



**SENG**  
SCHOOL OF  
ENGINEERING

# Leading Change

Making Global Impact



THE HONG KONG UNIVERSITY OF  
SCIENCE AND TECHNOLOGY

Status Report 2006-2008



## About SENG

The School of Engineering (SENG) is the largest of the 5 Schools within the Hong Kong University of Science and Technology (HKUST), enrolling about 40% of the University's undergraduate and postgraduate students and committed to teaching and research at the cutting edge of engineering. In 2008, HKUST was ranked No. 24 in The Times Higher Education Supplement Rankings "World's Top Technology University". HKUST admitted its first students in October 1991.







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# Dean's Message

## Leading Change, Making a Global Impact

The financial crisis, which left the world holding its breath in Fall 2008, brings the end of this 2006-08 review to a dramatic close. There is little doubt that the impact of the meltdown will reshape the global landscape in the times ahead. Indeed, Hong Kong has faced a number of highly significant developments over the past three years that will have far-reaching consequences for the future direction of the community, and the education sector in particular.

### Education Moves

Among the most important alterations for universities has been the end of government budget-cutting and the air of pessimism in higher education and the start of a morale-boosting expansion as Hong Kong gears up for one of the biggest changes in the city's tertiary education history: the switch from a three-year degree program to four years, starting in 2012. This will be accompanied by a move from seven to six years of secondary education in schools to be divided into three years at junior secondary and three years at senior secondary (also known as the "3+3+4 system").



The scale of the undertaking and its impact on universities in Hong Kong are enormous, and designing the new four-year curriculum is being looked at as both an opportunity and a challenge. In the School of Engineering, we have been reviewing how engineering education has changed in the past 20 to 30 years and the best ways to introduce outcome-based learning. In the past, the idea was to "deliver", that is, to look at input. Now, the view is that it is output which must be gauged, as Prof Edmond KO explains in his article for this report. All faculty members will be involved in a concerted effort to make this transition smooth and successful.

## Research Excellence

In recent years, the School has started to see the retirement of senior professors. However, younger faculty members have been successfully stepping up to continue to advance the School's strong research reputation. This is clearly shown by the many basic and applied world-class innovations achieved by our faculty members over the review period. It also reveals the overall strength of the School's recruitment of high-potential academics and their positive impact on research.

In line with international trends, interdisciplinary research is starting to play a greater role and will be an important area for future development for the School, and the university as a whole. The School is a key performer in many of the interdisciplinary high-impact areas designated by HKUST as selected fields in which the university is seeking global leadership. These include nanoscience and technology; sustainable development, energy and environment; electronics, wireless and information technology; and bioengineering.

## Global Learning

To enhance students' learning experience, the School shall adopt a broader outlook toward engineering education in order to produce graduates who possess not only technical knowledge but also communication and leadership skills. The academic awards received by our students and graduates, together with our success in competitions that test innovation and creativity through real projects and case studies, show the benefits they are deriving from such an approach.

In addition, we have been expanding our international student exchange program which assists the School community in two major ways. It enables our own students to travel overseas to gain fresh perspectives, and expands their independence and cross-

cultural understanding in preparation for joining today's globalized workplace. It also allows exchange students from our many partner institutions around the world to join us in Hong Kong. In the past, Hong Kong campuses were very homogenous, limiting students' horizons. Bringing people from different cultures, with different learning habits and views of the world to study alongside those from Hong Kong really helps to broaden campus life along with friendships and international networks.

## Extended Vision

Another form of boundary crossing has become more significant during 2006-08, with the School becoming increasingly engaged in local, national and international collaborations. Academic partners now hail from countries as diverse as the Korea, Saudi Arabia and Belarus. The School has also played a pivotal role in the establishment of the HKUST Fok Ying Tung Graduate School (FYTGS), the University's fifth school, in Nansha, at the heart of the Pearl River Delta. Meanwhile, business partnerships and support from local enterprises in the form of generous donations have strengthened our connections with various industries.

Locally, the School is actively participating within the Hong Kong community. Faculty members have organized top-level international conferences in numerous cutting-edge engineering fields. Camps and contests to inspire Hong Kong secondary school students to consider further studies and a career in engineering have taken place. The launch of an ambassador scheme has also been particularly successful, bringing current undergraduates into contact with prospective students to share their experiences and knowledge of different engineering fields and life at HKUST.

## Driving the Future

All these changes and activities reflect the School's ongoing drive to increase the popularity of engineering as a study option, advance cutting-edge knowledge in the field, widen and deepen students' educational experience to add to their competitive edge, and raise community awareness of the essential role that engineers play in improving the world we live in. It has been an exciting three years. While uncertainty looms over the world in 2009, the directions taken by the School of Engineering during 2006-08 should position us well in the future.

**Prof Philip C H CHAN**  
Dean of Engineering

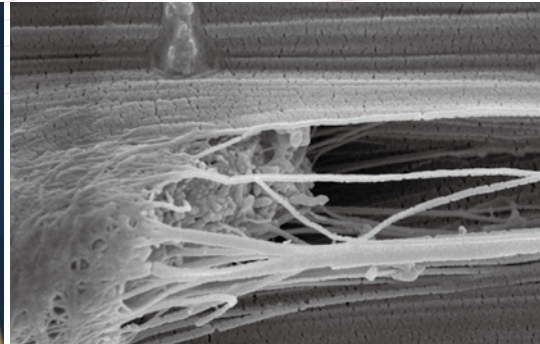
The background features a dark space with several glowing, curved lines in shades of blue, cyan, and green. On the right side, a portion of the Earth is visible, showing the blue oceans and white clouds. The overall aesthetic is futuristic and global.

# SENG Shines Globally

During 2006-08, the School of Engineering continued to receive worldwide recognition for its achievements with high rankings in international engineering league tables and significant academic accomplishments







## Leading the Way

The quality of work carried out at the School of Engineering has been highlighted by HKUST's excellent performance in different global rankings.

HKUST was placed at No.24 in the world's top 50 universities for technology in the *Times Higher Education-Quacquarelli Symonds (THE-QS) World University Rankings 2008*. The University has been ranked in the top 25 of the THE-QS technology league tables since the category was launched in 2005 and is the only university in Hong Kong consecutively listed in the top 50 in the past four years.

Peer review is central to the THE-QS technology rankings of the world's top universities in Engineering and IT. The University's consistent presence in these tables reflects its strong international standing and the respect for faculty members and their work among fellow academics internationally.

With a growing response rate from the global academic community to the THE-QS university ranking surveys, HKUST's continuous high ranking is further indication of the wide reach of its reputation. There were 6,350 responses in 2008 compared with around 5,100 in 2007.

In the Shanghai Jiao Tong University's world university rankings in 2007 and 2008, HKUST was also ranked in the world's top 50 universities in engineering, being placed at 37 and 40 respectively. The Shanghai Jiao Tong league tables include all institutions with Nobel Laureates, Fields Medal winners and frequently cited researchers. More than 1,000 institutions were ranked in each of the five subject fields covered.

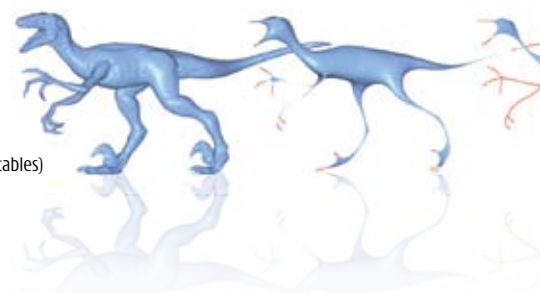
## Geotechnical Group Keeps Up Pioneering Pace

Members of the Geotechnical Group in the Department of Civil and Environmental Engineering have maintained their No.1 ranking for total number of journal papers published in four major geotechnical journals.

Ranked  
**24<sup>th</sup>**

## The World's Top 50 Universities for Technology

(Times Higher Education Supplement world's top universities' league tables)





Our faculty members in this area have held the top position from 2001-08, according to Web of Science® statistics. The leading journals are *Geotechniques*; *Journal of Geotechnical and Geoenvironmental Engineering*, *ASCE*; *Canadian Geotechnical Journal*; and *Soils and Foundations*.

### Inspiring SIGGRAPH Success

The Computer Vision and Graphics Group, Department of Computer Science and Engineering, has been drawing strong attention at the frontiers of new international knowledge with 10 papers accepted by SIGGRAPH in 2008. This saw HKUST become the first institution in Hong Kong to publish a double-digit number of SIGGRAPH papers in a single year.

The SIGGRAPH papers program is the top global forum for unveiling new scholarly work in computer graphics and interactive techniques. In 2008, HKUST had eight papers accepted for the inaugural SIGGRAPH-Asia event and two accepted at the established SIGGRAPH-US.

SIGGRAPH-Asia is equivalent to SIGGRAPH-US with submissions comparable in quality and papers from SIGGRAPH-US and SIGGRAPH-Asia published in the same top journal ACM Transactions on Graphics (TOG). The acceptance rate at both SIGGRAPHS was around 18%.

Current focuses of the HKUST research group include segmentation, tracking/matching, multi-view geometry, uncalibrated reconstruction, modeling and rendering. Targeted applications are 3D authoring tools for multimedia, medical imaging, and biometrics.

Such success has provided additional motivation to the Group's pursuit of inspirational research. In 2007, the Group had six papers accepted at SIGGRAPH.

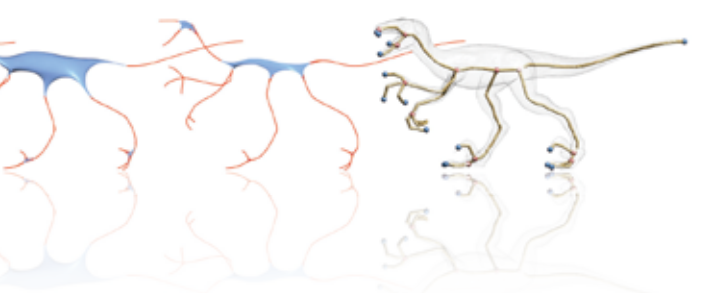
### Super-Strong Fibers

Interdisciplinary research in the School of Engineering is leading to further innovative discoveries. More effective bullet-proof vests and extra-durable nautical rope may be the outcome of an exciting new technology involving carbon nanotubes developed by Prof Ping GAO, Department of Chemical and Biomolecular Engineering, and Prof Tong-Xi YU, Department of Mechanical Engineering.

The technology aligns nanotubes along the length of polymer fibers, greatly increasing tensile strength and enabling garments to withstand high impact while remaining light. The high ventilating capability of carbon nanotubes also means that end products can be more comfortable for users. Other uses for the new materials include tennis racket threads with greater elasticity and strings for musical instruments.

### ECE Publications Earn Global Acclaim and Academic Excellence

The Electronic and Computer Engineering Department continues to shine and maintains its high ranking in terms of the total number of journal papers published. It is ranked in top 5 places amongst the 5 prestigious journals in the world.

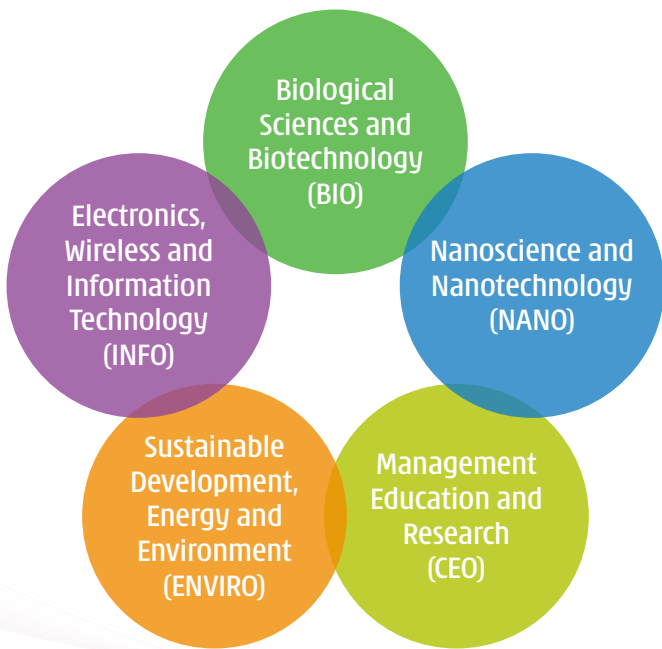


		<p><b>No.1</b> IEEE Transactions on Wireless Communications (2002-2007)</p>
	<p><b>No.2</b> IEEE Transactions on Electronic Devices (1998-2007)</p>	<p><b>No.3</b> IEEE Journal on Selected Areas in Communications (1996-2007)</p>
<p><b>No.4</b> IEEE Transactions on Communications (1996-2007)</p>	<p><b>No.5</b> IEEE Electron Device Letter (1998-2007)</p>	

# Expanding Knowledge Frontiers

by Prof Jang Kyo KIM, Associate Dean of Engineering (Postgraduate Studies)

Pioneering research is an integral part of the School of Engineering, and its numerous internationally recognized breakthroughs have played a major role in rapidly establishing HKUST's position within the global academic community. Prof Jang Kyo KIM, Associate Dean of Engineering (Postgraduate Studies), discusses research developments in 2006-08 and their impact on future opportunities



With the launch of HKUST's Strategic Plan 2005-2020, the University is seeking to build on its previous successes. To do so, it is focusing on attaining global leadership and maximum influence, in particular in five high-impact areas that will determine the way we live in the years to come: Biological sciences and biotechnology (BIO), Nanoscience and nanotechnology (NANO), Sustainable development, energy and environment (ENVIRO), Electronics, wireless and information technology (INFO), Management education and research (CEO).

## Faculty Strengths

In 2006-08, the School of Engineering showed it had a leading part to play in driving forward these various "Os", in particular in the first four categories, with research advances ranging from wireless sensor network to increase mine safety (INFO) to direct alcohol fuel cells research (ENVIRO). Almost all the School's 150-plus faculty members are involved in one way or another in high-impact areas. Indeed, our world-class academics are the key to the School's outstanding research track record. Faculty members do not only conceive and pursue innovative ideas. They also possess the international credibility to attract other top-flight researchers to work together on projects and the major funding support that enables cutting-edge research to be carried out.

Faculty members collaborate with other Schools within HKUST, and with other universities and industries locally, nationally and internationally on leading research projects. Such collaborations, between colleagues, different disciplines and institutions, are the prerequisite to building up critical mass and research networks.

Our departments have also been contributing through the successful development of interdisciplinary research and graduate teaching programs, such as nanotechnology, bioengineering and environmental engineering. These types of interdisciplinary programs foster and educate graduate students - the next generation of academic explorers - and inspire further frontier research.







## Funding

During 2006-08, the School of Engineering continued to draw substantial funding to its projects from a variety of sources. Major funding locally centers on the Hong Kong government's Research Grants Council's (RGC) General Research Fund (formerly known as Competitive Earmarked Research Grant) schemes and the Innovation and Technology Fund (ITF). In these years, the School received well over 40% of RGC money awarded to the whole university, the largest percentage for an individual school at HKUST, and maintained an average annual percentage project success rate of around 65%. Almost 95% of ITF funding for HKUST came to the School of Engineering. Faculty members also successfully source research money from industry, especially for applied research and development projects. Companies may be based locally, in Mainland China, and/or overseas.

## Outstanding Infrastructure

Another singular benefit driving School of Engineering research output is HKUST's special approach to infrastructure and support. The University currently hosts nine research institutes, six associated with the School of Engineering, and 40 research centers, of which 20 are associated with the School of Engineering. In addition, 10 out of 13 centers/programs of the Fok Ying Tung Graduate School, the fifth school of the University, are associated with the School of Engineering. These provide a unique platform for the School's faculty members to pursue their research.

Unlike many other institutions, HKUST takes a centrally administered approach to many of its research facilities. This offers major advantages. It means the University can maintain leading-edge facilities by avoiding duplication, and a greater variety of equipment can be acquired. Thus, when new areas of research are identified to develop, we can start right away.

Administrative support is another important component of the School of Engineering's success story. HKUST's efficient system and the services in place allow faculty members to concentrate on their work, raise research funding, and nurture graduate students. This, in turn, allows the School to continuously add to its reputation and that of the University as a whole.

## Research Students

Top faculty, funding, and infrastructure help the School to draw the best and brightest of the young generation of research scholars. In 2008, it had over 1,350 postgraduates from Hong Kong, Mainland China and overseas, out of a total of more than 3,500 engineering students.

HKUST has already established its reputation among Mainland China postgraduate students. To boost presence and research connections overseas, the University will launch a new initiative starting from 2010 to provide international fellowships for PhD students from countries and regions other than Hong Kong, Mainland China and Taiwan. Through this move, the School of Engineering will be able to attract more top students from all over the world, in particular from the Asia-Pacific region. This will foster ties for future regional research collaborations and help to build closer connections with institutions in these locations.

## The Way Ahead

As can be seen in this report, 2006-08 have been eventful and exciting years for School of Engineering research, years that have paved the way for comprehensive future growth in project areas under study, funding, research students, and collaborations.







# Empowering Leaders

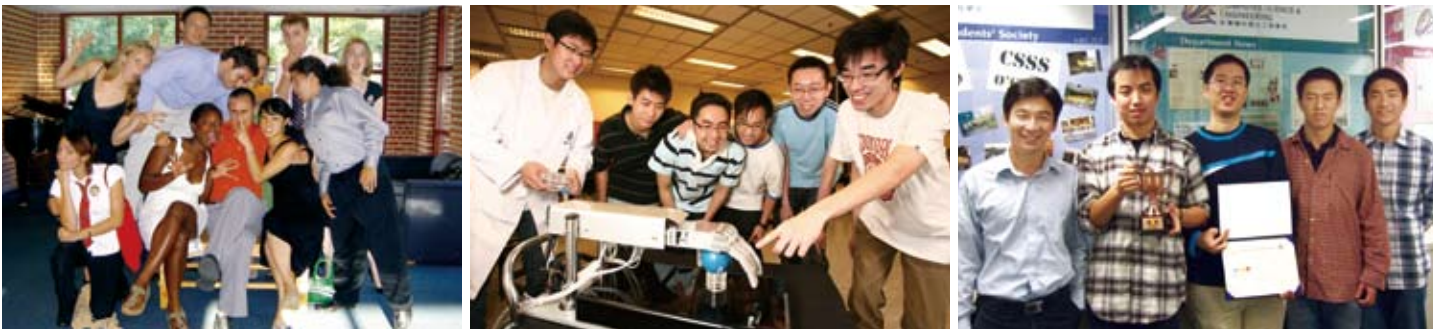
## of Tomorrow

Hong Kong tertiary education will enter in a new era with the introduction of four-year curriculum in 2012. To prepare for this move, the School of Engineering has been putting great efforts in reviewing its pedagogy and planning for the new curriculum to offer best learning outcomes for our future graduates

# Preparing for the New Era

by Prof Charles W W NG, Associate Dean of Engineering (Undergraduate Studies)

Hong Kong's move from a three-year undergraduate degree to a four-year system in 2012 is a challenging, exciting development that will open up a range of fresh learning opportunities for university students. Prof Charles W W NG, Associate Dean of Engineering (Undergraduate Studies), discusses the preparatory moves made in the School of Engineering in 2006-08



The four-year university degree structure being introduced across Hong Kong involves enormous alterations to the educational framework previously in place. Hong Kong secondary and tertiary education as a whole will change fundamentally and extensively. Secondary education will be shortened from seven years to six years to accommodate the expansion to four years at university. The secondary school curriculum and exit qualifications will be restructured, with one public examination, the Hong Kong Diploma of Secondary Education (HKDSE), replacing HKCEE and Hong Kong A-levels. The interface between secondary and university will also alter.

## Impact of Curriculum Change

The curriculum arrangements being put in place for undergraduates in the School of Engineering envisage greater breadth and more educational choices for student learning while at the same time retaining the depth and focus to obtain the necessary skills and knowledge to fulfill professional requirements and to pursue further studies. It also provides sufficient flexibility for students to learn outside the books through exchange and internship.

With an additional year, there will be more time for our students to explore different subject areas, across engineering disciplines and in other fields. To make our four-year curriculum more flexible, the School has designed a "three-track" model that reflects students' differing learning goals in professional engineering, further studies

or diverse career path. The "heavy major" option will prepare our students to be professional engineers and further studies. The "light major" tracks will pave the way for postgraduate studies and diverse careers.

The School has been actively participating in interdisciplinary collaborations. In addition to the Dual Degree Program in Technology and Management, there are many new interdisciplinary programs such as Bioengineering Graduate Program jointly offered with the School of Science; BSc in Risk Management and Business Intelligence with Departments of Information Systems, Business Statistics & Operations Management, Mathematics and Computer Science & Engineering taking in students from 2009 onwards, and an Environmental Technology and Management program, subject to the university's approval in admitting students from 2010 onwards, that marks the concerted efforts between the four Schools of the University.

Apart from the existing double major, there will also be new minor options such as Minor in Business, Environmental Sustainability & Management. With the adoption of the new curriculum, students can discover their strengths and interests before making up their mind as to the direction they wish to go in. And once decided on a certain path, they will be able to see their chosen field - and the world - in a broader perspective, given their greater all-round knowledge.



Social development demands that our graduates can operate across traditional boundaries and take on roles that demand not only technical knowledge but a range of other skills, including communication, leadership and management capabilities. In order to nurture graduates with good attitude, sense of responsibility and ethical value, holistic teaching and learning is emphasized. We must not only produce excellent engineers but also enable our students to transform themselves into entrepreneurs, business executives, and cutting-edge researchers. They must be able to see themselves as social leaders, capable administrators and creative thinkers. We have already been evolving the School's engineering curricula in this new direction. The four-year program allows us to step up this move to expand students' career choices and to move toward outcome-based learning.

### School-based Admission

The start of School-based admission for our engineering undergraduates, announced in September 2008, is one clear indication of the greater flexibility that students will gain under the new arrangements. In 2009-10, students applying for admission under Hong Kong's Joint University Programmes Admission Scheme (JUPAS) and Early Admission Scheme (EAS) will have an alternative

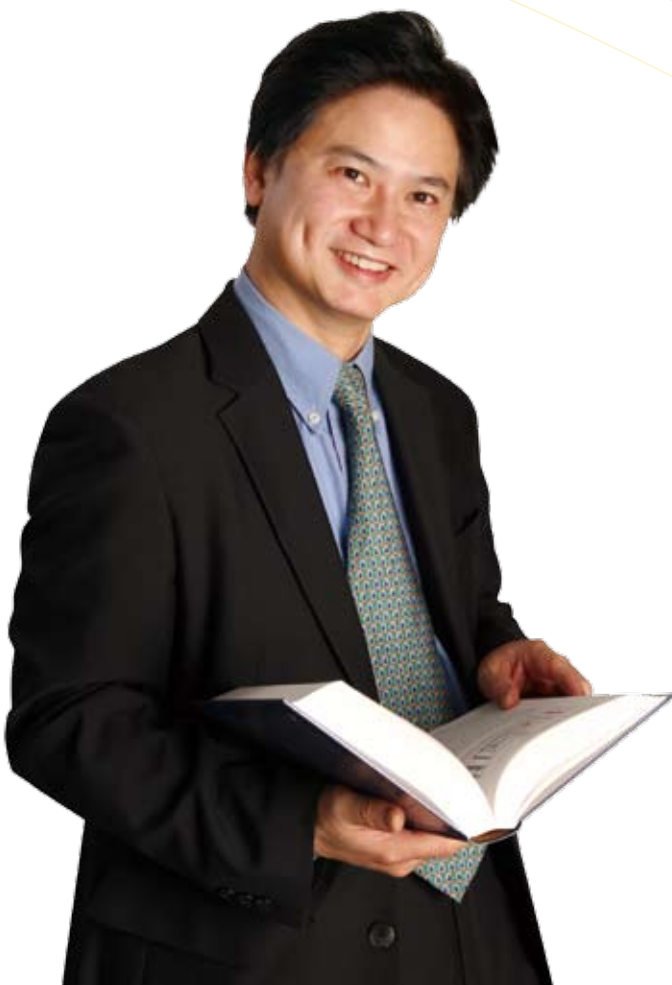
to selecting one of the School's 13 individual programs. They will be able to choose either of two School-based streams, each comprising a different group of the School's engineering departments. Students entering under School-based admission will only need to choose an individual program toward the end of their first semester. Those interested in several engineering disciplines initially will thus be able to gain a broader understanding of what fields encompass before deciding their major. School-based admission is set to evolve in the run-up to 2012.

### Internationalization

The School has attached paramount importance to widening students' horizons through greater internationalization of its student body. Internationalization encompasses two major aspects. One involves student exchanges, which will be further facilitated by the migration from the 3-year curriculum to the 4-year one; the other seeks to raise the number of overseas students who take bachelor's degrees with us. Many students from Mainland China have already been taking advantage of the world-class education available at the School.

In addition to the US and Canada, our university exchange partner network has expanded to 7 new regions (Malaysia, New Zealand, South Korea, Spain, Switzerland, Taiwan and Thailand) which add up to over 60 partners stretching over 17 regions. New exchange links have been forged with top-notch universities in the world, such as ETH Zurich and the University College London. The value of exchanges is tremendous and the benefits are multi-faceted. Exchanges allow students to broaden their cultural understanding, foster their independence and very often to experience a different academic approach. Such an experience also helps to make graduates more marketable. In a global world of the 21<sup>st</sup> century, young professionals are highly likely to be working in multicultural teams and/or different countries. An exchange provides early preparation for this. By the end of 2008/09 academic year, over 20% of the School's total student body will have a chance to study outside Hong Kong through the School's exchange programs.

With regard to international undergraduate students studying full-time at the School, our applicant pool has expanded from 15 nationalities for the 2006 intake to 27 for the 2008 intake. We believe that numbers will keep soaring in the coming years. In addition to its world-class faculty, and excellent learning/research opportunities, the international campus culture at HKUST and the cosmopolitan, East-West lifestyle in Hong Kong offers a wonderful platform from which



one can learn more about the China market, according to feedback from international students. Geared to the needs of the international students, we have been working with the School of Humanities and Social Science to modify China-related minor program and courses specifically designed to provide insight into its society, politics and economy for those from overseas.

### Co-curricular Activities

In addition, the School has started to extend the nature of the learning experience that students receive. Under a three-year system, time to participate in additional activities can often be tight. Yet students have shown they recognize the benefits of these opportunities by their enthusiasm and willingness to participate despite heavy workloads. In 2006-08, undergraduates have been involved in a growing number of local and international competitions, outreach activities such as the Student Ambassador Program (see P.48), and internships.

Activities will be further extended in the future through co-curricular programs to encourage students to engage in and contribute to society while earning credits towards their degree. The School has been busy establishing or utilizing previous links with non-

governmental organizations, such as the Lions Club Metropolitan Hong Kong. A new course - the Community Services Project - will be launched in Spring 2009 to offer students an opportunity to serve the community and from which to acquire necessary soft-skills such as time management, communication skills, etc. A series of community service and charitable work will be lined up with the objective of cultivating a social responsibility culture. After graduation, this social experience can place them in a better position as engineers when handling projects requiring formal or informal community approval and/or increase their prospects of success as entrepreneurs.

### All-round Vision

All these new developments will positively impact on undergraduate life for our engineering students. They are given ample opportunities to learn from other cultures through internationalization and at different levels of the society via community service and charitable work. The four-year system will provide a longer timeframe that opens up greater mental space to adapt the transition from school to university. They will also be able to more comfortably engage in a broader range of studies and activities to develop academically, creatively, ethically, socially and personally.





# A New Paradigm for Engineering Education

by Prof Edmond KO, Acting Head of the Department of Chemical and Biomolecular Engineering,  
Senior Advisor to HKUST's Vice-President for Academic Affairs (Deputy to the President)

Engineering education in Hong Kong is moving toward an outcome-based approach as universities prepare for the introduction of the four-year curriculum in 2012. Prof Edmond KO, Acting Head of the Department of Chemical and Biomolecular Engineering and Senior Advisor to HKUST's Vice-President for Academic Affairs (Deputy to the President) reviews the impact of this change and how the School of Engineering has been preparing for it

## Engineering as Liberal Education?

To this day, many people regard engineering as a dry technical discipline that only involves the application of mathematics and science to solve real-world problems. In this light, engineering students are often perceived to be “nerdy” in the sense that they are too analytical, too narrowly focused, or lacking in people skills. It is thus incumbent on engineering educators to come up with innovative curricula that would arouse young people's interest and attract them to the profession.

The fact of the matter is, since the beginning of the 20<sup>th</sup> century, there has been an emphasis on the non-technical component (often referred to as general or liberal education) of an engineering curriculum. This emphasis is even stronger in the 21<sup>st</sup> century when engineering graduates now face more complex, multidisciplinary problems and at the same time a much wider choice of career paths across national boundaries.



Moves by engineering accreditation boards worldwide have brought in criteria that hold engineering schools responsible for helping their students develop a series of graduate attributes other than academic and technical knowledge. The Hong Kong Institution of Engineers (HKIE), which is a signatory of the Washington Accord, is also moving in this direction. Specifically, five non-technical graduate attributes that the Washington Accord emphasizes are the ability to:

- Communicate effectively
- Function effectively in diverse teams and in multi-disciplinary settings
- Engage in lifelong learning and professional development
- Act in accordance with the ethical principles of the engineering profession
- Function in contemporary society





These attitudes and skills are usually regarded as hallmarks of a liberal education. However, our focus should not be on the label (professional versus liberal) but on clearly defining the intended learning outcomes of an engineering education in terms of the desirable graduate attributes, then delivering these outcomes in an effective and convincing manner. This is the approach taken by the School of Engineering in its planning for the four-year curriculum to be introduced in 2012.

### Addressing Learning Outcomes

The concept of learning outcomes is a convenient way to define the impact of an educational process on students. A learning outcome is what a student should know or can do as a result of a learning experience. The learning outcomes that university graduates should possess can be broadly classified into three categories: knowledge, skills, and attitudes.

At the School of Engineering, some 15%-20% of our graduates each year pursue further studies. Of the remaining 80% or so, about half work in engineering-related fields (for example, manufacturing and industries, construction) and half in the commerce and business sector. These employment statistics show that we need a curriculum with sufficient flexibility to prepare students for different career paths, along with a strong advisory system to help them make informed decisions. Above all, skill and attitude outcomes should be treated as essential components of the curriculum.

A concern often expressed by engineering educators is that spending time on developing skill and attitude outcomes will adversely affect the advancement of students' professional knowledge. Along this line, a 2006 research report from the United States is of interest. The study\* found that since the country's accreditation board, ABET, Inc., began promoting outcome criteria (EC 2000), there had been a



positive impact on engineering programs, student experiences, and student learning. In particular, these researchers reported a greater emphasis on professional skills and active learning and, at the same time, higher levels of faculty support for continuous improvement. Even though this is an initial finding, it reminds us that in designing engineering curricula we should not just think of how to divide the pie. Instead, we should enlarge the pie through using effective learning and teaching methods to benefit students in different ways simultaneously.

### Aligning Teaching and Assessment

Research on student learning has repeatedly identified the usefulness of aligning learning outcomes with pedagogy and assessment. Thus, with enhancement of student learning as the primary objective, the University Grants Committee - Hong Kong's university funding body - has been encouraging its institutions to adopt an outcome-based approach in planning the four-year undergraduate curriculum.

In this regard, an inter-institutional task force was formed in February 2007 to take the initiative forward. With Prof Mounir HAMDJ of the Department of Computer Science and Engineering as a co-convenor and myself a member of this task force, we have been working closely with colleagues at both local and overseas institutions in identifying and disseminating best practices that will help us in the design and implementation of our new curriculum.

The School of Engineering has also benefited from visits by many experts in engineering education and accreditation such as Dr Ira JACOBSON, Prof Karl SMITH, and Prof Charles SODINI. Through a series of seminars, workshops and department-based meetings, faculty members from all engineering departments had fruitful discussions with these visitors on a wide range of learning and teaching issues. The School has also held two half-day curriculum-planning workshops in May and October 2008, during which representatives from all departments presented their progress in curriculum design and exchanged views on how best to move forward.

The introduction of a four-year curriculum may appear to be a daunting task, but it presents a rare opportunity for the School to examine critically its educational mission, objectives, and delivery. By bringing faculty members together to work as a team, we have identified ways to improve our learning and teaching activities not only for the new curricula, but also for existing ones. We are poised to move ahead with enthusiasm and purpose in providing the best possible learning outcomes for our graduates.

*\* Lisa R. Lattuca, Patrick T. Terenzini, J. Fredricks Volkwein (2006). Engineering Change - A Study of the Impact of EC 2000. Baltimore: ABET, Inc.*

### Keeping Competitive





# Working Together to **Drive Progress**

Increasingly in today's global environment, leading research and education involves crossing international borders as well as teaming up with other institutions nationally and forging bonds with different sectors of the local community. In 2006-08, the School of Engineering benefited from HKUST's highly active approach to collaborations to substantially built up its partnerships





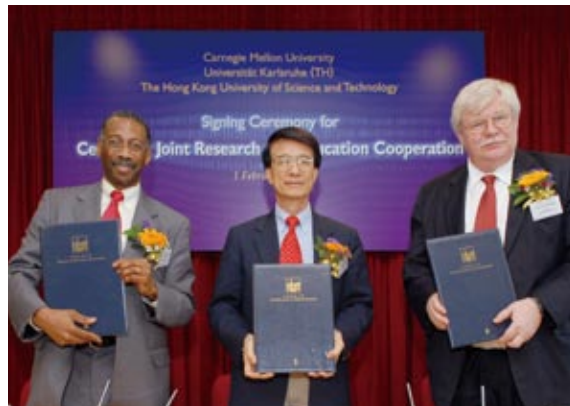
# International

Bringing together academics and students with different cultural values and diverse world views offers the prospect of fresh vision and dramatic advances in engineering education and research

## Three Universities, Three Continents, One Goal

In 2007, a significant international agreement between three leading universities, each located on different continents, saw HKUST set up a pioneering new research and education center focused on computing and communications technology and hosted by the School of Engineering.

The International Center for Advanced Computing and Communications Technology (InterACT) works with similar centers at top-ranked Carnegie Mellon University in the US and renowned German research institute Universität Karlsruhe to foster ideas, discoveries, and the education of young computer and communications engineers. The agreement also encompasses student and faculty exchanges to widen global perspectives.



The first and current director of InterACT at HKUST is Prof Pascale N FUNG, Electronic and Computer Engineering and co-founder of the Human Language Technology Center.

## Member Universities

(alphabetical order in country/ region names)

- Monash University
- Tsinghua University
- National Taiwan University
- The Hong Kong University of Science and Technology
- Indian Institute of Technology, Bombay
- Bandung Institute of Technology
- Tokyo Institute of Technology
- Korean Advanced Institute of Science and Technology
- University of Malaya
- The University of Auckland
- Nanyang Technological University
- Chulalongkorn University

## Joining Forces Regionally

In 2007, regional relations received a boost when HKUST and 11 other high-flying universities in Asia and neighboring locations agreed to establish a league to raise engineering education and research quality further.

The Asia-Oceania Top University League on Engineering (AOTULE) encourages collaboration through student, staff and information exchanges, joint annual research symposiums and an annual gathering for Deans of Engineering Schools/Faculties. Members include Tsinghua University (China), Indian Institute of Technology Bombay (India), Monash University (Australia), National Taiwan University (Taiwan), and Tokyo Institute of Technology (Japan).



## Belarus Connection

Further afield, HKUST and Belarusian State University of Informatics and Radioelectronics signed a five-year agreement in 2007 to build academic connections, student exchanges, and develop joint projects involving nanomaterials and nanoelectronics. Chair Professor Hoi Sing KWOK, Electronic and Computer Engineering and Director of the Center for Display Research, represented HKUST at the signing ceremony.



## Meeting of Minds in Middle East

In 2008, a Memorandum of Understanding was signed between HKUST and Saudi Arabia's King Abdullah University of Science and Technology (KAUST), a new, graduate-level research institution. The inspiring development seeks to establish a long-term relationship between the two young academic powerhouses. It focuses on generating boundary-breaking discoveries in nanotechnology and marine genomic research, with scientists conducting marine research off the coast of the Red Sea where KAUST is situated.

The multi-faceted agreement involves collaborative research programs; scientific, technical and administrative staff exchanges; and the establishment of fellowships for graduate students and postdoctoral fellows from each of the two universities to study at the other institution.

## Nanofiber Venture

HKUST and Finetex Technology Global Limited, a leading Korean manufacturer of nanostructured materials, signed a collaborative agreement to foster research into the development and applications of carbon-nanofibers and nanocomposites. With financial support from Finetex, the FINETEX-HKUST R&D Center was established in 2008 to pursue multidisciplinary research into the field and develop new technologies for the industry.



# National

In the period under review, the School has greatly helped to boost HKUST's presence in Mainland China and encourage productive alliances

## Boeing Research Takes Off

In a notable academic-industrial venture, HKUST, Tsinghua University, and Southeast University in Nanjing entered into collaborative agreements with US aviation innovator Boeing Phantom Works to research and develop new wireless communications-related technology. Research centers on breakthroughs related to onboard entertainment systems and communication between maintenance technicians at airports. Each university will work separately on a different aspect of the wireless communications system.

The School's Computer Science and Engineering faculty and doctoral and master's degree candidates are tackling seamless connectivity among different networks used by aircraft line maintenance technicians. Hong Kong International Airport is participating in the project. The agreement between HKUST and Boeing Phantom Works was made in 2007.

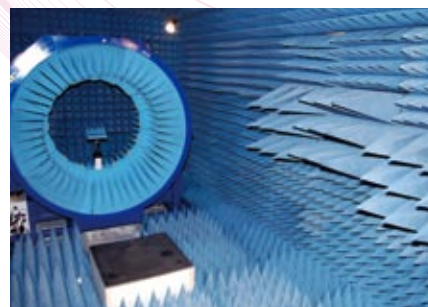


## Concrete Measures

Civil engineering academics are participating in a significant 973 project involving research on environmentally friendly contemporary concrete. A 973 project is the highest-level basic research project category in China. The interdisciplinary team also includes colleagues from HKUST's Mathematics and Chemistry departments. The research is being carried out together with Southeast University and other institutions.

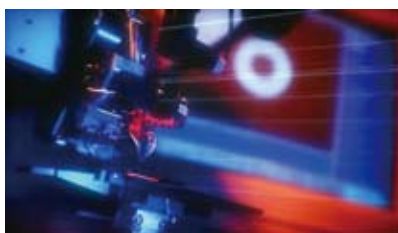
## Wireless Connections

The Huawei-HKUST Joint Research and Development Center was established in 2007 to support academic excellence in wireless communication technology, train up future leaders in the field, and boost industrial collaboration. Huawei Technologies Co Ltd, based in Shenzhen, is a leading force in next-generation telecommunications networks. The center will also support Huawei's product development and nurture its research and development capability.



## Nano Partners

The Department of Electronic and Computer Engineering and the Chinese Academy of Sciences' highly regarded Shanghai Institute of Microsystem and Information Technology (SIMIT) agreed in 2008 to establish a platform for collaborative research into innovative micro and nano-electronic device structures and semiconductor memory technology. The Joint Laboratory for Nano-Electronic Device Research will also foster the development of postgraduate students and work together on project applications.



## Seeing the Future

A joint South China University of Technology (SCUT) and HKUST laboratory for display technology was established in 2008. SCUT, a key science and engineering university in Mainland China, and the Guangdong government committed HK\$100 million to set up the facility, which is dedicated to thin film transistor technology.

## Fok Ying Tung Footprint

The HKUST Fok Ying Tung Graduate School (FYTGS), the University's fifth School, has been established in Nansha to provide a base for growing HKUST's presence in Mainland China. FYTGS conducts research in high-impact technology areas. It also collaborates with local industries including those in the Pearl River Delta, offers professional training programs for businesses and government agencies, and will provide postgraduate education programs.

The Dean of FYTGS is Prof Tong-Xi YU who is also Chair Professor of the Department of Mechanical Engineering and Associate Vice-President for Research and Development (Mainland Programs) at HKUST.

Since establishment, FYTGS has collaborated in several prestigious Mainland China research schemes and also gained the Mainland's Science and Technology Bureau grants as well as research and technology projects from companies/industries. In 2008, FYTGS was awarded the International Science & Technology Cooperation Base status by China's Ministry of Science and Technology. Such official recognition will add to its ability to cooperate with overseas universities and institutions.





Environmental Engineering

Biomolecular Engineering

Department of Chemical and Biomolecular Engineering

Department of Civil and Environmental Engineering

Department of Computer Science and Engineering

Department of Electronic and Computer Engineering

Department of Industrial Engineering and Logistics Management

Department of Mechanical Engineering

Mechanical Engineering



Engineering

Engineering

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# World-Class Pioneers

## SENG Departments Profile

- Department of Chemical and Biomolecular Engineering
- Department of Civil and Environmental Engineering
- Department of Computer Science and Engineering
- Department of Electronic and Computer Engineering
- Department of Industrial Engineering and Logistics Management
- Department of Mechanical Engineering





# Department of Chemical and Biomolecular Engineering

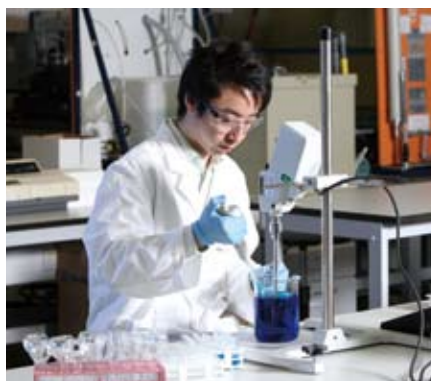
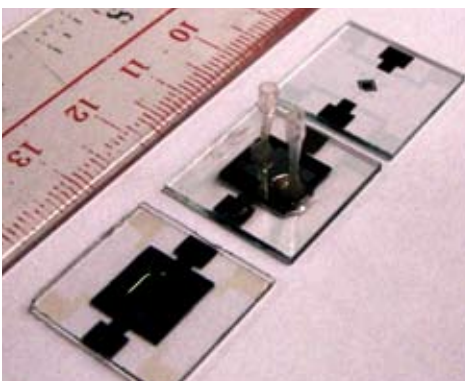
Acting Head: Prof Edmond KO

The Department's pioneering chemical engineering program is the first of its kind in Hong Kong. During the period under review, the Department of Chemical Engineering changed its name to the Department of Chemical and Biomolecular Engineering. Biomolecular engineering adds a further horizon in pharmaceutical engineering and biotechnology.

Faculty members seek to provide a high-quality academic base which, when supplemented with professional training and experience, enables graduates to contribute to the technological, socio-economic development and competitiveness of Hong Kong and the region. Our research and development is focused on work that is academically challenging, particularly that which has potentially global impact and relevance to Hong Kong. Faculty members collaborate with business and industry to promote technological innovation and economic development. The Department also strives to promote and catalyze sustainable development in Hong Kong.

At a Glance	
<b>Faculty Members</b>	15
<b>Undergraduates</b>	188
<b>Postgraduates*</b>	50
• Research	
<b>Academic Programs</b> <b>Undergraduate</b> <ul style="list-style-type: none"> <li>• BEng in Chemical and Bioproduct Engineering</li> <li>• BEng in Chemical and Environmental Engineering</li> <li>• BEng in Chemical Engineering</li> </ul> <b>Postgraduate</b> <ul style="list-style-type: none"> <li>• MSc in Chemical Engineering</li> <li>• MPhil in Chemical and Biomolecular Engineering</li> <li>• PhD in Chemical and Biomolecular Engineering</li> </ul> <b>Major Research Areas</b> <ul style="list-style-type: none"> <li>• Advanced materials</li> <li>• Bioprocess engineering</li> <li>• Environmental engineering</li> <li>• Product and process design</li> </ul>	<b>Departmental Teaching and Research Laboratories</b> <ul style="list-style-type: none"> <li>• Advanced Materials for Environmental Protection Lab</li> <li>• Aerosol Laboratory</li> <li>• Biomicrosystem &amp; Fuel Cell Lab</li> <li>• Bioprocessing and Biocomputation Laboratory</li> <li>• Catalysis, Adsorption &amp; Nanomaterials Laboratory</li> <li>• Drug Delivery and Biomaterials Laboratory</li> <li>• Liquid Adsorption &amp; Environmental Materials Lab</li> <li>• Micro and Nano Systems and Materials Laboratory</li> <li>• New Energy and Intelligent- &amp; Bio-Materials Laboratory</li> <li>• Physical Properties Characterization &amp; Materials Processing Laboratory</li> <li>• Polymer Processing &amp; Systems Laboratory</li> <li>• Polymer Surface &amp; Interface Analysis Laboratory</li> <li>• Process Systems Engineering Laboratory - Catalysis and Reaction Engineering</li> </ul>

\* as at 31 December 2008





## Faculty Honors

### Prof Chak Keung CHAN

Awarded China's National Natural Science Award, First Class, in 2007 for his contribution in a joint project led by Tsinghua University in collaboration with HKUST and Tongji University on the characteristics of emission and complex pollution of particulate matter and its precursors. The honor is one of the country's most significant research accolades. He has been appointed Executive Editor of *Atmospheric Environment* and a member of the editorial advisory board of *Atmospheric Chemistry and Physics* and *Aerosol Science and Technology*.

### Prof Guohua CHEN

Appointed an editorial board member of *International Journal of Environment and Waste Management*, reappointed an editorial board member of the *Chinese Journal of Chemical Engineering* in 2007. He was awarded the "Certificate of Excellence" by World Forum for Crystalization, Filtration and Drying in 2007.

### Prof Ping GAO

A Nano and Advanced Materials Institute Limited (NAMI) project coordinated by Prof Ping GAO received around HK\$3 million from Fibrastrics (HK) Ltd and HK\$2.6 million in matching funds from Hong Kong's Innovation and Technology Fund. The project, which runs from 2008-10, focuses on high performance polymer nanocomposite fibers for electronic applications.

### Prof Xijun HU

Received "Top-50 most Cited Paper 2003-06" awards for his co-authored paper [Feng, J., Hu, X., Yue, P.L., Zhu, H.Y. and Lu, G.O., A Novel Laponite Clay-based Fe Nanocomposite and Its Photocatalytic Activity in Photo-assisted Degradation of Orange II, *Chemical Engineering Science*, 58, 679-685 (2003)] published in *Chemical Engineering Science*. Prof HU was appointed an editorial board member of the *International Journal of Chemical Engineering* in 2007. He has also been the Associate Editor of *Asia-Pacific Journal*

of *Chemical Engineering* and *Chinese Science Bulletin* since 2006. Together with Prof Wei-Kang YUAN, East China University of Science and Technology, they worked on a jointly funded National Natural Science Foundation of China/Research Grants Council project to look at preparation of catalytic architecture composed of titanium silicate and carbon nanofiber.

## Research Highlights

### On-the-Spot DNA Tests

Development of a polymerase chain reaction (PCR) microchip by a HKUST team, led by Prof I-Ming HSING, brought on-the-spot testing of forensic evidence at crime scenes and disease diagnosis at surgeries a step closer. The team miniaturized the technology needed to perform PCR using electrochemical DNA sensors to provide simultaneous DNA amplification and detection on a silicon-glass microchip. The advance drew international attention with HKUST's results published in the American Chemical Society journal *Analytical Chemistry* in 2008.

### Air Pollution Study via Single Particle Levitation

Prof Chak Keung CHAN's group specializes in understanding the atmospheric transformation of particulate pollutants and how they affect visibility and climate change via cloud formation. In his laboratory, research students levitate single 10-20 microns particles to study their physical and chemical changes in the atmosphere. He co-authored the paper 'Understanding hygroscopic growth and phase transformation of aerosols using single particle Raman spectroscopy in an electrodynamic balance' with A K Y LEE and T Y LING, PhD and MPhil students in the Department respectively. This was published in *Faraday Discussions* in 2008 and named a hot article by the journal. He has now extended the single particle studies into chemical reactions between gas phase and particulate phase pollutants.

Department of Chemical and Biomolecular Engineering website:

<http://www.cbme.ust.hk>



From left to right:

Prof Edmond KO, Prof Chak Keung CHAN, Prof Guohua CHEN, Prof Ping GAO, Prof Xijun HU, Prof I-Ming HSING



# Department of Civil and Environmental Engineering

Head: Prof Moe M S CHEUNG

The School of Engineering contains one of the most creative, innovative Civil and Environmental Engineering departments among the region's universities. The Department's mission is to provide the high-quality engineering education needed to design, construct, protect and maintain both infrastructure and the environment; and to provide students with a productive and fulfilling experience at all stages of their program.

The Department's world-class faculty members serve as directors, advisors and executive members in numerous organizations, institutions and associations, including the Hong Kong Institution of Engineers and American Society of Civil Engineers. The Department's research strategy is formulated to balance high-impact fundamental and applied research with local and international significance. Collaborative projects with other first-rate universities are also undertaken to enrich research output.



At a Glance	
<b>Faculty Members</b>	25
<b>Undergraduates</b>	391
<b>Postgraduates*</b>	
• Research	105
• Taught	98
<b>Academic Programs</b>	<b>Major Research Areas</b>
<p><b>Undergraduate</b></p> <ul style="list-style-type: none"> <li>• BEng in Civil and Environmental Engineering</li> <li>• BEng in Civil and Structural Engineering</li> </ul> <p><b>Postgraduate</b></p> <ul style="list-style-type: none"> <li>• Graduate Diploma in Civil Infrastructural Engineering and Management</li> <li>• Graduate Diploma in Environmental Engineering<sup>^</sup></li> <li>• MSc in Civil Infrastructural Engineering and Management</li> <li>• MSc in Environmental Engineering<sup>^</sup></li> <li>• MPhil in Civil Engineering</li> <li>• MPhil in Environmental Engineering<sup>^</sup></li> <li>• PhD in Civil Engineering</li> <li>• PhD in Environmental Engineering<sup>^</sup></li> </ul> <p><b>Departmental Teaching and Research Laboratories</b></p> <ul style="list-style-type: none"> <li>• Civil Engineering Laboratory</li> <li>• Construction Materials Laboratory</li> <li>• Geotechnical Centrifuge Facility (GCF)</li> <li>• Geotechnical Engineering Laboratory</li> <li>• Hydraulics Research Laboratory</li> <li>• Hydraulics Teaching Laboratory</li> <li>• Intelligent Transportation Systems Laboratory</li> <li>• Structural Engineering Laboratory</li> </ul>	<p><b>Constructional Management:</b> web-based decision tools and computer simulation techniques; project delivery systems; infrastructure project financing and international financial markets; mathematic and simulation modeling in infrastructure operations and management</p> <p><b>Environmental Engineering:</b> water/wastewater treatment technologies, solid/hazardous waste disposal, air quality modeling</p> <p><b>Geotechnical Engineering:</b> slope stability, retaining structures, excavations, tunnels, bridge abutments, pile foundations, geotechnical earthquake engineering, geotechnical systems and risks</p> <p><b>Hydraulics Engineering:</b> environmental hydraulics and fluid mechanics, urban hydrology and hydraulics, probabilistic analysis of hydro system engineering and wind engineering</p> <p><b>Material Engineering:</b> development of materials with high performance and durability for sustainable development of civil infrastructures</p> <p><b>Structural Engineering:</b> wind engineering, structural optimization, advanced design technologies, sustainable green design for tall buildings</p> <p><b>Transportation Engineering:</b> network modeling, transport pricing and economics, dynamic traffic assignment and control, public transport systems, network reliability studies</p>

\* as at 31 December 2008    ^ Interdisciplinary program



## Faculty Honors

### Prof Moe M S CHEUNG

Elected a Fellow of the Institution of Structural Engineers (IStructE) in 2007 for his contributions to structural engineering and design. Prof CHEUNG also received the James A Vance Award from the Canadian Society for Civil Engineering (CSCE) in 2008. The accolade recognizes a CSCE member's dedicated service and contributions to the society and engineering community.

### Prof Mohamed S GHIDAOU

Received the Arthur Thomas Ippen Award in 2007 for his leading research in hydraulics and environmental fluid mechanics, in particular the fields of hydraulic transients, stability of shallow flows and time dependent flows, and computational hydraulics. The prize is the most prestigious bestowed by the International Association of Hydraulic Engineering & Research (IAHR). Prof GHIDAOU was the second Asia-based researcher to gain the award since it was established in 1977.

### Prof Jun Shang KUANG

Following received TK Hsieh Award in 2006 from Institution of Civil Engineers (ICE) UK with his former PhD student, presented for the best paper on seismic engineering in the journal of Structures and Buildings, awarded HKIE Transaction Prize in 2007 from Hong Kong Institution of Engineers with his former student, presented for the best paper on seismic design in HKIE Transactions. Elected an IStructE Fellow in 2006 for his significant research achievements in structural engineering and design. Prof KUANG is also a Fellow of the UK's Institution of Civil Engineers. His research interests include earthquake engineering and earthquake-resistant design; reinforced concrete; tall building structures; and damage and vulnerability assessment of structures.

### Prof Christopher K Y LEUNG

Gained the Best Applied Research Paper Award for 2007 from the *Journal of Composites for Construction* (ASCE) for the research paper

"Effect of Size on the Failure of Geometrically Similar Concrete Beams Strengthened in Shear with FRP Strips". The paper, written together with Dr Stephen LEE (AEMF) and other co-authors challenged current understanding and practice, paving the way for further research to develop better design approaches for shear strengthened concrete beams.

### Prof Irene Man-Chi LO

Selected by the American Society of Civil Engineers for the 2007 Samuel Arnold Greeley Award together with her former PhD student, Dr Keith C K LAI, and her research partners in Denmark. The prestigious award recognizes Prof LO and her research group for their outstanding paper "Field Monitoring of a Permeable Reactive Barrier for Removal of Chlorinated Organics", published in the *Journal of Environmental Engineering* in 2006. Prof LO employed her expertise in remediation technologies for contaminated soils and groundwater to return polluted groundwater in Denmark to satisfactory levels. She is a leading force in field monitoring and the application of tracer studies to Permeable Reactive Barrier technology.

### Prof Charles W W NG

Elected a Fellow of the Institution of Civil Engineers (FICE), Fellow of the Hong Kong Academy of Engineering Sciences (HKAES) and Fellow of the American Society of Civil Engineers in 2008 for his outstanding contributions to civil and geotechnical engineering. Prof NG received the Overseas Young Scholar Award (National Science Foundation of China (NSFC)) in 2007 for his work on the "Three-dimensional Centrifuge and Numerical Modeling of Tunneling Effects on Dykes" project. The same year, he gained the R M Quigley Honorable Mention, together with former PhD student Liang Tong ZHAN and Prof Del FRELUND, for their joint paper "Field Study of Rainfall Infiltration into a Grassed Unsaturated Expansive Soil Slope". The paper was published in the *Canadian Geotechnical Journal* and provided a pioneer study into the behavior of expansive soil slopes in China.



## Research Highlights

### Constructive Move

A research team led by Profs Kenny Chung Sau KWOK, Chun Man CHAN, Chih-Chen CHANG and Lambros KATAFYGIOTIS has developed an integrated design platform for an innovative performance-based approach to cost-effective design solutions for tall buildings in a typhoon-prone urban environment.

Research advances have been achieved by the development of novel design and structural optimization technologies, including state-of-the-art wind tunnel modeling studies, advanced computer-aided design techniques, sophisticated performance monitoring systems and a unique motion simulator test facility, to facilitate design optimization of tall buildings in terms of safety, serviceability and occupant comfort.

The major benefits of the research will be a new generation of landmark tall buildings and high-rise residential buildings for mass housing that are cost-effective in materials and construction and superior in design quality, space utilization, and performance under strong winds. The research has attracted considerable interest from building professionals locally and internationally.

### South-North Water Transfer Project & Heritage Protection

As one of the China's mega infrastructure projects in the 21<sup>st</sup> century, the South-North Water Transfer Project is designed to transport portable water from the Yangtze River to Beijing. Prof Charles W W NG and his research team were involved in the preliminary field study of the middle route. Their research paper reporting a field trial was named a recipient of the R M Quigley Honorable Mention for 2007 by the National Research Council

Canada (NRC). In collaboration with the Yangtze River Scientific Research Institute, Prof NG also has been actively involved in the detailed design of the water transfer canal using the state-of-the-art Geotechnical Centrifuge Facility at HKUST.

Being an expert in unsaturated soil mechanics, Prof NG has also been invited by the Institute of Geology and Geophysics, Chinese Academy of Sciences and the Dunhuang Academy to participate in a national research project to devise environmentally friendly preservation technology for heritage protection in Mainland China.

### Sludge Disposal

Mainland China faces a great challenge in reducing sludge disposal from sewage treatment. To solve this problem at low cost, the HKUST and Sun Yat-sen University Joint Research Team, led by Prof Guanghao CHEN, has invented a new oxic-settling-anoxic (OSA) process. The method can modify existing sewage treatment works and reduce excess sludge by 30% without increasing operational and maintenance costs. The Education Ministry of China and Guangdong Science and Technology Agency jointly awarded a trial (50-100 m<sup>3</sup>/day) at the Le De Sewage Treatment Works in Guangzhou (60,000 m<sup>3</sup>/day) to the team from 2008-10. The plant is the largest sewage treatment works in Guangdong.

Prof CHEN has also developed low-cost membrane bioreactor technology for wastewater reuse and recycling using a high-flux and non-fouling membrane module.

Department of Civil and Environmental Engineering website:

<http://www.ce.ust.hk>



From left to right:

(Top): Prof Moe M S CHEUNG, Prof Mohamed S GHIDAoui, Prof Jun Shang KUANG, Prof Christopher K Y LEUNG, Prof Irene Man-Chi LO, Prof Charles W W NG

(Below): Prof Kenny Chung Sau KWOK, Prof Chun Man CHAN, Prof Chih-Chen CHANG, Prof Lambros KATAFYGIOTIS, Prof Guanghao CHEN



# Department of Computer Science and Engineering

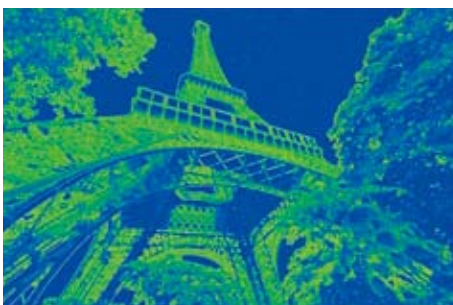
Head: Prof Mounir HAMDJ

The Department was one of the earliest academic departments established at HKUST. When the Department first opened in 1991, the year HKUST commenced, it consisted of seven faculty members. Demand for our courses has since seen the Department expand to a faculty team of more than 40, supported by administrative and system staff members.

We work in exciting times as computer science is now widely recognized as an essential source of tools and techniques for advancements in many spheres. Our high-achieving Department is research oriented and student centered. We engage in creative research and new technologies in Computer Science and Engineering and across disciplines; and we seek to produce highly qualified and well-rounded graduates in computing and information technology, who can lead the way in Hong Kong, China and globally.

At a Glance	
<b>Faculty Members</b>	47 (including 5 visiting faculty)
<b>Undergraduates</b>	566
<b>Postgraduates*</b>	
• Research	176
• Taught	129
<b>Academic Programs</b>	<b>Departmental Teaching and Research Laboratories</b>
<p><b>Undergraduate</b></p> <ul style="list-style-type: none"> <li>• BEng in Computer Science</li> <li>• BEng in Computer Science and Information Engineering</li> <li>• BEng in Computer Engineering (jointly with the Department of Electronic and Computer Engineering)</li> <li>• BSc in Computer Science</li> </ul> <p><b>Postgraduate</b></p> <ul style="list-style-type: none"> <li>• MSc in Information Technology</li> <li>• MPhil in Computer Science and Engineering</li> <li>• PhD in Computer Science and Engineering</li> </ul> <p><b>Major Research Areas</b></p> <ul style="list-style-type: none"> <li>• Artificial Intelligence</li> <li>• Data, Knowledge and Information Management</li> <li>• Networking and Computer Systems</li> <li>• Software Technologies</li> <li>• Theoretical Computer Science</li> <li>• Vision and Graphics</li> </ul>	<p><b>Teaching</b></p> <p>The Department is served by about 600 workstations and PCs, including those in four teaching laboratories: two PC laboratories, one Linux laboratory and a multi-media laboratory. Each teaching laboratory has 41 sets of computers networked together, a LCD projector, and at least one high-speed laser printer. Teaching laboratories are upgraded frequently to keep the equipment current. The multi-media laboratory is equipped with professional grade amplifiers, speakers, synthesizers, Sound Blaster XFi sound cards, and 3D graphics cards.</p> <p><b>Research</b></p> <ul style="list-style-type: none"> <li>• Computer Engineering Laboratory</li> <li>• Database Laboratory</li> <li>• Pervasive Laboratory</li> <li>• Vision and Graphics Laboratory</li> </ul>

\* as at 31 December 2008



## Faculty Honors

### Prof James Tin-Yau KWOK

Received the *IEEE Transactions on Neural Networks* Outstanding 2004 Paper Award, bestowed in 2006, the IEEE Computational Intelligence Society. The paper, co-authored by PhD student Ivor Wai Hung TSANG, focused on "The Pre-Image Problem in Kernel Methods".

### Prof Fangzhen LIN

Honored with a Croucher Senior Research Fellowship in 2006 for his outstanding research on artificial intelligence. Prof LIN is renowned for his advances in the theory and implementation of knowledge representation and reasoning. He has developed a methodology for "Computer-Aided Theorem Discovery" to help analyze and predict computer program behavior, assisting the design of reliable software. He has also made important contributions to Answer Set Programming.

### Prof Qiang YANG

Elected a Fellow of the Institute of Electrical and Electronics Engineers (IEEE) in 2008 in recognition of his understanding and application of intelligent planning, learning and data mining. Prof YANG has published over 200 articles on artificial intelligence and data mining and is an associate editor for several leading journals, including *IEEE Transactions on Knowledge and Data Engineering*.

### Prof Qian ZHANG

Recipient of the Overseas Young Scholar Award (National Natural Science Foundation of China) in 2006 for her research into cognitive radio networks and dynamic spectrum access. Prof ZHANG also won the Best Paper Award at the IEEE Global Telecommunications Conference ASNA Symposium in 2007, together with PhD student Ji LUO. Their paper was entitled "Relative Distance Based Localization for Mobile Sensor Networks".

## Research Highlights

### Mine of Information

The dangerous occupation of mining is set to become safer, thanks to award-winning wireless sensor network research and development by Prof Yunhao LIU and PhD student Mo LI. Their coal mine surveillance project sought to decrease the number of fatal accidents through more effective monitoring and data about mine conditions. The wireless sensor network system that resulted detects and alerts personnel to gas leaks, water seepage and oxygen-enriched areas. It can then rapidly and reliably deliver information when emergencies arise, creating the opportunity for better decision-making about rescue and escape plans.

The researchers' work received the Best Innovation and Research (Open) Gold and Grand awards at the Hong Kong ICT Awards 2007 and drew acclaim at the 7<sup>th</sup> International Symposium on Information Processing in Sensor Networks 2007, a leading global forum. Tests were carried out in an Inner Mongolian coal mine over several years.

### Cost-Effective 3D Images

The creation of a new technology that simplifies the conversion of two-dimensional photographs into three-dimensional images may change the look-and-feel of films and computer games in the future. Computer vision and imaging expert Prof Long QUAN's semi-automatic, image-based computer modeling technique can cut the time to produce 3D models by 90%, reducing what currently takes weeks to a few hours.

The application was presented at prestigious computer graphics conference SIGGRAPH 2007 and post-production companies have shown interest in the research.

Department of Computer Science and Engineering website:

<http://www.cse.ust.hk>

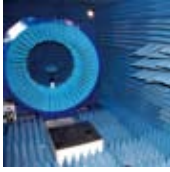


From left to right:

(Top): Prof Mounir HAMDY, Prof James Tin-Yau KWOK,  
Prof Fangzhen LIN

(Below): Prof Qiang YANG, Prof Qian ZHANG,  
Prof Yunhao LIU, Prof Long QUAN





# Department of Electronic and Computer Engineering

Head: Prof Khaled BEN LETAIEF

The Department is committed to excellence in teaching and world-class research. We have recruited a talented and dedicated faculty team with PhDs from globally renowned universities and work experience in hi-tech industries. Faculty members are internationally recognized as inventors, academic leaders, entrepreneurs, editors of prestigious journals, and fellows of peer societies, such as the Institute of Electrical and Electronics Engineers (IEEE). In 2008, the ECE Department had 13 IEEE Fellows among its faculty.

We strive to prepare our students to become well-rounded and technically competent engineers who will continue learning in the ever-changing world of high technology. Our laboratories and classrooms are equipped with state-of-the-art facilities for cutting-edge research and multimedia teaching, with students introduced to fundamental and frontier knowledge in electrical engineering. Graduates can expect a wide range of career opportunities including engineering and hi-tech industries, business and management, and higher degree studies, locally or overseas.

At a Glance	
<b>Faculty Members</b>	41 (including 4 visiting faculty)
<b>Undergraduates</b>	624
<b>Postgraduates*</b>	
• Research	207
• Taught	181
<b>Academic Programs</b>	<b>Departmental Teaching and Research Laboratories</b>
<p><b>Undergraduate</b></p> <ul style="list-style-type: none"> <li>• BEng in Electronic Engineering</li> <li>• BEng in Electronic Engineering (Information and Communication Engineering)</li> </ul> <p><b>Postgraduate</b></p> <ul style="list-style-type: none"> <li>• MSc in IC Design Engineering</li> <li>• MSc in Telecommunications</li> <li>• MSc in Electronic Engineering</li> <li>• MPhil in Electronic and Computer Engineering</li> <li>• PhD in Electronic and Computer Engineering</li> </ul> <p><b>Major Research Areas</b></p> <ul style="list-style-type: none"> <li>• Biomedical engineering</li> <li>• Computer engineering</li> <li>• Integrated circuit and system design</li> <li>• Micro-Electro-Mechanical Systems (MEMS)</li> <li>• Microelectronics</li> <li>• Multimedia signal processing</li> <li>• Photonics</li> <li>• Speech and language processing</li> <li>• Systems and automation</li> <li>• Wireless communications and networking</li> </ul>	<p><b>Research Centers and Labs</b></p> <ul style="list-style-type: none"> <li>• Advanced Electronic Packaging and Assembly Cooperative Research Center</li> <li>• ATM/IP Telephony Solution Cooperative Research Center</li> <li>• Automation Technology Center (ATC)</li> <li>• Centre for Display Research (CDR)</li> <li>• Center for Medical Diagnostic Technology (CMDT)</li> <li>• Center for Networking</li> <li>• Center for Wireless Information Technology (CenWIT)</li> <li>• Consumer Media Center (CMC)</li> <li>• Cooperative Research Center for MPEG-4 Based Information Technology</li> <li>• Hongkong Telecom Institute of Information Technology (HKTIIT)</li> <li>• Human Language Technology Center (HLTC)</li> <li>• Institute of Integrated Micro Systems (I2MS)</li> <li>• Internet Switching Technology Center</li> <li>• Materials Characterisation and Preparation Facility (MCPF)</li> <li>• Multimedia Technology Research Center</li> <li>• Nanoelectronics Fabrication Facility (NFF)</li> <li>• Photonics Technology Center</li> <li>• Semiconductor Product Analysis and Design Enhancement (SPADE) Center</li> </ul> <p><b>Teaching Labs</b></p> <ul style="list-style-type: none"> <li>• Advanced VLSI Design and Test Laboratory</li> <li>• Analog Research Laboratory</li> <li>• Automatic-Control Laboratory</li> <li>• Biomedical Instrumentation Laboratory</li> <li>• Broadband-Network Laboratory</li> <li>• Chemical-Mechanical Polishing Laboratory</li> <li>• Computer-Networks and System-Integration Laboratory</li> <li>• Device-Characterization Laboratory</li> <li>• Digital-Electronics and Microprocessor Laboratory</li> <li>• Electro-Optics Laboratory</li> <li>• Fine-Line Lithographic Laboratory</li> <li>• Integrated Power Electronics Laboratory</li> <li>• Machine-Intelligence Laboratory</li> <li>• Mobile Computing System Laboratory</li> <li>• Nanoelectronic Circuits and Gigascale Systems Laboratory</li> <li>• Optical Device-Characterization Laboratory</li> <li>• PC CAD Laboratory</li> <li>• Photonic Device Laboratory</li> <li>• Photonic Materials Laboratory</li> <li>• Robot Manipulation Laboratory</li> <li>• Robotics Teaching Laboratory</li> <li>• Sensor and Instrumentation Laboratory</li> <li>• Signal-Processing and Communication Laboratory</li> <li>• Smart Sensory Integrated Systems Laboratory</li> <li>• Wireless-Communication Laboratory</li> </ul>

\* as at 31 December 2008



## Faculty Honors

### Prof Khaled BEN LETAIEF

Received the prestigious 2007 IEEE Communications Society Publications Exemplary Award. The annual award is presented to individuals who have made outstanding contributions and given sustained support and service to the society's publications. Prof BEN LETAIEF is a world-renowned expert on wireless communications and was from 2002 to 2006 the Editor-in-Chief of the prestigious IEEE Transactions on Wireless Communications, the world's leading journal in the field. He is a Fellow of IEEE and has been invited to give keynote talks all over the world. He has also served as the Technical Program Chair of the 2008 IEEE International Conference on Communications, the flagship IEEE conference in the communications field. The conference is held annually in different parts of the world and brings together the world's leading scientists from academia and industry.

### Prof Xiren CAO

Named Fellow of the International Federation of Automatic Control (IFAC) in 2008, Prof CAO was the first Hong Kong scholar to achieve this status since the Federation's launch in 1957. He was cited for his contributions to the analysis of discrete event systems, stochastic learning and optimization theory, and their applications.

### Prof Philip C H CHAN

Elected Fellow of the IEEE in 2006 for his contributions to the development of low-cost flipchip technology. Prof CHAN's research interests include microelectronics devices, circuits, integrated sensors and electronic packaging. He is also a Fellow of the Hong Kong Institution of Engineers.

### Prof Vladimir G CHIGRINOV

Named Fellow of the Society for Information Display (SID) in 2008, Prof CHIGRINOV received the honor for his outstanding achievements in display technology over the years. Only six people in any given year become Fellows. Prof CHIGRINOV has been the Vice-President of the Russian Chapter of SID since 1997 and a Senior Member of SID since 2004.

### Prof Hoi Sing KWOK

Co-author, with O YAROSHCHUK and V CHIGRINOV, of the paper "Factors in liquid crystal photoalignment on polymer films: photoorientation versus self-assembly". The paper appeared in *Liquid Crystals* and was ranked one of the 10 most accessed articles of this top journal in 2006.

### Prof Kei May LAU

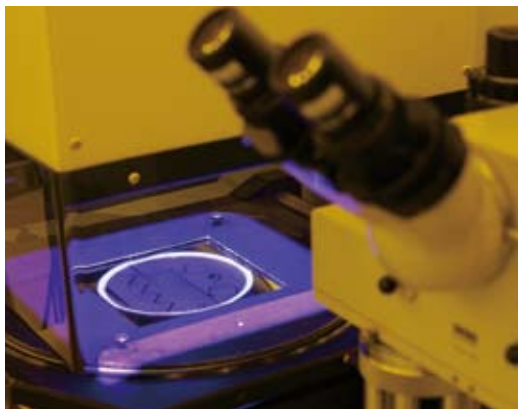
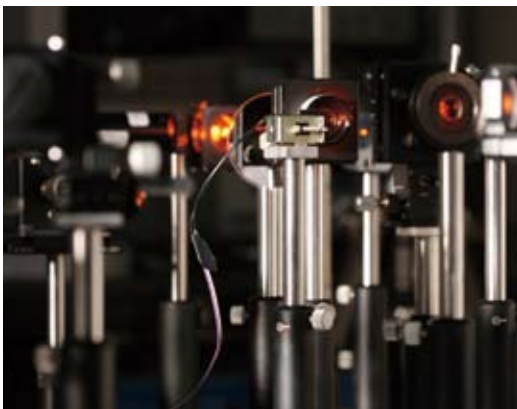
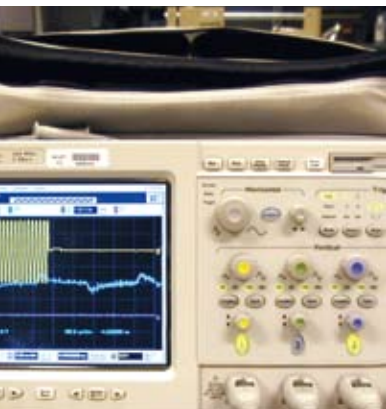
Awarded the Senior Research Fellowship in 2008 by the Croucher Foundation, a private endowment that promotes excellence in natural science, technology and medicine in Hong Kong. Prof LAU's research interests focus on compound semiconductor materials and devices with highfrequency, high speed and photonic device applications, and light-emitting diode lighting systems.



From left to right:

Prof Khaled BEN LETAIEF, Prof Xiren CAO, Prof Philip C H CHAN, Prof Vladimir G CHIGRINOV, Prof Hoi Sing KWOK, Prof Kei May LAU





#### **Prof Zexiang LI**

Named IEEE Fellow in 2008 for his contributions to robotic manipulation, nonholonomic motion planning and workpiece localization. Prof LI is also the Director of HKUST's Automation Technology Center (ATC).

#### **Prof Ross D MURCH**

Elected IEEE Fellow in 2008 for his pioneering work on multiple antenna systems which revolutionized modern wireless communication systems. Prof MURCH is a leading global contributor in this field. He is also an Area Editor for IEEE Transactions on Wireless Communications and has 20 patents allowed or in progress.

#### **Prof Li QIU**

Elected IEEE Fellow in 2006 for his innovative work on robust and optimal control of multirate and periodic systems. Prof QIU's research interests include control, computing, signals, systems theory and mathematics in information sciences. He has been an IEEE Control Systems Society Distinguished Lecturer since 2007.

### **Research Highlights**

#### **Portable Media Center**

Prof Oscar C L AU, together with Hong Kong company AnTech MPS (Global) Ltd, achieved a breakthrough enabling mobile phone handsets to become mobile media centers, an innovation that has been successfully commercialized on the world market. Pan-V technology allows mobile phone users to substantially expand the video/audio content available on their phones. Owners of 3G and 3.5G

mobile phones can watch DVDs, tune in to television programs, and watch surveillance videos, among other options. Pan-V complies with international data computing and communications standards and can be used around the globe.

#### **Wireless Standards**

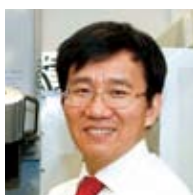
Algorithms developed by the HKUST Wireless Research Team and Huawei Technologies have been accepted for inclusion in international standards for the 802.22 Wireless Regional Area Network (WRAN) system. The 802.22 WRAN system targets long-range wireless access and is designed to operate in the VHF/UHF television frequency range, enabling dynamic sharing with spectrum license users. This opens up the possibility of cost-effective wireless internet provision to rural areas, among other new opportunities.

#### **Fluorine Plasma Treatment Technique**

Prof Kevin J CHEN's research group developed a novel fluorine plasma treatment technique that provides robust threshold voltage control in wide-bandgap gallium nitride transistors. This technology enables the world's first self-aligned enhancement-mode AlGaN/GaN HEMT that has a wide range of applications in compact high-power low-noise circuits, high temperature digital ICs and high-efficiency power converters. Several patents have been filed in the US, Japan and Mainland China.

Department of Electronic and Computer Engineering website:

<http://www.ece.ust.hk>



From left to right:

Prof Zexiang LI, Prof Ross D MURCH, Prof Li QIU, Prof Oscar C L AU, Prof Kevin J CHEN



# Department of Industrial Engineering and Logistics Management

Acting Head: Prof Fugee TSUNG

The Department seeks excellence in research with lasting impact on the field. In addition to global impact, much of our research work is focused on deployment in local and regional industries to enhance their competitiveness. We also provide a stimulating environment in which to train future leaders in the Industrial Engineering and Logistics Management arena. We equip students with the knowledge, skills and tools to make contributions to the economy through translating business vision into reality and the continuous improvement of organizations.

Students are trained in the mathematical, physical, and social sciences, along with the principles and methods of engineering analysis and design, in order to solve problems arising in a variety of systems. Industrial engineers and logistics managers are in a unique position to solve complex system problems in which people are important and integral elements. Careers for our graduates not only focus on manufacturing industries but service industries seeking to improve their effectiveness and efficiency.



At a Glance	
<b>Faculty Members</b>	17
<b>Undergraduates</b>	254
<b>Postgraduates*</b>	
• Research	46
• Taught	120
<b>Academic Programs</b>	<b>Departmental Teaching and Research Laboratories</b>
<p><b>Undergraduate</b></p> <ul style="list-style-type: none"> <li>• BEng in Industrial Engineering and Engineering Management</li> <li>• BEng in Industrial Engineering and Logistics Management (Logistics Management and Engineering)</li> </ul> <p><b>Postgraduate</b></p> <ul style="list-style-type: none"> <li>• MSc in Engineering Enterprise Management</li> <li>• MPhil in Industrial Engineering and Logistics Management</li> <li>• PhD in Industrial Engineering and Logistics Management</li> </ul> <p><b>Major Research Areas</b></p> <p><b>Design and Manufacturing:</b> mass customization; computer-aided design and manufacturing; precision manufacturing; ergonomics/human factors engineering; statistical quality control and Six Sigma</p> <p><b>Logistics and Supply Chain Management:</b> logistics management; supply chain management; transportation management; information technology and e-business</p>	<ul style="list-style-type: none"> <li>• Advanced Audio and Visual Laboratory</li> <li>• CAD/CAM Lab</li> <li>• Computational Ergonomics and Simulation Laboratory (formerly Virtual Reality Laboratory)</li> <li>• Human Performance Laboratory</li> <li>• Industrial Automation Laboratory</li> <li>• Information Systems Laboratory</li> <li>• Manufacturing Processes Laboratory</li> <li>• Manufacturing Systems Laboratory</li> <li>• Precision Manufacturing Laboratory</li> <li>• Quality Laboratory</li> <li>• Simulation and Optimization Laboratory</li> <li>• Transportation Logistics Laboratory</li> </ul>

\* as at 31 December 2008



## Faculty Honors

### Prof Chung-Yee LEE

Appointed Regional Vice-President Australasia by the Production and Operations Management Society (POMS) for 2007-09. The organization is the most authoritative source of developments in the production and operations management field. Prof LEE was elected Regional Vice-President (Asia) of the Institute of Industrial Engineers (IIE) from May 2006-April 2008. IIE is the world's largest professional society dedicated solely to the support of the industrial engineering profession and individuals involved with improving quality and productivity.

### Prof Neville K S LEE

Awarded China's prestigious National Natural Science Award First Class in 2007. Prof LEE was honored for his contribution to modeling, fabrication and characterizing of a poly crystal silicon thermal flexure actuator.

### Prof Jeff L HONG

Awarded second prize in the 2007 INFORMS Junior Faculty Interest Group Paper Competition. The title of the paper is "Estimating Quantile Sensitivities".

### Prof Richard H Y SO

Invited to join Technical Committee TC1-67 at the International Commission on Illumination (Commission Internationale de L'eclairage [CIE]). CIE is a scientific non-profit organization responsible for developing standards in the field of light and lighting. Members of the Technical Committee are invited to join by virtue of their academic contributions to the field of lighting and display. Prof SO is also a member of the drafting committee of the International Standard Organization (ISO) International Workshop Agreement 3 on image safety.

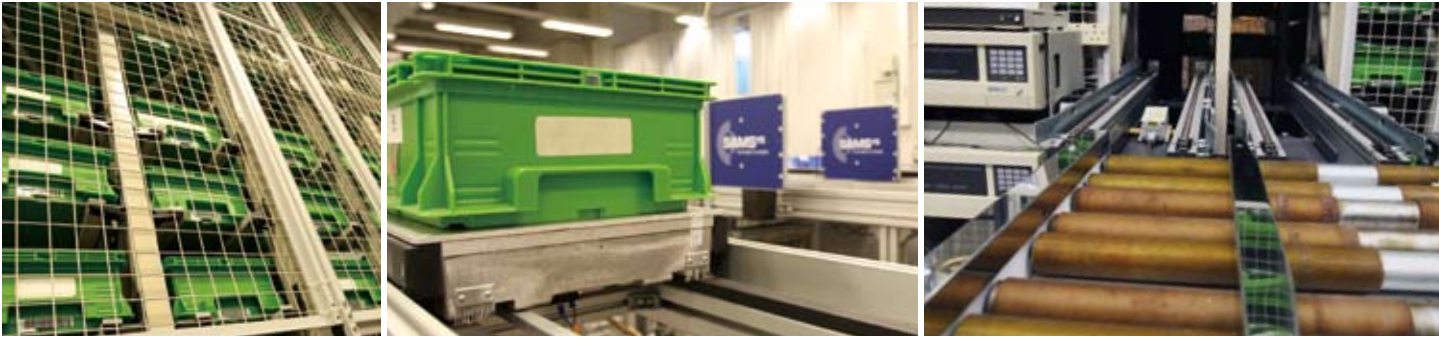
### Prof Mitchell M TSENG

Elected a Fellow of the American Society of Mechanical Engineers (ASME) in 2007 for his achievements and exceptional contributions to the engineering profession. Prof TSENG's research interests include novel production systems and processes such as diamond machining for polygons used in laser printing; and custom products and low-volume high-variety manufacturing systems such as mass customization.

### Prof Fugee TSUNG

Elected Regional Vice-President (Asia) of the IIE and made a member of the organization's 2008 National Leadership Council. In 2006, Prof TSUNG was made a member of the International Statistical Institute (ISI), one of the world's oldest scientific associations. Members are elected for their distinguished contributions to the development or application of statistical methods.





## Research Highlights

### Reducing Border Crossing Time

A study by Industrial Engineering and Logistics Management researchers pointed the way to reduce vehicle crossing time and ease congestion at the land borders between Hong Kong and Mainland China and reduce vehicle crossing time by suggesting the adoption of the Electronic Product Code (EPC), a real-time technology for identifying goods in the supply chain.

EPC, a unique number that identifies a specific item in the supply chain, works together with a Radio Frequency Identification (RFID) tag, which can remotely store and retrieve data and be attached to products for shipping enabling real-time automatic identification of goods. The system could lower manpower costs, reduce environmental impact, and boost Hong Kong's position as a logistics hub. The study, completed in 2006, was funded by the Hong Kong government and private sponsors.

### Advances in Quality Technology

Keeping up quality throughout the many different processes involved in manufacturing and service industries is a continual challenge for businesses. To take advantage of advances in technology that enable data on quality-related metrics to be acquired at multiple stages of the operation, Prof Fugee TSUNG has developed a new method that seeks to assist in overcoming that challenge.

In "Statistical Monitoring of Multi-Stage Processes Based on Engineering Models", written together with Liming XIANG of Nanyang Technological University, Singapore, the researchers use engineering models based on physical and mechanical laws to represent how quality variations are transmitted between stages and to develop a new way to estimate the parameters required for multi-stage statistical process control (SPC) analysis. As an example, they apply the innovative method to data from the automobile hood manufacturing and workpiece assembly. The innovative approach appeared in *IIE Transactions* in October 2008.

Department of Industrial Engineering and Logistics Management  
website:

<http://www.ielm.ust.hk>



From left to right:

Prof Fugee TSUNG, Prof Chung-Yee LEE, Prof Neville K S LEE, Prof Jeff L HONG, Prof Richard H Y SO, Prof Mitchell M TSENG



# Department of Mechanical Engineering

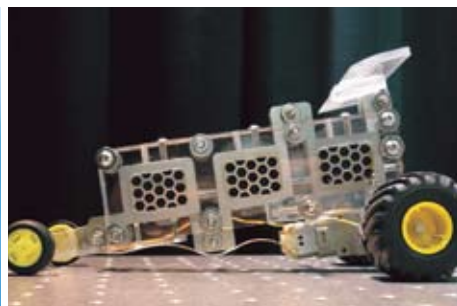
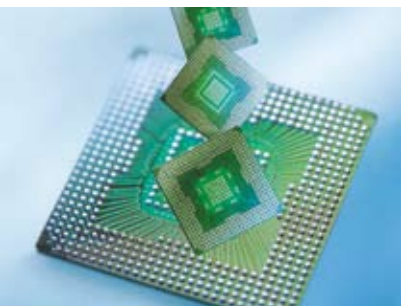
Head: Prof Matthew M F YUEN

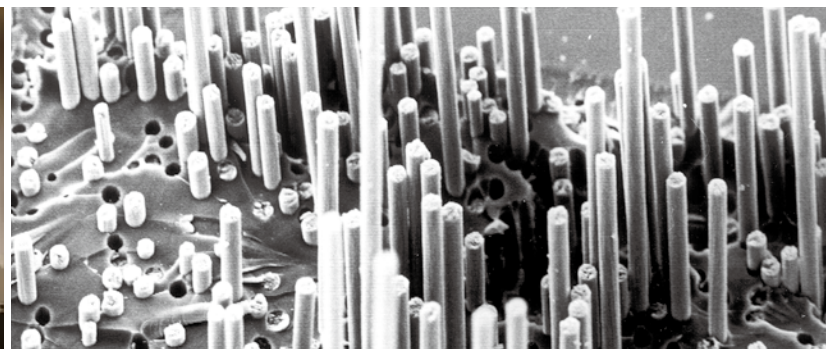
The Department has a strong research track record, with individual faculty members working in established research groups on cutting-edge research in their area of specialization. Our programs train students to deal with the technological issues of mechanical and thermal systems to prepare them to become productive and contributing members of their profession and future leaders.

Graduates take up employment in a wide range of industrial and government sectors in Hong Kong. These include electrical and mechanical services, utilities, building development, manufacturing, marketing, sales and finance. A special feature of our undergraduate curriculum is the Co-Op program, which provides students with the opportunity of working in industry during their final year while maintaining their original graduation schedule.

At a Glance	
<b>Faculty Members</b>	21
<b>Undergraduates</b>	303
<b>Postgraduates*</b>	
• Research	89
• Taught	115
<b>Academic Programs</b> <b>Undergraduate</b> <ul style="list-style-type: none"> <li>• BEng in Mechanical Engineering</li> <li>• BEng in Mechanical Engineering (Building Services)</li> </ul> <b>Postgraduate</b> <ul style="list-style-type: none"> <li>• MSc in Intelligent Building Technology and Management</li> <li>• MSc in Mechanical Engineering</li> <li>• MPhil in Mechanical Engineering</li> <li>• PhD in Mechanical Engineering</li> </ul> <b>Major Research Areas</b> <b>Energy:</b> green energy resources and power generation; energy storage <b>Manufacturing:</b> precision engineering focused on micro-sensor technology, integrated high-precision system <b>Materials:</b> nanomaterials; electronic packaging & assembly; biomaterials; smart materials	<b>Departmental Teaching and Research Laboratories</b> <ul style="list-style-type: none"> <li>• Automation Laboratory</li> <li>• CAD Research Laboratory</li> <li>• Combustion and Fire Research Laboratory</li> <li>• Control and Robotics Laboratory</li> <li>• Departmental Terminal Room</li> <li>• Energy/Environmental Technology Laboratory</li> <li>• Manufacturing Laboratory</li> <li>• Mechanics and Materials Laboratory</li> <li>• Mechanical Fabrication Shop</li> <li>• Micromachine Laboratory</li> <li>• Sample Preparation Laboratory</li> <li>• Solid/Structural Dynamic Laboratory</li> <li>• Thermal Systems Laboratory</li> <li>• Undergraduate Computer Laboratory</li> <li>• Undergraduate Teaching Laboratory</li> </ul>

\* as at 31 December 2008





## Faculty Honors

### Prof Christopher Yu Hang CHAO

Made a Fellow of the Institution of Mechanical Engineers (UK) in 2006 in recognition of his outstanding academic and professional achievement in the field. Prof CHAO's research interests include energy and the environment, and expiratory aerosol transport in indoor environments and infectious disease transmission mechanisms.

### Prof Jang Kyo KIM

Elected President of the Asian and Australasian Association for Composite Materials (AACM) in 2008 for a two-year term. Prof KIM previously served as the organization's Executive Secretary from 1997-2004 and Vice-President from 2004-06.

### Prof Ricky Shi-Wei LEE

Recipient of three leading international awards in 2008. Prof LEE was made a Fellow of the Institute of Electrical and Electronics Engineers (IEEE) for his contributions to solder joint reliability and the development of three-dimensional packaging technologies. He received the IEEE CPMT Electronics Manufacturing Technology Award for his significant research in various areas of packaging, and his worldwide dissemination of that research through teaching, authored books, journals, articles, technical conference presentations and short courses. Prof LEE also gained the American Society of Mechanical Engineers (ASME) EPPD Mechanics Award for his outstanding contributions in the area of engineering mechanics applications to the field of electronic and photonic packaging.

### Prof Yang LENG

Made a Fellow of Biomaterials Science and Engineering in 2007 by the International Union of Societies for Biomaterials Science and Engineering (IUSBSE). The fellowship is rewarded every four years in

the World Biomaterials Congress. This honorary status is awarded to members to recognize high achievement and excellent professional standing in the field.

### Prof Tongyi ZHANG

Received China's 2007 State Natural Science Award, Second Class. The State Natural Science Award (SNSA) is China's highest honor for achievements in natural science. Prof ZHANG won the prize for his research of the fracture of "Piezoelectric Materials," which are smart materials that can convert electric energy into mechanical energy.

### Prof Tianshou ZHAO

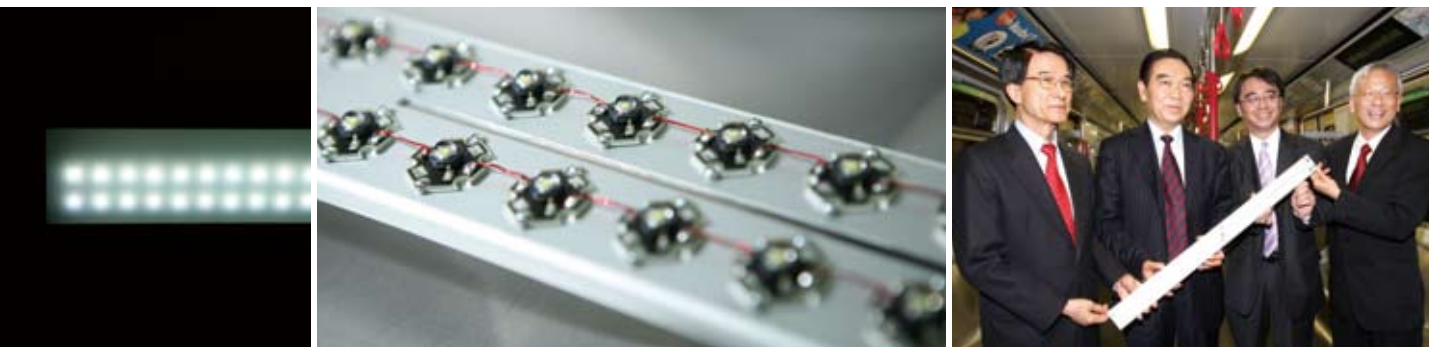
Gained an Overseas Young Scholar Award from the National Natural Science Foundation of China in 2006 for research on multi-scale mass transport in fuel cells. Prof ZHAO was made a Fellow of the American Society of Mechanical Engineers (ASME) in 2007 and awarded a Croucher Senior Research Fellowships in 2008 for his work on clean and high-efficiency energy technologies, focusing on fuel cells.

## Research Highlights

### Lighting the Way

Researchers in the Department of Mechanical Engineering, led by Prof Ricky Shi-Wei LEE, have been working on packaging and assembly of LED arrays for general solid state lighting. Their prototype modules were adopted by Hong Kong's MTR Corporation, which operates the city's underground transportation system, and installed in one carriage in 2006. Compared with the original fluorescent light tubes, the LED modules provided energy savings of up to 20%-30%. MTR has decided to upscale the previous pilot-run of LED solid state lighting. Three full trains of MTR are being equipped with the LED array modules developed by Prof Ricky Shi-Wei LEE and his industrial partner. These trains will be in public transportation services in early 2009.





### Smart Materials

One of the qualities that distinguish living systems from inanimate matter is the ability to adapt to changes in the environment. Smart materials have the ability to perform both sensing and actuating functions and are, therefore, capable of imitating this rudimentary aspect of life. The research of Prof Tongyi ZHANG's and Prof Qingping SUN's groups has been focusing on smart materials including ferroelectric materials and shape memory materials. Achievements include the establishment of the foundation of fracture mechanics for piezoelectric materials; the development of failure criteria for ferroelectric materials under combined mechanical and electrical loading; and the methodology of multi-scale and multi-field modeling of time- and length-dependent phase transition pattern evolution and hysteresis behaviors of shape memory materials.

### Powering Forward

A research team led by Prof Tianshou ZHAO, Associate Director of the Center for Sustainable Energy Technology, has taken up one of the great challenges of the 21<sup>st</sup> century: the development of environmentally friendly energy-conversion technologies that avoid

the use fossil fuels. Work focuses on direct alcohol fuel cells, which can convert the chemical energy of liquid methanol or ethanol directly into electricity. Such fuel cells potentially offer cost-effective, low-emission energy conversion and a way to replace conventional batteries in portable electronic devices. They may also be able to take over from internal combustion engines in cars.

Breakthroughs include a passively operated prototype direct methanol fuel cell that has achieved the highest performance (about 35 mW/cm<sup>2</sup>) reported in open literature; and the discovery that a fuel cell using ethanol, a more environmentally friendly fuel, can yield a higher power output than methanol, which is conventionally regarded as the best choice for alcohol fuel cells. Prof ZHAO has published more than 50 papers on fuel cell research and is internationally renowned for his achievements.

Department of Mechanical Engineering website:

<http://www.me.ust.hk>



From left to right:

(Top): Prof Matthew M F YUEN, Prof Christopher Yu Hang CHAO, Prof Jang Kyo KIM

(Below): Prof Ricky Shi-Wei LEE, Prof Yang LENG, Prof Tongyi ZHANG, Prof Tianshou ZHAO, Prof Qingping SUN

# Innovators of the Future

In 2006-08, young and talented students in School of Engineering have demonstrated the enterprising, forward-thinking nature of the education they receive at the School through their success in local and international awards and contests, and other forms of external recognition

## Prize-winning Creativity

Students from the Computer Engineering Program (CEPG) were on prize-winning form at the 2006 Intel Cup Undergraduate Electronic Design Contest - Embedded System Design Invitational Contest. The biennial competition, jointly organized by China's Ministry of Education, Ministry of Information Industry and Intel China, gives undergraduate teams from universities around the region the opportunity to design real projects based on assigned embedded hardware platforms.

One of the two CEPG teams participating gained a first prize for its Vision Game Platform, which allows players to use natural body movements and hand gestures to participate in games. The other received a second prize for its Speech-controlled Room Service Assistant. The latter enables users to control electrical appliances via voice commands and a touch screen.

## Strong Showing at ICT Awards

Computer Science and Engineering students have received recognition for their ingenuity at the Hong Kong Information and Communication Technology (ICT) Awards, launched in 2006.

In 2006, a group of final-year students won an eYouth Certificate of Merit for their environmentally friendly, intelligent "Green Bus" system. Postgraduate Jinhao ZHU received a similar eYouth award for "Soul Envoy", which features an interactive and powerful physics-based 3D game engine. ZHU's project was also presented at ITU Telecom World 2006.

In 2007, Computer Science and Engineering doctoral student Mo LI together with Prof Yunhao LIU received the Best Innovation

and Research (Open) Gold and Grand awards for their coal mine surveillance safety system utilizing wireless sensor networks (see also P32). In the Best Innovation and Research (College and Undergraduate) category, MPhil student Wing Yi CHAN, Computer Science and Engineering, received the Silver Award and a Certificate of Merit for her "Visual Analysis of the Air Pollution Problem in Hong Kong".

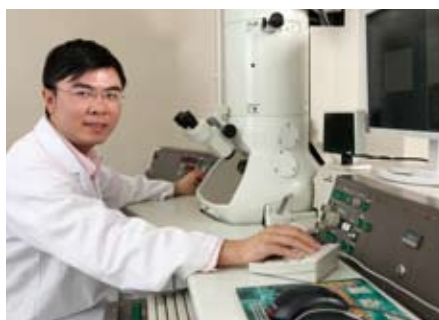
In addition, the Motivision team of graduates from the Computer Engineering Program gained the Best Digital Entertainment (Student) Award and a Certificate of Merit for their "Virtual Air Hockey", this turns traditional air hockey into a multimedia arcade game providing next-generation, real-motion entertainment.

## Programming Success

A three-member Computer Engineering Program and Computer Science and Engineering undergraduate team outshone more than 6,700 teams from 1,800 universities globally to reach the 2008 world finals of the prestigious ACM International Collegiate Programming Contest. The competition is organized annually by the Association for Computing Machinery in the US. It provides a platform for university students to develop their analytical and problem solving skills and is the largest and highest level event of its kind.

## IELM-Stanford Joint Solutions Gain Global Audience

Graduate and undergraduate students from the Department of Industrial Engineering and Logistics Management (IELM) and Stanford University saw their joint case studies for renowned international industries published in a globally distributed book.





*Transformation Through Global Value Chains: Taking Advantage of Business Synergies in the United States and China* features a number of business solutions provided by IELM students and their Stanford peers as part of the Global Manufacturing Program.

The book was co-authored by Prof Behnam N TABRIZI from Stanford and Prof Mitchell M TSENG, IELM Chair Professor. It was published by Stanford University Press in 2007.

### Fiery Performance in Robocon Contest

Robocon Hong Kong 2007 and 2008 saw great performances by interdepartmental School of Engineering teams. The Fiery Dragon team, participating both years, took home the Best Engineering Award and second runner-up prize in 2007 followed by the overall championship and Hong Kong Science and Technology Parks Best Team Spirit Award in 2008. The Hermes team became the 2008 second runner-up.

The annual competition requires university student teams to design their own robots. Each team's machine must then complete a series of tasks in a race with robots created by other student teams. The contest provides hands-on experience of engineering and information technology applications and fosters the exchange of ideas among students of different disciplines. Students from the Department of Computer Science and Engineering, Department of Electronic and Computer Engineering, Computer Engineering Program and Department of Mechanical Engineering took part.

### Driving Forward Hi-tech Logistics

In 2007, a group of students on the Technology & Management Dual Degree Program (T&M) drove forward their business know-

how and competitive edge with a winning proposal on how to use Radio Frequency Identification (RFID) and other technology tools to develop new ventures in the logistics industry.

The victorious team, competing against fellow T&M students, came up with the creative idea of setting up a company to provide a SMART Platform to boost quality control and cost-effectiveness. The platform would be equipped with a hi-tech Vehicle Monitoring System to check the location of trucks, monitor the condition of cargo, and provide SMS reports on the latest transportation situation. Senior executives from project sponsors Orient Overseas Container Line (OOCL) Limited and Sun Microsystems of California Limited praised the team members for their ability to utilize both theories and technologies.

In 2008, a team of four T&M students won a HK\$10,000 cash prize each for their RFID business proposal for the hotel industry in the first Schmidt-HKUST Apprentice Program. The activity, jointly organized by the T & M and Schmidt & Co., (HK) Limited, explored RFID applications in service industries beyond mainstream logistics in Hong Kong. Two students also gained internship offers.

### Nanotech Camp Triumph

Nano Science and Technology Program doctoral student Liyu LIU received a Tokyo Tech Young Researcher Award at the first Asia Nanotech Camp held in Japan in 2008. More than 30 young scientists from Asia Pacific were nominated to join the intensive training camp, which furthered knowledge about frontier discoveries in nanotechnology and built links across the region. For his outstanding research record and successful performance during the 18-day camp, LIU won a six-month academic exchange in Japan.



# Building Connectivity

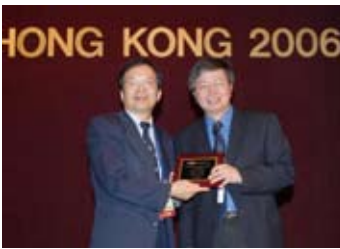
Throughout 2006-08, the School of Engineering was actively involved in many leading academic events in Hong Kong and the mainland. These focused on advances and cutting-edge ideas and discussions in various subjects within the engineering field and drew leading local and international participants





# Events

Throughout 2006-08, the School of Engineering has organized many leading international conferences in Hong Kong and the mainland. The following are just some of the major events which members of the School helped to succeed



## **INFORMS International Conference Hong Kong**

**June 2006**

Hosted by HKUST's Logistics and Supply Chain Management Institute (LSCMI), with Prof Chung-Yee LEE, Industrial Engineering and Logistics Management and Director of the LSCMI, as general chair. The large-scale event was a new departure for Hong Kong, covering all aspects of operations research and management science. It was organized by the Institute for Operations Research and the Management Sciences in conjunction with the Hong Kong Operational Research Society and the Operations Research Society of China.



## **6th International Conference on Physical Modeling in Geotechnics**

**August 2006**

The Geotechnical Centrifuge Facility (GCF) and Department of Civil Engineering\* won the bid to host the conference at HKUST despite strong competition from the UK and US. The event, held once every four years in different international cities, was chaired by Prof Charles W W NG, Director of the GCF. The conference attracted over 330 delegates from around the world and was the largest of its kind so far. A total of 238 papers from 30 countries were published in two conference proceedings.



## **5th Asian-Australasian Conference on Composite Materials (ACCM-5)**

**November 2006**

Organized by the Department of Mechanical Engineering and chaired by Prof Jang Kyo KIM. ACCM-5 was one of the largest composite events held in the region in terms of papers presented and participants. More than 350 presentations were given, with over 320 people attending from 22 countries. The conference addressed new scientific findings in many emerging composite materials, especially nanocomposites, smart composites and composites for medicine.



## **8th International Conference on Electronic Materials and Packaging (EMAP2006)**

**December 2006**

The meeting was co-organized by HKUST and the IEEE Components, Packaging and Manufacturing Technology (CPMT) Society. It focused on the latest developments in materials design and simulations, fabrication, reliability and thermal management of microsystems/MEMS packages. Prof Ricky Shi-Wei LEE, Mechanical Engineering, served as general chair.

\* The department name was changed to Department of Civil and Environmental Engineering in June 2008.





## IEEE Wireless Communications and Networking Conference

March 2007

The first time this major event had been held in Hong Kong. Academics from the Department of Electronic and Computer Engineering were among the key organizers, including general chair Prof Khaled BEN LETAIEF and technical program chair Prof Ross D MURCH. The theme was "Wireless Gateway". There were over 1,700 paper submissions and more than 950 people in attendance.



## 10th Computer Science Deans Forum

November 2007

Two-day forum for Deans and Department Heads of Computer Science colleges/departments in PhD-awarding universities in China. The meeting, hosted by the Department of Computer Science and Engineering, focused on "Internationalization of Graduate Studies". The forum provided an opportunity for the leaders of computer science disciplines to share ideas about professional developments, scientific infrastructure at universities, and recent trends in research and education. It was the first time the event had been hosted in Hong Kong.



## 1st International Symposium on Visually Induced Motion Sickness, Fatigue, and Photosensitive Epileptic Seizures (VIMS2007)

December 2007

Organized by the Department of Industrial Engineering and Logistics Management and chaired by Prof Richard H Y SO. VIMS2007 was the first of a bi-annual conference series that focuses on the standardization for image safety. It was the first conference that brings the top researchers on visual stress, photosensitive epileptic seizures, and motion sickness under one roof.



## 8th International Conference on Fundamentals of Fracture (ICFF VIII)

January 2008

The meeting, held at HKUST and in Guangzhou, marked the global conference's debut gathering in China. The conference included contributions from continuum mechanics, bioscience, ceramics, and physics, among others. Around 150 academics from 18 countries and regions attended. Prof Tongyi ZHANG, Mechanical Engineering, co-chaired the gathering.



## 4th International Meeting on Synthetic Biology (SB4.0)

October 2008

The event marked the meeting's debut gathering in Asia. More than 500 attendees from over 15 countries gathered at HKUST for discussions on research, education, investment and the industrial application of synthetic biology in areas such as energy, green manufacturing, agriculture, drug production and medicine. The conference brought together researchers working on new tools that make biology easy to engineer and leaders seeking to locate such research in its social context.

# Campus News

Initiatives and activities to bring the world of engineering into the community, especially to school students, are all part of the School's goal to raise awareness of the exciting and essential roles that engineers play in the world today



## Constructive Move

A RMB 5 million donation from Dr LAU Fu Wing, President of Chiu Hing Construction & Transportation Company Ltd in 2007 has provided opportunities to build up civil engineering connections between HKUST and Tsinghua University. The Dr FW Lau Engineering Education Exchange Fund assists faculty and students from the two universities to engage in civil engineering academic and exchange activities.



## Equipped for Success

Helping the Department of Chemical and Biomolecular Engineering plan for the long-term, Chiaphua Industries Limited gave a HK\$2 million pledge in 2007 to establish a research equipment fund for the department. The firm is a leading manufacturer of an extensive range of industrial and consumer products, including computers, clocks, sea-freight containers, lighters, toys, silver-plated hollow ware, security and telecommunications equipment, electrical appliances, motors and power tools. Its managing director, Mr Herbert S. CHENG Jr, was an HKUST Court Member (2003-06) and is currently an HKUST Council Member since 2006. The donation shows how industry can aid leading research, enabling the department to look ahead and purchase the best possible equipment for its overall development.



## Student Ambassadors

Launched in 2006, the School of Engineering Student Ambassador Program has proved a valuable way to widen interest in engineering among young people. Under the program, student ambassadors are nominated from different departments in the School. They then assist with visits to secondary schools and recruitment by sharing their experiences and understanding of engineering and university life with others. A training workshop prepares the ambassadors for their role. Student ambassadors have also found the program useful in building up their communication skills and confidence.



## Youth IT Summer Camps

Primary and secondary school students from ages 9 to 15 years were able to gain early insight into the world of information technology through absorbing annual summer camps co-organized by the Department of Computer Science and Engineering and the Hong Kong Federation of Education Workers.



### Bridge Design Contest

To inspire student engineers, the Civil and Environmental Engineering Students' Society, HKUSTSU and Department of Civil and Environmental Engineering held the Secondary School Bridge Design Competition annually during 2006-08. In the contest, student team finalists from schools in Hong Kong spent weeks designing and building model bridges. Models were then subjected to load-carrying tests and judged on their appearance. Each team also had to give a presentation explaining their design concept before an overall winner was chosen.



### RoboCupJunior Hong Kong

The Department of Computer Science and Engineering helped to provide an annual opportunity for Hong Kong primary and secondary school students to gain experience of artificial intelligence and robotics-oriented projects through the RoboCupJunior initiative. In this competition, students form teams to tackle a series of competitive robotics challenges, with winners of the Hong Kong Open competition entering the world final. The events were co-organized by the Hong Kong Federation of Education Workers and the Electronic Technology Company Ltd.



### Engineering Days

In May 2008, the School held two well-received special events for secondary schools in the New Territories to present the latest engineering advances and generate enthusiasm for engineering disciplines. Demonstrations of innovative applications and projects were included, along with discussions on internet security and nanotechnology. The first event was held in Tuen Mun Town Hall and the second at Yuen Long Merch Association Secondary School. Nearly 200 students attended the latter.



### Environment Week 2008

In June 2008, HKUST held an enterprising Environment Week on campus, coinciding with World Environment Day on June 5 and centered on the theme "Sustainability: A Leadership Role for Higher Education". All Schools were involved along with other sections of the university, while panel sessions involved non-governmental organizations, the business sector and academia in Hong Kong. Activities hosted by the School of Engineering included a talk on green building architecture by Prof Phil JONES from the UK's Cardiff University.



### IBM EX.I.T.E. Camp

HKUST and IBM China/Hong Kong Ltd held a successful activity camp to introduce female school students to the dynamic world of science and technology in the summer of 2008. The five-day camp, Exploring Interest in Technology and Engineering (EX.I.T.E.), saw more than 35 students participate in lively, hands-on workshops, games and lectures and build their knowledge of technology-related fields.



# Advisory Committee

## School of Engineering

### Academic Advisors

Name	Term of Appointment	Affiliation
Prof Eduardo D GLANDT	1 Jul 2005 - 30 Jun 2010	Dean of School of Engineering and Applied Science, Robert D. Bent Professor of Chemical and Biomolecular Engineering, University of Pennsylvania, US
Prof Nicholas P JONES	1 Jul 2006 - 30 Jun 2012	Dean, The Whiting School of Engineering, The Johns Hopkins University, US
Prof Vincent POOR	1 Jul 2006 - 30 Jun 2012	Dean of Engineering and Applied Science, Michael Henry Strater University Professor of Electrical Engineering, Director, Princeton Center for Innovation in Electrical Engineering, Princeton University, US
Prof Timothy W TONG	1 Jul 2003 - 30 Jun 2009	Dean, School of Engineering & Applied Science, The George Washington University, USA, Prof Tong is now the President of The Hong Kong Polytechnic University
Prof Benjamin WAH	1 Jul 2001 - 30 Jun 2008	Franklin W. Woeltge Endowed Professor of Electrical and Computer Engineering, University of Illinois, Urbana-Champaign, US
Prof David WU	1 Jul 2006 - 30 Jun 2012	Iacocca Professor and Dean, P. C. Rossin College of Engineering and Applied Science, Lehigh University, US

### Industrial Advisors

Dr Andrew Ka-Ching CHAN	1 Jul 2006 - 30 Jun 2012	Chairman, Ove Arup & Partners Hong Kong Ltd, Hong Kong
Mr Ben CHANG	1 Jul 2006 - 30 Jun 2012	Group Managing Director, iDS Group, Hong Kong
Ir James Y C KWAN, JP	1 Jul 2003 - 30 Jun 2009	Executive Director & Chief Operating Officer, The Hong Kong & China Gas Co Ltd, Hong Kong
Mr Sunny LEE	1 Jul 2006 - 30 Jun 2012	Executive Director, Information Technology, The Hong Kong Jockey Club, Hong Kong
Mr Humphrey LEUNG	1 Sep 2006 - 20 Jun 2012	President and Managing Director, Solomon Systech Ltd, Hong Kong
Mr Joseph WONG	1 Jul 2006 - 30 Jun 2012	(Retired from Du Pont China Limited, Hong Kong)

## Administration

President

**Professor Paul Ching-Wu CHU**

Vice-President for Academic Affairs

**Professor Roland T CHIN**

Dean of Engineering

**Professor Philip C H CHAN**

Associate Dean of Engineering (Undergraduate Studies)

**Professor Charles W W NG**

Associate Dean of Engineering (Postgraduate Studies)

**Professor Jang Kyo KIM**

Head of Department of Chemical and Biomolecular Engineering (Acting)

**Professor Edmond KO**

Head of Department of Civil and Environmental Engineering

**Professor Moe M S CHEUNG**

Head of Department of Computer Science and Engineering

**Professor Mounir HAMDJ**

Head of Department of Electronic and Computer Engineering

**Professor Khaled BEN LETAIEF**

Head of Department of Industrial Engineering and  
Logistics Management (Acting)

**Professor Fugee TSUNG**

Head of Department of Mechanical Engineering

**Professor Matthew M F YUEN**

## Figure at a Glance

Faculty		Students	
Regular	143	UG	2,171
Visiting	13	PG	1,369
<b>Total</b>	<b>156</b>	<b>Total</b>	<b>3,540</b>

*as at January 2008*

## Research Funding (2005-08) in Millions

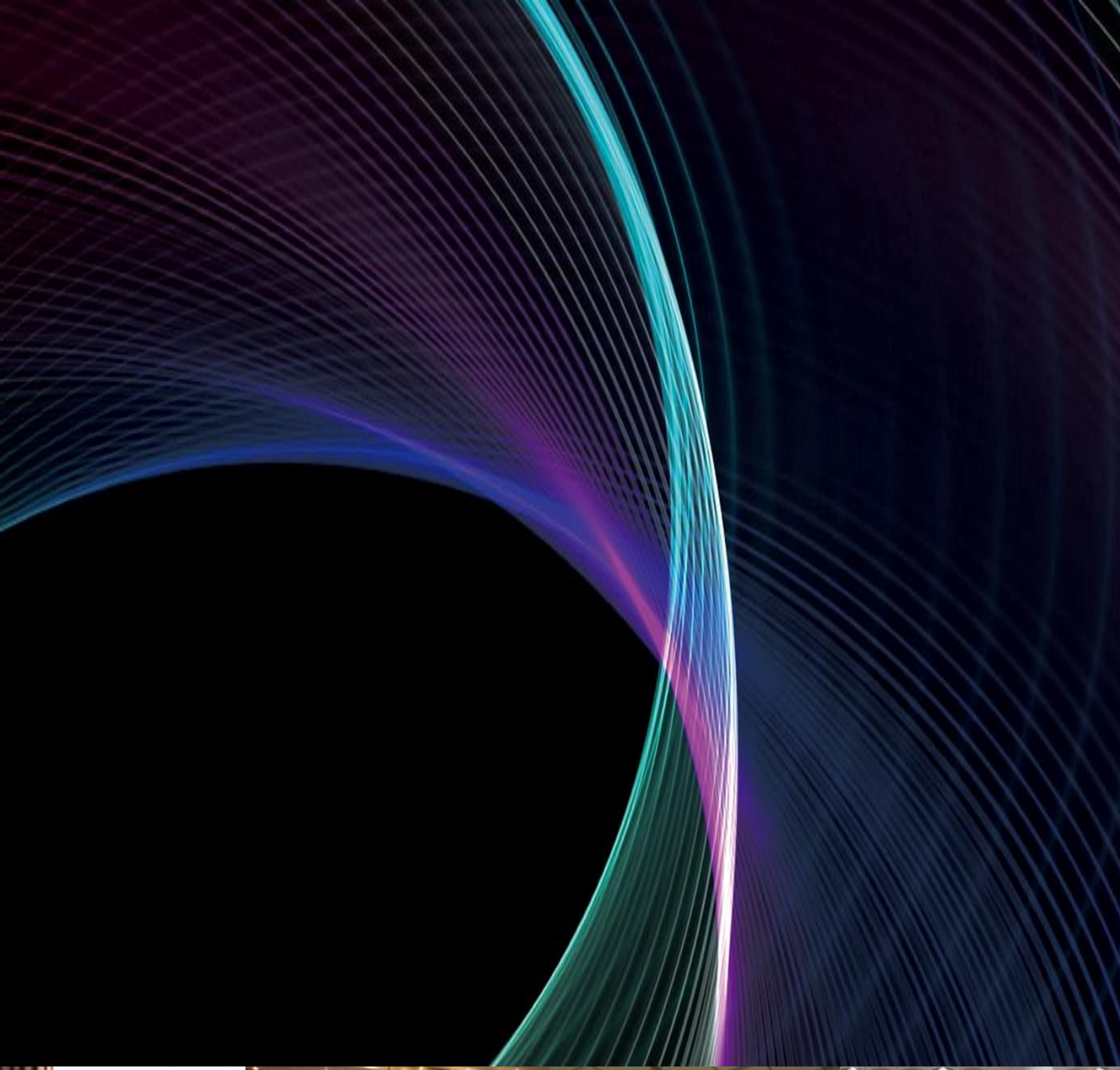
	2005-06	2006-07	2007-08	Total
UGC/RGC	\$47	\$56	\$70	<b>\$173</b>
Non-UGC/RGC	\$28	\$59	\$49	<b>\$136</b>

*as at 10 October 2008*

# Engineering Our Future







[www.seng.ust.hk](http://www.seng.ust.hk)



## School of Engineering

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