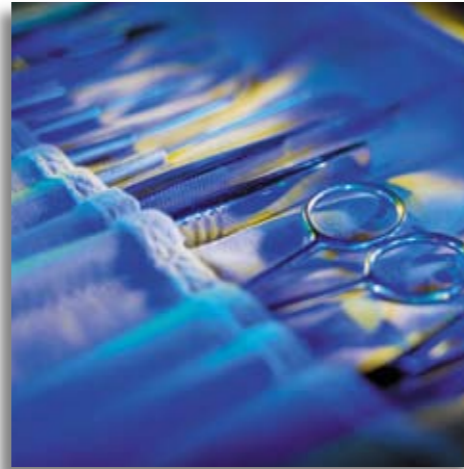
engineering principles and new technologies to improve medical and health care.

Professor Wu expects the next step will be to address the threats posed by the tension between energy demands and environmental sustainability.

"One strength of our University is that we want our students to have a broad education. For technology and engineering students, that means being aware of societal issues and of the contributions they can make to society," he says.

"It's true that if you choose a career in engineering, the salary is good, there are fabulous job opportunities and the work is interesting. But we also want students to know that engineering can play a major role in society.

"It is the job of scientists and engineers to solve the energy and environment problems that are threatening society."



Professor Felix Wu





## OUR ALUMNI

*As the oldest Faculty of Engineering in Hong Kong, we have long provided leaders for the city's physical and social development. Our graduates hold prominent positions in engineering, business, politics and other fields. They also provide a rich network of mentors and contacts for students and new graduates.*



## LOOK AFIELD FOR A BRIGHT FUTURE

*Opportunities abound for those willing to venture beyond Hong Kong's borders*

The story of industrialist and HKU alumni, Ir Dr W K Lo, has closely followed the path of China's growth.

He entered the workforce when the new open door policy promised opportunities for those willing to brave patchy transport services, poor communication and electricity networks and the most basic living conditions. Today, he has a successful business career and is Vice-President of the Hong Kong Institute of Engineers (HKIE).

His advice to young people considering engineering as a profession: be open-minded about where you want to work.

"The younger generation has to adjust themselves to living outside Hong Kong," he says. "Hong Kong is a small city. If you

lived in San Francisco, you wouldn't think your career development was limited to that area. Senior executives in Hong Kong find themselves more in the global arena, competing in the world market. There are changes and challenges."

The physical hurdles that Ir Dr Lo had to over-

come in 1980s China have diminished significantly. Now, there are plenty of new job opportunities, as well as plenty of more competitors. Ir Dr Lo, who holds a Bachelor's degree in Mechanical Engineering and Master's degree in Industrial Engineering from HKU, believes our graduates have advantages over others given their language skills and internationally-based training.

"They have both Chinese and English and the University is well connected with the rest of the world. A lot of students from overseas are studying here, and a lot of University students go overseas for exchange. So undergraduates have more cultural exchanges and stimulation, which will be helpful when they have to deal with clients from overseas," he says.

They are also supported by Hong Kong's long-established network of engineers. The HKIE offers membership to undergraduate students and graduates, while the Faculty of Engineering's alumni association provides mentoring for undergraduates and operates an active programme of activities such as technical visits and seminars and networking opportunities.

"This is one of the things that we should be proud of as University of Hong Kong alumni. We always treasure the history of the University – ours is the oldest engineering faculty in Hong Kong – and we see to it that university life does not end when you graduate," Ir Dr Lo says.

Ir Dr W K Lo



## HIGHWAY TO SUCCESS

*A Civil Engineering graduate has helped make Hong Kong one of the world's most transport-friendly cities.*

Mr C.K. Mak, has done what very few graduates do in the ever-changing world of modern industry – worked for the same employer throughout his career.

But as Permanent Secretary for the Environment, Transport and Works (Works), and a former Director of Highways, for the Hong Kong government his career has never been short of thrilling new challenges. Since graduating in 1973 this civil engineer has played a crucial role in the development of the city's railway networks – now appraised as one of the most successful models for urban transport development.

And he credits the engineering curriculum at HKU with providing him with a solid knowledge-base for his career.

"However, what we learn has to be supplemented by life long learning to continuously enrich our knowledge. It is only with the experience gained through years of hands-on practice and problem-solving that we can mature and consolidate our engineering knowledge."

As a part time teacher in the Engineering Faculty for some 20 years, he has seen the curriculum evolve into a very comprehensive syllabus that meets industry requirements.

"This," he says, "together with the thought provoking and inspiring presentations by our professors, has placed the CE curriculum amongst the best programmes in Hong Kong's tertiary education."

He says he enjoyed his own student life very much. "The participation in extra-curriculum activities opened my eyes, broadened my perspective and allowed me to gain useful exposures in tackling different matters, and handling awkward situations.

"This is invaluable. It helps build one's ability for problem solving. It is this learning process in the University that prepare us for real life challenges."

Although Mr Mak has never worked for either of the two Railway Corporations, a good part of his career has been closely associated with Hong Kong's railway development.

"In the late 70's and early 80's, I took part in the KCR electrification and modernization and saw the entire process of transforming an old diesel electric train service into a completely modernized commuter system.

"In the mid-80's, I continued with new railway projects and took charge of the development of the KCR Lo Wu Terminal and the monitoring of cross border rail transportation.

"Between 1994 and 2004, we saw the implementation and commissioning of the first batch of six new railway lines included in the first Strategy (RDS 1994). The railway expansion has changed Hong Kong's transport scene," he says.

Thanks to the input of a HKU graduate today more than one third of Hong Kong's daily commuter travel is by rail.



## TRAINING THE WHOLE PERSON

*Skills learned as an undergraduate open new horizons*

An engineering degree from the Faculty provides students with much more than the ability to apply technology. It also teaches valuable problem-solving skills that are relevant in other fields, as Joelle Woo, a Computer Science alumna, has found in her work in the marketing and sales side of Microsoft.

Ms Woo's job involves educating customers about the latest technologies, reaching out to new markets and developing a local software community. Her computer science background has given her a technical grounding in her subject, as well as the means to keep up with new technological developments and deal with daily challenges on the job.

"The whole Computer Science programme involves not just programming. It also trains us in terms of analytical thinking, project management, teamwork and good planning. You learn how to collaborate with others," she says.

"In addition, learning how to bridge the gap between technologies and business needs is a very practical skill."

These softer skills are reinforced outside the classroom, too. Hall life brought Ms Woo in contact with students from different departments and disciplines and opened her mind to other ideas and approaches. It also implanted in her a strong sense of belonging to Hong Kong.

"I'm a local, homegrown Hong Konger and studying at the University of Hong Kong has helped me to develop a sense that I belong to this community," she says.

"So when I have time, I like to give something back. I help in charity work such as educating young people and the elderly about information technology and computers in my spare time."

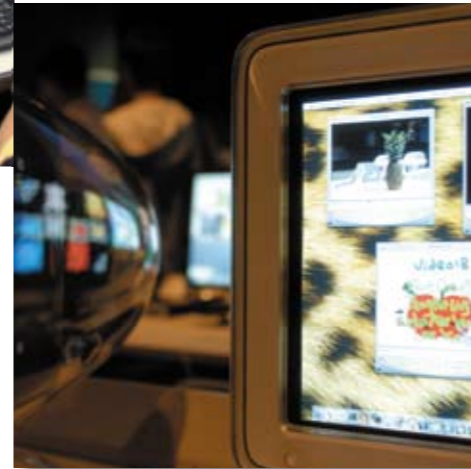
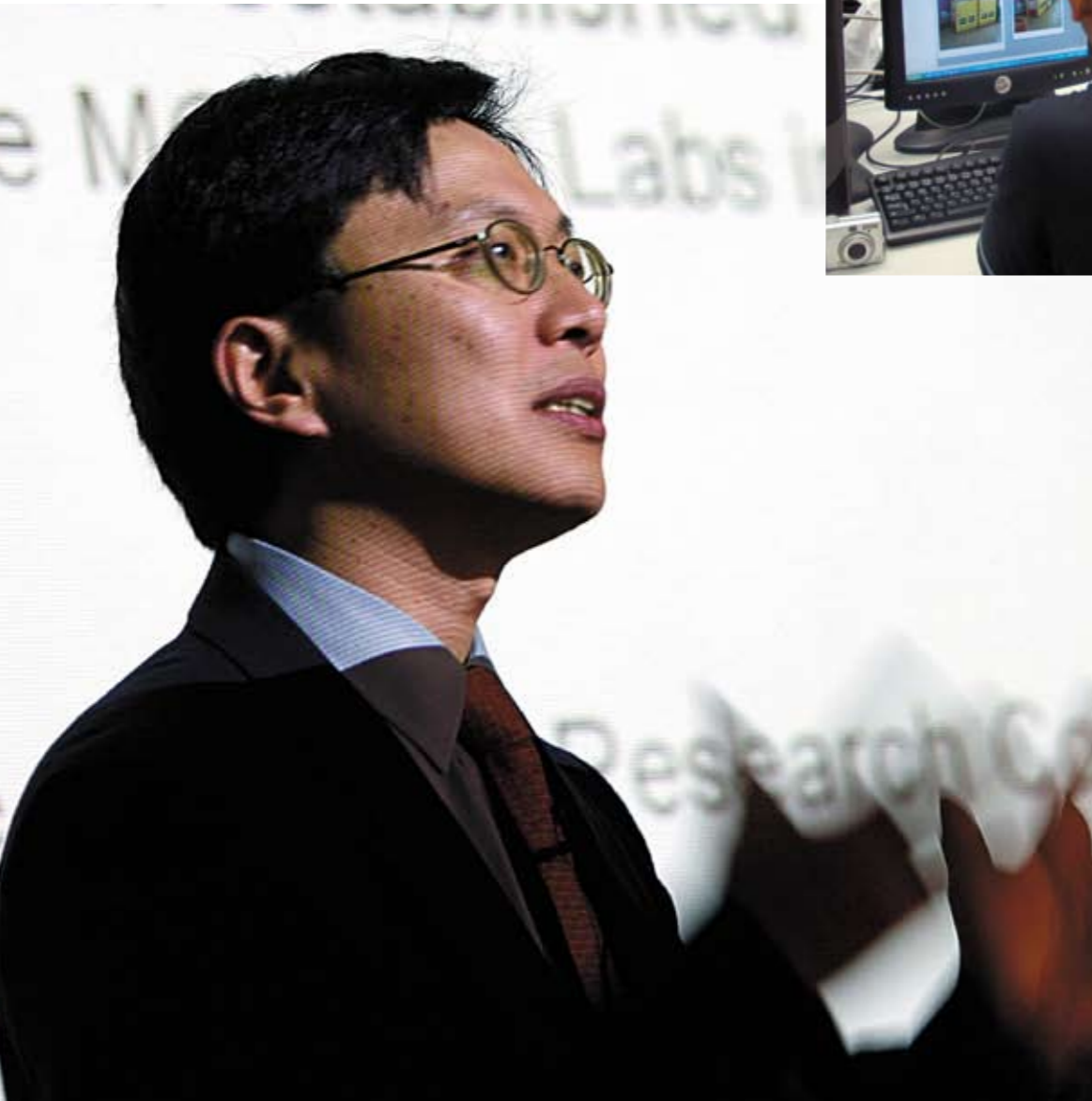


Ms Joelle Woo



## A SOARING CAREER

*HKU has a special place in the heart of top computer scientist*



Harry Shum is a high-flying computer scientist who studied for his MPhil in the Faculty of Engineering before heading to the United States for doctoral studies and the launch of a prominent career with Microsoft. He is now managing director of the company's Beijing laboratory, dubbed the "world's hottest computer lab" by the MIT Technology Review. But he

continues to keep up his links with the University of Hong Kong.

Dr Shum is exploring collaboration opportunities between his Beijing lab and the Faculty. He has the good fortune of overseeing a basic research laboratory of 300 scientists, whose success was the subject of a book, *Guanxi (The Art of Relationships): Microsoft, China, and Bill Gates's Plan to Win the Road Ahead*.

However, it is not just business that draws Dr Shum here. He has fond memories of his studies at the University where he excelled academically and was given opportunities to learn about wider society.

"I was awarded the Swire Scholarship and I lived at Robert Black College, where I learned so much which benefited my studies and also my career. My confidence was built up as a young student at Hong Kong U because I was able to interact with top scholars from around the world."

His three years at the University left a deep impact on his personal life. Dr Shum developed a close friendship with his MPhil advisor, Professor S K Tso, and the Master of Robert Black College, Professor Vincent Leung. More importantly, he met his wife here, a fellow student on campus.

"I also spent a lot of time playing soccer," he says, laughing. "Overall I had a wonderful time at Hong Kong U. There were meaningful relationships between students and professors and it was such a lively environment. I really treasure the years I spent here."

Dr Harry Shum

## THE KEY TO A DIVERSE CAREER

*A HKU graduate says Industrial Engineering helped him succeed in three very different fields.*

With a career path that started in manufacturing, moved to public transport and is now firmly established in telecommunications, Mr Frankie Yick is a leading role model for engineering students.

A graduate of the Department of Industrial and Manufacturing Systems Engineering (formerly Industrial Engineering), Mr Yick is now Chief Manager of Community Affairs at Wharf (Holdings) Ltd. He credits his education with providing the solid foundation he needed for such a successful career.

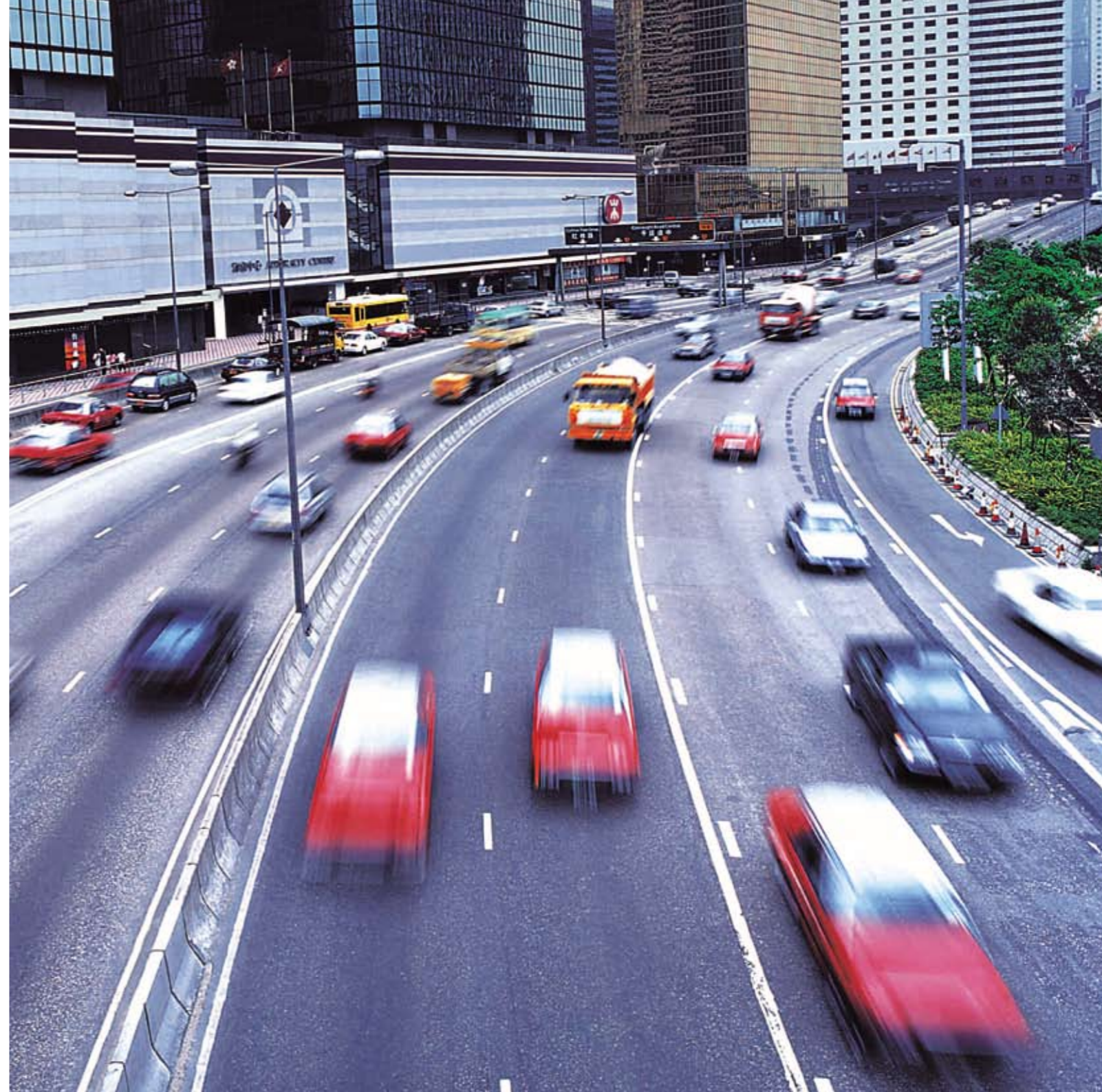
“The most important knowledge I gained from the degree course was not the fundamental theories behind the technical know-how, but rather how and when to apply the tools and techniques that I learnt. The ability to understand and analyse problems, and to devise cost effective solutions for them is the most valuable asset I acquired during my university days.”

Mr Yick says Industrial Engineering had helped him pursue various careers including roles in the fields of services and manufacturing.

“The skill of being able to adapt to different industries is very important and I believe there is no discipline, other than IMSE, that offers the training to excel in a career in any industry.”

But he insists that book learning alone is not enough to survive in the real world of industry and business. “Interpersonal skills, communication techniques, leadership and negotiation skills, to name just a few, are equally important.

“These skills can be acquired through active participation in various activities and the willingness to take responsibility for organising functions which are all part of a full university education.”



## THE FACULTY IS MADE UP OF FIVE DEPARTMENTS

- Civil Engineering
- Computer Science
- Electrical and Electronic Engineering
- Industrial and Manufacturing Systems Engineering
- Mechanical Engineering

## THE FOLLOWING ACADEMIC DEGREES ARE BEING OFFERED

### *BEng degree programmes*

- Civil Engineering
- Civil Engineering (Environmental Engineering)
- Computer Engineering
- Computer Science
- Electrical Engineering
- Electronic and Communications Engineering
- Industrial Engineering and Technology Management
- Information Engineering
- Logistics Engineering and Supply Chain Management
- Mechanical Engineering
- Mechanical Engineering (Building Services Engineering)
- Medical Engineering

### *BSc degree programme*

- Bioinformatics (jointly offered with Faculty of Medicine)

## DOUBLE DEGREE PROGRAMMES JOINTLY WITH OTHER FACULTIES

- BBA (Information Systems) / BEng in Software Engineering
- BBA (Information Systems) / BEng in Computer Science (starting from 2008-09)
- BEng in Civil Engineering (Law) / Bachelor of Laws

### *MSc(Eng) degree programmes*

- Building Services Engineering
- Electrical and Electronic Engineering
- Environmental Engineering
- Geotechnical Engineering
- Industrial Engineering and Logistics Management
- Infrastructure Project Management
- Mechanical Engineering
- Structural Engineering
- Transportation Engineering

### *MSc degree programmes*

- Computer Science
- Electronic Commerce and Internet Computing

### *MPhil and PhD degrees*

- At the research postgraduate level, the Faculty has well established MPhil and PhD programmes.

