

ENGINEERING THE FUTURE



Status Report 2009-2011



122



Introducing SENG

The ninth edition of the HKUST School of Engineering (SENG) Status Report, covering the period 2009 to 2011, finds the School has been energetically moving forward in its role as a global teaching and research powerhouse.

Since the founding of the research-intensive Hong Kong University of Science and Technology in 1991, the School has established a strong international reputation and consistently ranks among the top engineering schools in Greater China, Asia and around the world.

SENG is the largest of the five Schools at HKUST and enrolls almost 40% of the University's student body and over one-third of the University's faculty members.

Through our six departments – Chemical and Biomolecular Engineering, Civil and Environmental Engineering, Computer Science and Engineering, Electronic and Computer Engineering, Industrial Engineering and Logistics Management, and Mechanical Engineering – we offer wide-ranging coverage of the field and exciting opportunities for cutting-edge education and research.

The School provides more than 40 degree programs at the bachelor's, master's and doctoral levels, including innovative interdisciplinary programs that bring together the expertise of different departments within the School and across the University. We also collaborate with top global engineering schools to offer joint degree programs at the postgraduate level.

Continuously seeking to advance, the School has added to people's lives in many different ways: through significant research discoveries and globally recognized excellence; by contributing to the social and economic development of Hong Kong and its transition to a knowledge-based society; in evolving a pace-setting education experience for 21st century engineers; through our internationalization and multiple perspectives; and by participating in solution-building to overcome the grand challenges the world faces in areas such as sustainable development and energy.

As the report indicates, the School is taking exciting strides to further our endeavors and to raise awareness of the essential role that engineers play in technological advancement and social development. This is how we are *Leading Change*. We welcome forward-looking students, faculty members, researchers, alumni, administrators, industrial and community partners, and benefactors to join us in our quest.



TABLE OF CONTENTS

p.02 Dean's Message

- **p.04** Generating Global Impact
- p.08
 Inspiring Future Leaders

 >> Reinventing the Undergraduate Experience

 >> Advancing Postgraduate Research Education

 >> Embedding Lifelong Learning

p.22 Tackling the Grand Challenges

p.28 Cultivating Wider Vision

p-34 Empowering Excellence

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

p.60 Driving the Future

Honors and Achievements
Faculty
Students
Alumni
Advisory Committee
Faculty Appointments
Donations and Sponsorships
Teaching and Research Laboratories
Facts and Figures





DEAN'S MESSAGE

I was honored to take up the position of Dean of the School of Engineering in 2009 and have sought in the active and rewarding years since then to build on the solid foundations created by my predecessors and to propel the School to new heights of achievement.

I have been well supported in this task by our productive and inspiring faculty members, our hard-working and innovative students, and our stalwart administrative team who keep everything running behind the scenes. As a result, there have been many outstanding accomplishments, with members of the School collectively helping to raise the bar across the engineering spectrum.

My vision when taking up the post was to see the School become a "beacon of excellence", from teaching, research and knowledge transfer to raising awareness of our capabilities in the community, strengthening our ties with alumni and extending our global reach and achievements.

The School has already acquired a sterling reputation and is consistently ranked one of the leading engineering schools in the world. However, we are continuously seeking to improve.

International Solution-finders

One of our biggest and most exciting challenges over this reporting period has been preparing for the move from a threeyear to a four-year degree system, a change affecting higher education across Hong Kong from September 2012. It has proved an incredible opportunity to revitalize our curriculum and methods of teaching in line with the new needs of society.

The problems that the global community faces today are large and complex. Issues such as the environment, energy and healthcare need to be looked at from many different perspectives and mobilize different fields if they are to be resolved.

For our students, this means enabling them to be solutionfinders who can usefully assist in resolving problems wherever they may work in the world. They need to be given the opportunity to participate interactively in an education that equips them with the ability to understand and optimize advanced technologies, work on multidisciplinary projects and in multicultural teams, communicate their ideas, and fully consider the impact of what they undertake.

Advancing Engineering Education

We believe our Engineering PLUS concept, carefully worked on and developed by our faculty members, will provide the holistic, cutting-edge educational experience needed for our undergraduates to become the leading young engineers of today and tomorrow.

We have also recognized the importance of enhancing the personal development of our postgraduates in addition to providing a top-quality research environment. Through workshops and other activities, the School is now helping these students to extend their life skills and networks to add to their competitive edge as professional engineers, researchers, entrepreneurs and managers.

The School's commitment to leading engineering education practice and scholarship took another stride forward with the setting-up of the Center for Engineering Education Innovation (E²I). With its slogan of "Learning to Teach, Teaching to Learn", the pioneering Center seeks to bring the latest research

findings to our educational practice and to contribute to the literature through our own studies.

E²I founding director is the respected international engineering education expert and faculty member, Prof Edmond Ko, who unexpectedly passed away in April 2012. We will be continuing to move forward on this as part of the rich educational legacy Prof Ko has left the School.

Generating Global Awareness

Other key areas of focus for this reporting period include internationalization and student diversity. The goal has been to develop the multicultural dimension of our student body at both the undergraduate and postgraduate levels and bring in stimulating new perspectives, ways of thinking, and worldwide connections. Widening our international recruitment and expanding our popular student exchange are two successful ways we have advanced our efforts.

We have been building up our research collaborations with academics, institutions and enterprises globally, with the pioneering research work of our faculty members putting our School in a strong position to develop such partnerships.

Closer to home, research opportunities have continued to grow in the Pearl River Delta, a hugely significant industrial and manufacturing hub for China – and the world. The area is located next door to Hong Kong and seeking to upgrade to the next level of technology and human resources. The University's research facilities in Nansha and Shenzhen as well as our well-equipped main campus in scenic Clear Water Bay in Hong Kong are assisting faculty in maximizing these openings.

As a result, our interaction with different parts of the world has expanded considerably, helping to raise our profile while at the same time providing us with fresh ideas and wider global awareness.

Research Edge

With our international research reputation, excellent research infrastructure and the development dynamism within the region, the School has remained an attractive place for senior and rising faculty to base themselves. This in turn keeps our research at the forefront of change and our teaching at the cutting-edge of discovery.

Collaborative research involving faculty from different fields within the School is also being encouraged in order to contribute to the grand challenges the world faces in areas that stretch across a multitude of fields, such as the environment.

The School has thus been developing strategies to draw our senior faculty and other researchers together to work on theme-based research and other key initiatives, such as the establishment of an Energy Institute at HKUST.

Drivers of Technological Development

The impact that engineers have on the world often goes unrecognized in today's society. Technological achievements from medical technology to wireless communication are applauded yet the vital role of engineers in designing and implementing such advances is often overlooked.

I have been keen to alter such a view. As this report shows, the School has made great efforts to bring engineering into the community. This has taken many forms, from much greater interaction with secondary school students to public exhibitions. In addition, we have encouraged our students to put their knowledge to work on social projects, including practical innovations to assist those in need, to develop understanding on both sides.

As the largest School at HKUST, with the highest number of undergraduates, graduates and faculty and the most comprehensive range of engineering fields in Hong Kong, we have a pivotal role in building recognition of the role that engineers play and how they improve lives.

We are still working on these goals but I believe in the past three years we have taken major steps forward toward reaching them.

Prof Khaled Ben Letaief

Dean of Engineering

CERTERATING COLORS CONTROL CON



In the past three years, which included HKUST's 20th Anniversary in 2011, the School of Engineering has sought to advance and apply knowledge at the forefront of engineering education and research in line with our goal of continuous improvement. Building on the foundation of excellence put in place over the past two decades, the School was pleased to see our efforts recognized internationally and to further raise HKUST's academic leadership profile. While rankings offer a highly visible indication of the School's achievements, the highlights in this section also show some of the many other ways that our pioneering academics generated impact in 2009-11 as we strive to advance the major issues of our time.

World-class Performance

The all-round drive for first-rate scholarship and a fulfilling student experience at the School saw HKUST maintain its strong presence in international engineering rankings surveys.

HKUST was ranked No. 26 in the *Times Higher Education*-QS World University Rankings in Engineering & IT in 2009, the last year of the rankings partnership between *Times Higher Education* and QS. (Subsequently, each organization has produced rankings independently.)

In the QS World University Rankings – Engineering & Technology in 2010 and 2011, HKUST was placed at No. 26 and No. 22 respectively worldwide, and was the No. 1 university in Hong Kong in this field in both years. Criteria included academic reputation, employer reputation, citations per faculty and internationalization. In 2010 and 2011, HKUST was ranked within the top 30 in the *Times Higher Education* World University Rankings – Engineering & Technology, and No. 1 in Greater China in 2011. The rankings considered teaching, research, citations, industry income and international outlook.

		2009	2010	2011
QS World University Rankings	Overall	/	40	40
	Engineering & Technology	/	26	22
OS Asian University Bankings	Overall	4	2	1
US Asian University Rankings	IT & Engineering	6	7	7
OS World University Rankings by Subject - Engineering and Technology Civ Civ Civ Civ Civ Civ Civ Civ Civ Civ	Computer Science	/	/	26
	Electrical Engineering	/	/	28
	Civil Engineering	/	/	42
	Mechanical Engineering	/	/	44
	Chemical Engineering	/	/	51-100
Times Higher Education-QS World	Overall	35	/	/
University Rankings	Engineering & IT	26	/	/
<i>Times Higher Education</i> World University Rankings	Overall	/	41	62
	Engineering & Technology	/	20	28
Academic Ranking of World Universities, by Shanghai Jiao Tong University	Engineering/Technology & Computer Sciences	36	39	36
	Computer Science	27	26	21

HKUST flies high



Decade of Achievement

The Geotechnical Group retained its No. 1 ranking for the total number of papers oublished in four major geotechnical journals in the 10 years from 2001-10, according to online academic database service Web of Science[®]. The great accomplishment was a result of the collective work of members of the Civil and

Profs Charles Ng, Gang Wang, Jui Pin Wang, Yu Hsing Wang, Limin Zhang, and Jidong Zhao. The journals were Géotechnique, Journal of Geotechnical and Geoenvironmental Engineering, Canadian Geotechnical Journal, and Soils and Foundations.



Contributing to National Success

The School of Engineering saw 10 academics receive State Science and Technology Awards during the period under review. The honors are China's most prestigious in these fields. Among awards provided under the scheme, State Natural Science Awards celebrate academic excellence in basic and applied research while State Scientific and Technological Progress Awards are the top recognition given to outstanding contributors to the advancement of science and technology.



Prof Xiren Cao, Electronic and Computer Engineering, 2009 State Natural Science Award, Second Class, "Optimization Theory and Methodology for Discrete Event Dynamic Systems" in information technology.



Prof Shing Chi Cheung, Computer Science and Engineering, 2011 State Scientific and Technological Progress Award, Second Class, "Software Technology, Platforms, and Internet Ware".



Prof Bo Li, Computer Science and Engineering, 2011 State Natural Science Award, Second Class, "Stochastic Models and Performance Optimization for Resource Management in Computer Networks".



Prof Chak Keung Chan, Chemical and Biomolecular Engineering and Division of Environment, 2009 State Natural Science Award, Second Class, "The Characteristics of Emission and Complex Pollution of Atmospheric Particulate Matter and Its Precursors".



Prof Yunhao Liu; Prof Lionel Ni, Chair Professor; **Dr Mo Li** and **Dr Zheng Yang**, Computer Science and Engineering, 2011 State Natural Science Award, Second Class, "Range-free Localization and Localizability for Wireless Network and IOT: Theory and Practice".



Prof Joseph Lee, HKUST Vice-President for Research and Graduate Studies and Chair Professor of Civil and Environmental Engineering, 2010 State Scientific and Technological Progress Award, Second Class, "Buoyant Jets in Complex Environments – Theory, Innovative Technology and Application".



Prof Hai Yang, Civil and Environmental Engineering, 2011 State Natural Science Award, Second Class, "Behavior-based Spatial-temporal Features of Urban Traffic Flow Distribution and Numerical Study".



China Accolade

Prof Tongyi Zhang, Chair Professor, and **Prof Ping Cheng**, Professor Emeritus and the second Department Head (1995-2002), Mechanical Engineering, were elected to the Chinese Academy of Sciences in 2011. Membership of the prestigious academy is the highest academic title conferred by the Chinese government for achievements in science and technology research. Such an honor is reserved for the nation's top minds in natural sciences, technology and engineering.

Prof Zhang's main research focus is on hydrogen embrittlement, fracture and failure of multi-field coupling materials and micro/ nanomechanics. He has published over 160 Science Citation Index papers and is the co-holder of two US patents. The eminent scholar has twice received the State Natural Science Award, Second Class, and is a Fellow of the ASM International, US, a Senior Research Fellow of the Croucher Foundation, Hong Kong, and an active and respected member of the international community.

Prof Ping Cheng has achieved global recognition for his research in the field of heat transfer. He has published over 180 Science Citation Index papers on porous-media heat transfer, radiative heat transfer and microscale heat transfer with an h-index of 39. He is a Fellow of the American Society of Mechanical Engineers (ASME) and the American Institute of Aeronautics and Astronautics (AIAA). Prof Cheng is a past recipient of the ASME/ AIChE Max-Jakob Memorial Award, considered the highest international honor in the field of heat transfer, and has received the Shanghai Science and Technology Award, First Class, and State Natural Science Award, Second Class.

IEEE Fellows Increase Their Presence

The high quality of the School's faculty was reflected in the large number of Fellows of the Institute of Electrical and Electronics Engineers (IEEE) among its academics. From 2009-12, 11 more School of Engineering academics were elected IEEE Fellows for contributions to their respective fields, with the total number at the School reaching 27* by January 2012. The IEEE is the world's leading professional association for advancing technology for humanity, with 395,000 members in more than 160 countries.





Prof Ross Murch, Chair Professor and Head, Electronic and Computer Engineering, Director of Center for Wireless Information Technology: multiple antenna systems for wireless communications



Prof Qiang Yang, Associate Head (Postgraduate and Research), Computer Science and Engineering: understanding and application of intelligent planning, learning and data mining

2010



Prof Long Quan, Computer Science and Engineering, Director of Center for Visual Computing and Imaging Science: three-dimensional computer vision

2011



Prof Mounir Hamdi, Chair Professor and Head, Computer Science and Engineering, Director of Cyberspace Center: design and analysis of highspeed packet switching



Prof Bo Li, Computer Science and Engineering: content distribution via the internet

* excludes faculty who joined the School after 31 December 2011

2012









Prof Johnny Sin, Electronic and Computer Engineering, Director of the Nanoelectronics Fabrication Facility, Director of the Semiconductor Product Analysis and Design Enhancement Center: design and commercialization of power semiconductor devices

Prof Vincent Lau, Electronic and Computer

Prof Oscar Au, Electronic and Computer

Studies) Prof Roger Cheng, Electronic







Prof Qian Zhang, Computer Science and Engineering, Founder and Co-director of Huawei-HKUST Innovation Laboratory, Director of Digital Life Research Center: mobility and spectrum management of wireless networks and mobile communications

Setting the Pace

The School's dedication to advancing the state of the art starts at the top with Dean of the School of Engineering **Prof Khaled Ben Letaief**, Chair Professor, Electronic and Computer Engineering. An IEEE Fellow since 2003 and the Founding Editor-in-Chief of *IEEE Transactions on Wireless Communications*, among other achievements, Prof Ben Letaief is an international leader in wireless and mobile communications.

In 2009, Prof Ben Letaief was awarded the IEEE Marconi Award in Wireless Communications. He was presented with the Best Paper Award at the IEEE International Communications Conference for research on "Minimum Sum Expected Distortion in Cooperative Networks" co-authored by MPhil graduate Shaolei Ren. In the same year, Prof Ben Letaief was elected Vice-President of the IEEE Communications Society, the world's leading organization for communications professionals.

His success as a role model was acknowledged when he received the Outstanding Electrical and Computer Engineering Award from Purdue University, US, in 2010. The honor is awarded to Electrical and Computer Engineering alumni who have made extraordinary contributions to economic development, prosperity and technological advancement.

Prof Ben Letaief was selected as ISI Highly Cited Researcher 2011 by Thomson Reuters in the field of Computer Science and Engineering. He also received the IEEE Communications Society Harold Sobol Award for Exemplary Service to Meetings and Conferences in 2011 for his longstanding efforts related to development of the field. Only one person from the Society's worldwide membership is chosen each year.



INSPIRING FUTURE LEADERS

With the introduction of the four-year degree system in Hong Kong in 2012, the School has seized this chance of a lifetime to transform our undergraduate education, widen the learning experience of research postgraduates, and develop our lifelong learning opportunities

Reinventing the Undergraduate Experience

2009-11 has been a remarkable period for undergraduate teaching and learning at the School, with faculty members engaged in extensive preparations for the move from a three-year to a fouryear degree system



The launch of the new undergraduate degree system in Hong Kong in September 2012 has been seen at HKUST as a tremendous opportunity to redraw the engineering curriculum into a truly 21st-century learning experience. Key objectives of the revitalization process have been to create a more studentcentric experience and to encourage undergraduates to develop skills and passion to engage in lifelong learning after graduation. The resulting "Engineering PLUS" education seeks to **P**repare Leaders for **U**Itimate **S**uccesses by:

- Developing basic transferable skills, such as communication, critical thinking, and quantitative reasoning
- Focusing on engineering fundamentals for further development as engineers or researchers
- Providing sufficient breadth for effective functioning in a chosen specialty while maintaining flexibility for broadening into other areas of interest
- Challenging students with research-type and open-ended problems to stimulate self-learning and improve problemsolving skills.

Alongside preparations for the four-year degree, logistical arrangements have been ongoing for the "double cohort" in 2012. This will see the last cohort of students graduating with Hong Kong A-levels (after seven years of secondary education) and the first cohort of students graduating with the new Hong Kong Diploma of Secondary Education (after six years at secondary school) both enter their first year at university at the same time. The School will thus run three-year and fouryear degree programs simultaneously during the double cohort years, as will happen across Hong Kong's higher education institutions.

The School's senior administrators and faculty have made huge efforts to prepare for this, with new faculty members hired, and teaching, laboratories and other practical arrangements organized. As at December 31, 2011, the School had a total of 2,373 undergraduates. For its September 2012 intake, it is estimated there will be a total Year 1 intake of 660 for the threeyear degree program and 760 for the four-year degree program.



Optimizing the Four-year Curriculum

The four-year curriculum, comprising around 120 credits, adopts an outcomebased approach. Under the new system, students will enter the School, not a specific field of engineering.

In the first year of study, students will acquire foundation knowledge in science, quantitative methods and common core education which covers broad areas in science and technology, social analysis, humanities, quantitative reasoning, English and Chinese communication and a healthy lifestyle. Students will also take engineering introductory courses designed to give them a taste of various engineering disciplines and to help them decide on their major.



The School's majors cover a wide spectrum of engineering fields, allowing students to pursue their studies in the area of most interest to them.



Engineering major programs

- BEng in Chemical Engineering
- BEng in Chemical and Biomolecular Engineering
- BEng in Chemical and Environmental Engineering
- BEng in Civil Engineering
- BEng in Civil and Environmental Engineering
- BEng in Computer Engineering
- BEng in Computer Science
- BEng in Electronic Engineering
- BEng in Industrial Engineering and Engineering Management
- BEng in Logistics Management and Engineering
- BEng in Mechanical Engineering
- BSc in Computer Science

Engineering students can also choose from one of three interdisciplinary majors after their first year of study in the School, namely:

- Dual Degree Program (BEng and BBA) in Technology and Management
- BSc in Risk Management and Business Intelligence
- BSc in Environmental Management and Technology

Minor programs that add additional perspectives to the learning experience can be taken within or outside the School. In 2009-11, the School expanded its list of minors with two new programs. The Minor Program in Environmental Sustainability and Management enrolled its first students in Fall 2009. The Minor Program in Engineering Management and Law was launched in Fall 2010. Both are open to students across the University.

Engineering minor programs

- Aeronautical Engineering*
- Bioengineerin
- Engineering Management and Law
- Environmental Sustainability and Management
- Information Technology
- Technology Management
- * to be launched in 2012



Minor Program (18 credits)

NEW For All UG students Launch in Fall 2010

- Intellectual Property Law in Engineering
- Project Investment Strategies and Cost Control
- E Engineering Management
 - Legal Perspective of Engineering Practice and Operation

Exprovement Non-Assessment and Decesson Making Principles of Project Fluetce Constrainties Law and Contract Administration Dashta and Process Improvement Lapitics Princenng and Service Management Employments Business Development and merce.



Undergraduates will have further enrichment options through second majors, international and internship experiences, early research experience, community service, and soft skills training in areas such as communication.

To ensure a smooth transition in 2012, the Schoolbased Admission Scheme was launched in 2009 as an addition to the established system of individual program applications. Students gaining a place under school-based admission take introductory courses to learn about different engineering fields and receive counseling and insight into different engineering professions. Under the three-year system, students admitted under the scheme have chosen their engineering major at the end of the first semester. When fully implemented under the four-year system, students will make their decision after one year.

During the period under review, two school-based admission streams, ENGG-A and ENGG-B, were offered covering between them all six engineering departments. Both were welcomed by students. In 2011, Hong Kong's Joint University Programmes Admissions System (JUPAS) statistics showed that ENGG-B was the most competitive of all degree programs at HKUST in terms of Band A choices and number of places available, while the stream was the second most popular program at HKUST overall for such applicants.

Empowering Excellence

Driving the Future

Exchange Program Expansion

The School has made concerted efforts to extend opportunities for students to go on exchange in the past three years in line with its goal to broaden students' learning experiences. Exchanges help to build students' independence, widen their perspectives, and increase cultural awareness, preparing them for the globalized workplace. By 2010-11, the number of engineering undergraduates who had participated at least once in an exchange had risen substantially to close to 30% compared with 21% in 2008-09. Greater flexibility for exchange arrangements is also envisioned with the four-year program. It is the School's goal to send 50% of its undergraduates on exchange.





Our exchange network has also expanded. Study destinations in countries such as the US, UK and Canada have been joined by exchange agreements with institutions in countries such as France, Sweden, Denmark, Switzerland, Thailand, Malaysia, Korea and Japan. In addition, partnerships with universities in Turkey and Israel have been established. By December 31, 2011, the School had over 80 institutional partners from 19 countries/regions, including Mainland China.

With the School's continuous efforts in promoting non-traditional regions, exchange destinations had become more evenly distributed by 2010-11, with 32% in North America, 31% in Europe, and 37% in Asia. The diversity of exchange destinations enabled students to bring back a wide range of cultural experiences to share with classmates in Hong Kong. Those remaining in Hong Kong also gained the benefit of meeting students from a variety of academic and cultural backgrounds who exchanged in from partner institutions.

As a cost-effective alternative to the full semester exchange, the School has developed shorter summer exchange programs. The move has allowed a greater number of students to experience life outside Hong Kong. Each summer program is carefully chosen to blend credit-bearing courses in engineering with cultural activities and foreign language training.

To cater for research-oriented undergraduates, the School launched an innovative summer exchange program in collaboration with Princeton University in 2011. The program enables HKUST students to be attached to a research project at Princeton for eight weeks and vice versa. Princeton students may also work with research teams from the Hong Kong Applied Science and Technology Research Institute (ASTRI).



Fostering Internationalization

Along with its highly successful exchange program, the School widened the diversity of its undergraduate population through stepping up international recruitment. This helped international applications grow from 130 in 2008 to 597 in 2011, a leap of 360% that has heightened competition for places further and an indication of the increasing popularity of the School's programs among students from outside Hong Kong. Diversity among the undergraduate population has also jumped, with international students from 17 different locations in 2008 rising to 30 in 2011. In 2011-12, there were students from Europe (e.g. Sweden, Norway, Spain, UK), Asia (e.g. India, Indonesia, Korea, Vietnam), the Middle East (e.g. Iran, Saudi Arabia, Israel) and Africa (e.g. Botswana, Nigeria, Zimbabwe) studying at the School.

In addition, the School has seen an upward trend in quality, including two of Malaysia's top students who chose to enroll in 2011. Jun Kang Chow, Civil and Environmental Engineering, and Wilson Wei King Lye, Mechanical Engineering, were among just eight students out of 53,000 candidates to gain five A grades in Malaysia's nationwide pre-university STPM examination. Neither student had previously been to Hong Kong before.

High-flying Mainland China applicants have also continued to find the School an attractive option, with the students recruited of comparable quality to Peking University and Tsinghua University.

New exchange partnerships Jan 2009 - Dec 2011

	Drexel	University,	US
-			

- Institut Supérieur d'Electronique de Paris, France
- 👩 Koç University, Turkey
- Michigan State University, US
- Munich University of Applied Sciences, Germany
- Nagoya University, Japan
- Pohang University of Science and Technology, Korea
- Princeton University, US
- Rutgers, The State University of New Jersey, US
- 📄 Sabanci University, Turke
- State University of New York at Stony Brook, US
- 👩 Sungkyunkwan University, Korea
- Technion Israel Institute of Technology, Israel
- The Cooper Union, US
- 🔰 Universiti Putra Malaysia, Malaysia
- University of Exeter, UK
- Juniversity of Manitoba, Canada
- University of Stuttgart, Germany
- University of Sussex, UK
- University of Utah, US
- University of Virginia, US
- University of Wisconsin-Madison, US
- 📄 Vanderbilt University, US
- 💽 Yeungnam University, Korea



Holistic Education Initiatives

With the increased emphasis on holistic learning under the four-year curriculum, the School sought to launch further support measures, foster personal development and encourage students to engage in enrichment activities in 2009-11 to build awareness of different types of learning among students and faculty members.

Center for Engineering Education Innovation (E²I)

The School identified the critical transition period from school to university and the growing advisory needs of undergraduates under the student-centric four-year curriculum as key areas for greater support. One significant undertaking that aims to address both these needs is the Center for Engineering Education Innovation (E²I), established in September 2010.

E²I seeks to position the School at the forefront of engineering education practice and research. Its mission is to design, deliver, and evaluate innovative learning experiences for student and faculty development.

In student development, E²I serves as a one-stop shop in advising first-year students admitted under the School-based Admission Scheme so that they can make a successful transition to university life and study, and make an informed decision on their majors. A Peer Mentoring Program has been in place since 2010 to provide support for incoming students. Peer mentors are empowered to play a role in the learning of other students by designing purposeful learning experiences for them. This "Learning to Teach, Teaching to Learn" philosophy is also followed in other student development programs offered by E²I both on and off campus.

E²I has been involved in two major initiatives related to the launch of the four-year undergraduate curriculum. It has been helping to scale up and refine the current system of academic advising for students. This involves the recruitment and training of peer, professional, and faculty advisors, along with the provision of physical space that would be conducive to academic and social interactions among students. The other move is to advance pedagogy through working with faculty and teaching staff on innovative teaching and assessment strategies in order to maximize student learning. For example, the Center has offered a series entitled "E²I Conversations on Engineering Learning and Teaching" since Spring 2011, whereby the School's faculty and guests gather once a month during the semester to discuss issues on engineering education informally over lunch. Ideas are being tried out in new School-sponsored courses and will be applied to other courses. E²I is also engaged in teaching a course in collaboration with the University's Center for Enhanced Learning and Teaching for new faculty and one for postgraduate students for the entire university.

Another focus underpinning E²I's work is engineering education research. Most of the research in this area has been done in Western societies, and much remains to be learned about Chinese students in the local context. E²I has identified many exciting research opportunities and plans to collaborate with similar centers elsewhere to establish an international network to promote engineering education scholarship.

Global and Community Engagement (GCE) Program

To nurture a socially responsible culture among engineering students and encourage them to use their engineering and technology knowledge to contribute to society, the School has actively involved its undergraduates in different forms of community service.

The School started its first credit-bearing co-curricular course in 2009. Developed by Prof Charles Ng, then Associate Dean of Engineering, the community service course enabled students to gain social service experience as well as training in leadership, public relations, event management, communication and presentation skills. The initial project was sponsored by the Lions Club of Metropolitan Hong Kong.

Community-oriented student projects have also led to innovative technologies. In 2009, three of the School's undergraduates developed a digital photo frame with a built-in set of games designed to enhance the cognitive power of the elderly. The project went on to win three design awards in open competitions. In 2010, an undergraduate project by two students led to the creation of a cost-effective and efficient Braille Embosser for the visually challenged. The userfriendly machine has received nine engineering design awards locally and internationally.

To provide a greater infrastructural framework for such work, the co-curricular Global and Community Engagement (GCE) Program was launched in 2011. Its goals are to: foster holistic development for engineering students to rise to the grand challenges of the 21st century; strengthen students' international and local engagement in engineering disciplines; and provide a platform for students to contribute their engineering knowledge to the community.

The GCE Program also aims to widen and broaden students' exposure by engaging them in international and local project competitions, conferences, or professional events related to engineering. For example, the HKUST Robotics Team, which is embedded within the GCE Program, was restructured in January 2011 into four sub-teams to extend its participation in Asia-Pacific, Mainland and international robot contests. During 2011, the sub-teams took part in several competitions and received nine awards. The overall team increased from 40 undergraduates in 2010 to over 70 undergraduates from the School's six departments. Outcome-based pedagogy has also been implemented in the project-based course for the team.

Undergraduate Research Opportunities Program (UROP)

This special HKUST program has given undergraduate students a way to participate in research activities ahead of graduation. UROP has proved increasingly popular and many of the School's students have gained valuable exposure to research team culture and worked closely with faculty members through the program. Given its strong appeal, from Fall 2010 the program was offered each semester rather than summer only. Engineering students participating in UROP rose from 67 in 2008 to 124 in 2011.

Foundations for the Future

While the School has endeavored to maximize the opportunities presented by Hong Kong's education reforms, it is recognized that the work of the past three years is only the start of an ongoing endeavor to deliver a truly inspirational undergraduate experience for our students. As the new curriculum is rolled out, there will undoubtedly be adaptations to accommodate and new challenges to overcome. However, with the strong foundations put in place during 2009-11, the School looks forward to the arrival of the four-year degree with immense optimism and great enthusiasm.



Advancing Postgraduate Research Education

Equipping research students with a broader range of skills and awareness is taking the School's learning environment to the next level



While the School and its world-class faculty members have already established a formidable reputation for cutting-edge research and development that draws top research students, HKUST's front-running environment ensures that fresh endeavors to enhance its provision are always being explored. In 2009-11, major initiatives for the School's research postgraduates centered on greater internationalization and diversification of the educational experience.

Building International Connections

The School attracts top-caliber research students, many from Mainland China. To increase our postgraduates' multicultural outlook and assist them in developing international connections, the School has actively sought to build diversity among our research students while rigorously maintaining quality.

Hong Kong PhD Fellowship Scheme

The Hong Kong Research Grants Council scheme was established in 2009 to attract the best and brightest students from around the world to pursue doctoral studies in Hong Kong. The School of Engineering has done particularly well in drawing such candidates, receiving the largest number among engineering faculties in Hong Kong in 2010 and 2011, the first two years that the fellowships were awarded. Such success can be attributed to the dedication and outstanding research performance of our faculty team, the potential for awardees to maximize their capabilities at the School, and the School's enthusiasm for drawing such top students in line with our goal of strengthening ties around the world.

International Student Recruitment

The School also engaged in overseas recruitment drives and visits to build the presence of international research postgraduates. This saw international numbers more than triple in the past three years. Students came from Australasia, Africa, South and East Asia, Eastern Europe, Western Europe, the United States, and the Middle East. The School continued to draw a large number of

Expanding the Postgraduate Experience

To nurture well-trained engineers and academics who can make significant contributions in today's global context, the School has taken an active role in broadening the learning opportunities and support activities available to research students.

Joint Collaborations

To expand research and learning opportunities, the School collaborates with leading overseas and Mainland China institutions. The number of partners grew considerably over the period under review. School delegations overseas also helped more institutions around the world get to know the School and its achievements, enhancing interest in collaboration. Such collaborations open up avenues for students to gain insight into different research team cultures and perspectives. Those established in 2009-11 are listed below.

School of Engineering partner agreements

Partner institution	Nature of agreement	Year signed
Telecom SudParis, France	Dual master's degree program	2009
Université Joseph Fourier (Grenoble I), France	Memorandum of Understanding on a dual doctoral program	2009
Ecole Supérieure d'Electricité (Supélec), France	Agreement to develop a partnership within the framework of a master's program on "advanced wireless communications systems"	2010
University of Wisconsin- Madison, US	Memorandum of Understanding on collaborations, including research projects, student/faculty exchange and outside funding sources	2010
Woongjin Coway, Korea	Degree program and research and development projects	2010
Moscow State University, Russia	Memorandum of Understanding on facilitating academic, scientific and technological exchange and cooperation	2011
Pohang University of Science and Technology, Korea	Joint PhD program	2011
Tsinghua University, Mainland China	Agreement on summer internship program	2011
Zhejiang University, Mainland China	Co-supervision agreement	2011





Dean's Message

Overseas Research Awards for PhD Students

The School encouraged doctoral students to gain a wider view of their field, and the world through participation in HKUST's Overseas Research Awards for PhD Students. The scheme was launched in 2006-07 by the Provost's Office. Students chosen to participate can conduct research at leading universities overseas for two to six months, providing both cultural exposure and practical research experience. It is also an effective way to promote inter-institutional research collaboration. Institutions involved include MIT, Stanford, Yale, University of Sydney, Imperial College London, National University of Singapore and Technische Universität Darmstadt. Germany, among many others. In 2011-12, 14 engineering students were selected by the School to participate in the scheme.



PhD Research Excellence Awards

To recognize the achievements of the School's doctoral students and recent graduates, the School established the PhD Research Excellence Awards in 2011. The honors celebrate those who have made significant and influential contributions to their engineering discipline during PhD studies at HKUST. The first winners were Dr Weiping Wang, Chemical and Biomolecular Engineering, Dr Huanfeng Duan, Civil and Environmental Engineering, and Dr Yu Zhang, Computer Science and Engineering. Dr Yinshi Li, Mechanical Engineering, received an Honorable Mention.



International Forums

Postgraduate students also attended overseas conference and regionally organized activities. Annual events include workshops organized by the University of Tokyo's Asian Program for Incubation of Environmental Leaders (APIEL), and the Asian Science and Technology Pioneering Institutes of Research and Education (ASPIRE), which seeks to help to realize a sustainable world. HKUST is a collaborating partner and member of these two organizations respectively.

In 2010, APIEL conducted a field exercise in the Greater Pearl River Delta to explore environmental sustainability and management in relation to trans-boundary and international cooperation, in collaboration with HKUST and Sun Yat-sen University in Guangzhou. In 2011, the ASPIRE workshop was held at the Korea Advanced Institute of Science and Technology (KAIST) focused on "Sustainability for the Globe: Energy and Environmental Issues". Five students from the School of Engineering took part.



Additional Support and Social Activities

More activities were organized within the School to help postgraduates get to know peers outside their own research teams. To welcome students at the start of the new semester, the School organized its first Postgraduate Orientation in September 2011. The get-together enabled School management, faculty members and students to become acquainted. Around 100 research students attended the orientation. To encourage social interaction between students from different locations, the School started to organize activities outside the classroom. A barbecue was held in December 2011. Other activities, such as hiking, festival gatherings and cultural exchange, were also arranged.

Future Development

Further plans are being laid to boost postgraduates' soft skills and career planning by building their communication capabilities, entrepreneurship opportunities and mentoring. Presentation and interpersonal skills are increasingly valuable for both future academics and those who go into industry in an era of highly competitive research funding and public participation, where engineers may need to engage support for their projects. Activities being looked at include workshops and forums to assist students to explain their work to people outside their specialty.

In this way, together with the innovations of the current reporting period, the School seeks to set our postgraduate education apart, delivering a holistic experience that addresses not only excellence in research opportunities but students' all-round skills and personal development needs.

The University of Sydney

Embedding Lifelong Learning

The School's highly sought-after taught postgraduate programs added to their strengths with a series of initiatives to broaden students' educational experience and enhance interaction



Situated in Hong Kong, Asia's world city, HKUST is both a hub for Asia and a gateway to China. To support the growth of technology industries in the region and to cater for the professional development needs of local and overseas engineering professionals, the School of Engineering offers a comprehensive suite of part-time and full-time self-financed taught master's programs, which continued to develop in 2009-11.

Program Diversity and Expansion

Nine Master of Science programs were offered during the period under review, leveraging the strengths of the School's world-class faculty and reflecting the needs of specific technology industries. Preparations were also made for a new program in Chemical and Biomolecular Engineering to be launched in response to strong demand in the region.

School of Engineering taught postgraduate master's programs

- Chemical and Biomolecular Engineering*
- Civil Infrastructural Engineering and Management
- Environmental Engineering and Management
- Electronic Engineering
- IC Design Engineering
- Telecommunications
- Information Technology
- Engineering Enterprise Management
- Intelligent Building Technology and Management
- Mechanical Engineering

* to be launched in 2012-13

Continuous Improvement

The Master of Science in Environmental Engineering was renamed the Master of Science in Environmental Engineering and Management in September 2011 in line with the program's revamped curriculum, structure and broader focus. The move caters for the changing needs of the market. It will enable students to understand how fundamental environmental engineering concepts can be applied to environmental management and policy decisions. This will both increase students' breadth of knowledge and make them more competitive.

Rising Number of Applications

With the leading global position of the School, statistics show that interest in our taught master's programs has been growing rapidly. Applications rose over 100% in the three years from 2008-09 to 2011-12, increasing from 1,655 to 3,320. Despite applications doubling, admissions only grew by just over 21%, from 450 to 546, leading to extremely keen competition for places, and high-quality intakes.



Enhanced Learning Experience

To respond to the changing composition of the student body and the rising number of nonlocal students, various kinds of additional learning support were designed and offered to enrich students' learning experience.

Workshops, Seminars and Company Visits

Technical workshops and industry seminars were organized to keep students up to date with the latest technologies that are drawing global attention. Company visits and career seminars helped non-local students understand the work culture and environment in Hong Kong. In addition, industry professionals were invited to become part of the teaching team to bring new perspectives and insights to classes.

Taught master's programs local and non-local intake



Student Diversity

More taught postgraduate students in the three years up to December 31, 2011, elected to study full-time rather than part-time, with the proportion of full-time students rising from around 34% to 48%. One of the reasons for the jump is the greater number of non-local (international and Mainland China) students now coming to the School to take these programs. There was a particularly noticeable increase in the numbers of non-local international students. The non-local category includes Mainland China and international students studying on student visas. Local international refers to students who hold work, dependent or other valid visas for studying in Hong Kong.



English and Career-building Courses

To cater for the needs of the growing number of non-local students from Mainland China, an English course focusing on job-seeking was developed to add to the academic English course already established. A separate career-building course was introduced to help full-time students discover their career path and goals, and to acquire the knowledge and skills essential for job success. These courses were specifically designed for taught postgraduate students to enable the focus and content to be tailored to their requirements.

Networking and Alumni Support

To assist students in developing a strong social support network from the outset, a mega welcoming session was launched to help participants from all programs get acquainted with each other, teaching faculty, academic advisors, program directors and administrative members. Key support services such as the Language Center, Student Counseling Office, and Career Center were also introduced at the session. In addition, orientation and individual program tea receptions were held to facilitate course selection and course management. During their studies, students enjoyed more opportunities to attend informal gatherings and social events. Alumni were often invited to join these activities to share and to inspire students in their course work and career preparation. Students were also encouraged to join alumni activities.









Alumni Associations

In response to student feedback, two taught postgraduate alumni associations were formed during the period under review: the Engineering Enterprise Management Alumni Association and the MSc in Telecommunications Alumni Association. As alumni activities are often open to students as well, such organizations are highly useful in promoting networking as well as professional interflow.

Steps Forward

To attract more top students, scholarships will be made available for each program from 2012-13. To excel and to make our students more competitive, industry collaborations will also be explored in order to open up student internships and industrial project opportunities. Most importantly, program quality will be rigorously controlled in alignment with University guidelines. Dean's Message

TACKLING THE GRAND CHALLENGES

The drive to make a leading contribution to the global issues of our time is adding fresh, multidisciplinary dynamism to the School's thriving research culture

As theme-based research grows in global importance, the School is placing increasing emphasis on a multidisciplinary approach to projects, with the aim of bringing together our senior faculty members to work on transformational solutions to major issues facing humanity. In 2009-11, we have also encouraged collaborations outside and inside Hong Kong and set up a faculty award scheme to recognize the significant achievements of our academics.

Fostering Collaborations

As research issues escalate in complexity and cost of funding, collaborative projects are offering new, thought-provoking avenues for cutting-edge studies.

Focus on Energy

In line with the drive for tackling major global research challenges, the School started to establish an interdisciplinary Energy Institute in 2011. The initiative was a result of more than a year's planning and consultation by various members of the School's faculty team. It is being supported financially by HKUST's Special Research Fund Initiative. Initial areas of focus are sustainable technology, energy efficiency and conservation. The proposed Institute seeks to build on faculty strengths to promote interdisciplinary collaboration and serve as a focal point to attract major funding.

The School also helped to launch the HKUST Research Forum Series in November 2011, with the first event on the topic of energy. Co-organized by the Office of the Vice-President for Research and Graduate Studies, the gathering shared information about what was ongoing in energy research at HKUST. Guests Prof Qingyan Chen, Vincent P Reilly Professor of Mechanical Engineering at Purdue University, Prof Surendra Shah, HKUST Institute for Advanced Study Fellow and Walter P Murphy Professor of Civil and Environmental Engineering at Northwestern University and Mr Bob Aylsworth, Vice President, WW Engineering and Chief Innovation Officer of Emerson Network Power, presented their visions and gave valuable comments on energy research directions.





Water Treatment Advance

Prof Guanghao Chen, Civil and Environmental Engineering, established a close relationship with Delft University of Technology, UNESCO-IHE Institute for Water Education and the University of Cape Town, South Africa. A joint team from these institutions received a €700,000 grant from UNESCO-IHE to undertake a pilot-scale demonstration of an integrated saline water supply system with sulphate reduction, autotrophic denitrification and nitrification integrated (SANI) technology in Cuba. SANI is a novel sewage treatment technology invented by a HKUST research team led by Prof Chen. It has been recognized by the International Water Association as one of the most successful water management systems around the world. The relationship between the organizations also includes student exchange and supervision.

Cleaning Out Pollutants

Prof Gordon McKay, Head of Chemical and Biomolecular Engineering, worked with the Department of Energy and Environment, École des Mines de Nantes, France, on the removal of pollutants from water. Prof McKay and partners from École des Mines de Nantes received two Hong Kong Procore Awards in 2009 and 2010 to continue the research. Locally, Prof McKay teamed up with Prof Yau Shan Szeto, Institute of Textiles and Clothing, Hong Kong Polytechnic University, on a project involving the production and applications of nanochitosans. The pair shared two collaborative Research Grants Council awards in 2009 and 2010, with the awards totaling HK\$1.2 million.





Communication Lines

Prof Dekai Wu, Computer Science and Engineering, has been participating in the US Defense Advanced Research Projects Agency (DARPA)-funded collaboration on the Broad Operational Language Translation (BOLT) Program, together with SRI (Stanford Research Institute), US, and many other Western universities, including Columbia and Edinburgh. At the same time, he is participating in the European Union-funded collaboration on the EU-BRIDGE Large-Scale Integrating Project, together with Karlsruhe Institute of Technology and RWTH Aachen University in Germany, University of Edinburgh in the UK, research institute Fondazione Bruno Kessler (FBK) in Italy, and others. Both projects center on bringing semantic structure into the machine learning of automatic human language translation models. Prof Wu's DARPA and EU grants are generously funded by the US and the European Union. Each of the grants is about HK\$8 million, a scale of funding for projects of this type that is unprecedented in Hong Kong, China, and most of Asia.



Image Building

Prof Pedro Sander, Computer Science and Engineering, undertook projects with Microsoft Research, US, Instituto Nacional de Matemática Pura e Aplicada (IMPA), Brazil, and Princeton University respectively. Topics included image-based bidirectional scene reprojection, amortized supersampling, antialiasing recovery, anisotropic blue noise sampling, parallel view-dependent level of detail control, interactive painterly stylization of images, and videos and 3D animations.

Regional and Local Joint Studies

The School's researchers have also helped to boost progress in different engineering fields regionally and locally.



In 2011, **Prof Charles Ng**, Civil and Environmental Engineering, and five mainland professors were awarded funding of over RMB30 million in total under the Ministry of Science and Technology's 973 research program. The study will tackle major technical issues for solving potential environmental hazards from municipal solid waste in landfills. Research findings are expected to be applied to the design and operation of such landfills in China. In 2010, Prof Ng was made the first Chang Jiang Chair Professor in Geotechnical Engineering in the country by the Ministry of Education. The same year, he was invited to deliver a Zeng Guoxi Lecture at Zhejiang University, Hangzhou. The prestigious lecture series features distinguished presentations by world-renowned scholars from China and overseas.



Prof Oscar Au, Electronic and Computer Engineering, and his team have seen a series of technical tools adopted in the development of Mainland China's AVS standard. The team's L-slice was accepted in March 2009. Earlier, their fast motion estimation algorithm and light-weight encryption tool were accepted in March 2006 and December 2008 respectively. Prof Au also undertook research projects together with the Hong Kong Applied Science and Technology Research Institute (ASTRI). His team was involved in research on video coding tools for a future multimedia standard. The team explored intraprediction, motion vector coding and subpixel rendering. A second project focused on 3D video coding and view synthesis for 3DTV. The ASTRI research involved academics from The Chinese University of Hong Kong, City University of Hong Kong and Hong Kong Polytechnic University.



Prof Bo Li, Computer Science and Engineering, became the principal Hong Kong investigator for the Aquiculture Technological Innovation Platform at South China Agricultural University. The project received RMB2.5 million from the Hong Kong Guangdong Joint Program (Guangdong Science and Technology Bureau) in 2011. Prof Li has established a variety of ties with different mainland universities, including Tsinghua University where he is affiliated and engaged in research collaboration with the ChinaCache Lab, Shanghai Jiao Tong University, where he is Chang Jiang Visiting Chair Professor (2010-13), and Huazhong University of Science and Technology, where he serves as an adjunct professor.



The Department of Mechanical Engineering has developed a strong research infrastructure and network in Mainland China. Facilities include a mechanical engineering laboratory in the HKUST Shenzhen Industry, Education and Research (IER) Building in Shenzhen's High-Tech Industrial Park; and the Center for Engineering Materials and Reliability and the Building Energy Research Center, both at HKUST Fok Ying Tung Graduate School in Nansha, Guangzhou. In June 2010, the HKUST LED-FPD Technology R&D Center at Foshan was formally established. The Center will focus on applied LED research and development of packaging and manufacturing technologies to assist local industries. It also creates a platform to realize collaboration opportunities and to source funding in Mainland China. The Foshan Municipal Government provided start-up funding of RMB25 million and 1,800 sgm of space in Nanhai District.





In Hong Kong, **Prof Ying Chau**, Chemical and Biomolecular Engineering, collaborated with Dr Vincent Lee, a local ophthalmologist at Adventist Hospital, on an Innovation and Technology Fund project to develop a long-acting antiangiogenic formulation for treating eye diseases. She received industrial sponsorship from Lee's Pharmaceutical Ltd, Hong Kong for the project. Separately, Prof Chau is partnering Dr Amy Lo at the Eye Institute at the University of Hong Kong in evaluating a new ocular drug delivery system.

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Remain of Englanding Humanian Remains Excellence Award Remains Future Directions of Display Technologies Prof Hol-sing Kwok

28 Nov 2011 (Mn

Celebrating Faculty Achievements

To recognize the sterling work of faculty members, the School established annual research excellence awards in 2011. The awards provide an inspiring tribute to the work of senior academics as well as rising stars. Nominees must display excellence in research over a sustained period of time, with research achievements recognized by the award expected to be for work carried out mainly at HKUST. Other criteria included research training provided to students and post-doctoral researchers, and their leadership role in collaboration with national and international research partners.

The four inaugural winners were **Prof Hoi Sing Kwok**, Dr William MW Mong Chair Professor of Nanotechnology, Electronic and Computer Engineering (Distinguished Research Excellence Award); **Prof Guohua Chen**, Chemical and Biomolecular Engineering (Research Excellence Award); **Prof Qian Zhang**, Computer Science and Engineering (Research Excellence Award); and **Prof Matthew McKay**, Electronic and Computer Engineering (Young Investigator Award).



As part of the Distinguished Research Excellence Award, the most prestigious of the honors, the recipient is invited to deliver a public lecture, a distinction in itself. Prof Kwok's lecture on "Future Directions of Display Technologies", his field of expertise, drew more than 120 guests, industry partners, faculty members and students in November 2011. Prof Kwok's many achievements include the development of silicon micro-displays and the technology transfer of active-matrix organic light-emitting diode displays, all created at HKUST.

Prof Chen has been a major contributor to electrochemical technologies for industrial wastewater treatment and application of nanotechnologies to environmental protection. Prof Zhang is internationally known for her research in mobile multimedia communication and advanced wireless networking. Junior faculty member Prof McKay has made strong contributions to the fundamental understanding and design of advanced signal processing methods for wireless communications.





Research Funding

Funding for the School's research endeavors comes from Hong Kong's Research Grants Council and other sources. Over the period under review, the School attracted a significant amount of non-Research Grants Council funding, adding substantially to the annual totals obtained.

Sources of School of Engineering research funding (in HK\$M)							
Year	UGC/RGC*	Non-UGC/RGC	Total				
2008-09	77	73	150				
2009-10	75	89	164				
2010-11	75	72	147				

*University Grants Committee / Research Grants Council

The School of Engineering has been doing well in Collaborative Research Fund (CRF) grants. **Prof Charles Ng**, Chair Professor of Civil and Environmental Engineering, received a total of HK\$6.67 million for his project "Green Slope Engineering for Hong Kong" in 2009-10,



and **Prof Tianshou Zhao**, Chair Professor of Mechanical Engineering, was awarded HK\$4.3 million for his project "Understanding the Coupling of Mass-transport and Electrochemical Reactions in the Nanostructured Fuel Cell Electrodes" in 2011-12. A new Theme-based Research Scheme (TBRS) was established by the Research Grants Council in 2010. **Prof Chung Yee** Lee, Chair Professor of Industrial Engineering and Logistics Management, was awarded HK\$13.3 million for his project "Transforming Hong Kong's Ocean Container Transport Logistics Network" in 2011. The research team led by Prof Lee was the only HKUST-led team that was awarded TBRS in 2011. These major projects demonstrate the research capability of the School of Engineering in tackling inter-disciplinary problems.



In addition, the School's academics continued to succeed in gaining grants from the highly competitive National Natural Science Foundation of China/ Research Grants Council (NSFC/RGC) Joint Research Scheme. The success rate for scheme applicants overall in the past three years has been around 8% or less annually.

School of Engineering faculty receiving funding under the NSFC/RGC Joint Research Scheme



2009-10

Prof Lei Chen, Computer Science and Engineering, with Peking University, "Privacy-preserving Data Networks Publishing"



Prof Furong Gao, Chemical and Biomolecular Engineering, with Tsinghua University, "Fault-tolerant Control of Batch Processes with Hybrid Natures"



Prof Zongjin Li, Civil and Environmental Engineering, with University of Jinan, "Cement-based Piezoelectric Composites and Transducers for Concrete Structure Health Monitoring"



Prof Hai Yang, Civil and Environmental Engineering, with Beihang University (Beijing University of Aeronautics & Astronautics), "Multi-objective Design, Optimization and Implementation of Network Congestion Pricing Schemes"



Prof Qiang Yang, Computer Science and Engineering, with Shanghai Jiao Tong University, "Heterogeneous Transfer Learning with Applications to Web Data Mining"



Prof Guohua Chen, Chemical and Biomolecular Engineering, with Dalian University of Technology, "Novel Highly Ordered Micro-(Nano-) Tube Electrode Materials: Preparation, Characterization and Application in Photoelectrochemical Degradation of Priority PTS Pollutants"

Main source: Research Grants Council, www.ugc.edu.hk/eng/rgc/index.htm

2010-11



Prof Jeff Hong, Industrial Engineering and Logistics Management, with Fudan University, "Combing Simulation and Optimization with Applications in Financial Risk Management"



Prof Andrew Poon, Electronic and Computer Engineering, with Institute of Semiconductors, Chinese Academy of Sciences, "Hybrid InGaAsP-silicon Unidirectional-emission Microcavity Lasers for On-chip Optical Interconnects"

<u>2011-12</u>



Prof Bo Li, Computer Science and Engineering, with Institute of Computing Technology, Chinese Academy of Sciences, "The Minimized Energy Consumptions and Maximized Resource Utilizations in Large-scale Datacenters"



Prof Jianan Qu, Electronic and Computer Engineering, with University of Science and Technology of China, "Photochemical Properties of Endogenous Biological Molecules: Fundamental and Application"



Prof Long Quan, Computer Science and Engineering, with Shenzhen Institutes of Advanced Technology, Chinese Academy of Sciences, "Theory and Practice of Large-scale 3D Urban Reconstruction and Modeling"



Prof Tongyi Zhang, Mechanical Engineering, with University of Science and Technology Beijing, "Mechanical-electrical-chemical Coupling Properties of Nanoporous Metals"

CULTIVATING WIDER VISION

In 2009-11, the School successfully extended its reach at home and overseas through international alliances, regional initiatives and more interaction locally Building on the interactive partnerships with universities and organizations established in past reporting periods, the School endeavored to create alliances to help undergraduates increase their exposure outside Hong Kong and to propel forward regional ties. We also sought to develop community awareness of the key role of engineering and technological development in everyday life and to generate enthusiasm for engineering among high school students through hands-on experience.



International Vision

The School's presence in the global arena grew in several different areas during the period under review.

Fostering Young Pace-setters

Helping students to gain greater awareness of different perspectives through international alliances were ongoing School goals.

- A significant partnership between the School and Princeton University School of Engineering and Applied Science was established in 2011 to launch a reciprocal, research-based undergraduate summer exchange program. HKUST thus became the first university in Asia to enter such an agreement with Princeton in the field of engineering and only the second worldwide. The agreement was signed at the HKUST campus by Prof Khaled Ben Letaief, Dean of Engineering, and Prof Vincent Poor, Dean of the School of Engineering and Applied Science at Princeton.
- The prestigious annual Stanford-HKUST Joint Global Manufacturing Course continued to be jointly offered to students from the Department of Industrial Engineering and Logistics Management and Stanford University. First started in 1995, the course enables students to tackle industrial problems with their Stanford peers. It focuses on issues that are global in nature and related to product development, strategic planning and supply chain design. Three to four students from each institution work together as a team to tackle a defined problem sponsored by a company that has interests in North America and the Asia-Pacific region.
- Insight into Russia was boosted with the arrival of two undergraduate visiting students from Ural Federal University. The students came on exchange to the Department of Mechanical Engineering in 2011 under the UC RUSAL Scholarship program. These scholarships encourage communication and promote greater understanding between students in Russia and Hong Kong as well as provide a platform to facilitate exchange of knowledge and ideas. They are part of a wider five-year joint project between the world's largest aluminum producer and HKUST to foster joint scientific research, address environmental issues and promote cooperation between young scientists from both regions.



Technology Industry Innovation Award Launched

The School established a high-level accolade in 2011 to recognize the efforts of a top technology leader who has shown outstanding capabilities in implementing innovation that has improved people's lives. The first winner of the HKUST Technology Industry Innovation Award was Mr Pony Huateng Ma, Chairman and CEO of Tencent Holdings Ltd. The company has led the way in the development of online platforms in Mainland China and become one of the largest integrated Internet service companies in the world.



Hewlett Packard (HP) Catalyst Initiative

In 2010, HKUST became one of 35 educational institutions across 11 countries to be selected by Hewlett Packard to take part in the HP Catalyst Initiative. The project seeks to develop more effective approaches to worldwide education in science, technology, engineering and mathematics. HKUST is involved as a member of the Measuring Learning Consortium, led by Carnegie Mellon University. The University put the grant received from Hewlett Packard toward a new teaching lab with high-end computers for Computer Science and Engineering students. The aim is to assist in monitoring and evaluating quality of teaching and learning in computing classes.



Fast Forward to the Future

HKUST co-organized the first IEEE Technology Time Machine Symposium in June 2011. Organized by IEEE and co-organized together with Hong Kong Applied Science and Technology Research Institute (ASTRI), the major three-day international event brought 200 corporate industry leaders, academics and other experts from around the world to Hong Kong to discuss "Technologies Beyond 2020". The theme covered a number of potentially high impact emerging technologies, ranging from radio access technology and biomedical sciences to organic electronic materials. There was also a panel discussion focused on global R&D leadership. HKUST Dean of Engineering Prof Khaled Ben Letaief served as General Co-Chair of the Organizing Committee.



Wilson Tang Lecture

The contributions of Prof Wilson Tang, a leading member of the School in its early years, were recognized with the inauguration of a prestigious international keynote lecture. Prof Tang, Head of Civil Engineering at HKUST from 1996 to 2001, was a founding researcher in geotechnical reliability and risk, and his breakthroughs led to many fresh insights. The Wilson Tang Lecture was inaugurated in 2009 at the Second International Symposium on Geotechnical Safety and Risk (ISGSR) and is hosted by GEOSNet. Prof Tang passed away in early January 2012 at the age of 68.

Regional Driver

The School has contributed to strengthening ties between engineering institutions and industry, scholars and business leaders during 2009-11.

Links with Asia

The School has been proactive in helping HKUST establish links between top technology institutions within the region and participating in leadership conferences. In 2009, the Asian Science and Technology Pioneering Institutes of Research and Education (ASPIRE) League was formed. Members comprise HKUST, Korea Advanced Institute of Science and Technology, Nanyang Technological University, Tokyo Institute of Technology and Tsinghua University. The League plans and promotes joint activities, including student and research exchanges, with particular emphasis on sustainable development in Asia. HKUST is also a collaborating partner of the Asian Program for Incubation of Environmental Leaders (APIEL), established by the University of Tokyo. Engineering students have also been involved in the conference Festival of Thinkers held in the United Arab Emirates.

Greater China Collaboration

The Department of Industrial Engineering and Logistics Management brought 40 department heads from Mainland China, Taiwan and Hong Kong to HKUST in 2011 to promote the development of industrial engineering and related areas in Greater China and to boost exchanges. The 1st Forum for Council of Industrial Engineering Department Heads in Greater China saw Prof Fugee Tsung, Head of Industrial Engineering and Logistics Management at HKUST, elected Founding President of the Council.







Huawei-HKUST Innovation Lab

In a significant move, the Huawei-HKUST Innovation Lab opened in April 2009. Huawei Technologies Co Ltd is a leading global next-generation telecommunications networks provider, headquartered in Shenzhen. The research and development agreement with the University focuses on exploration of pioneering telecoms, wireless and related emerging technologies. The lab involves the Computer Science and Engineering Department and the Electronic and Computer Engineering Department and serves to connect researchers from industry and academia. It was Huawei's first research and development lab in Hong Kong.

Zhejiang Advanced Manufacturing Institute

The School continued to build HKUST's profile in the Yangtze River Delta through the Zhejiang Advanced Manufacturing Institute (ZAMI). The Institute was set up in 2004 together with the Zhejiang Provincial Science and Technology Department and Hangzhou Yuhang District Government to work with local partners on research and development projects to advance design and manufacturing technology. The ZAMI Director is Prof Mitchell Tseng, Chair Professor of Industrial Engineering and Logistics Management and Director of the Advanced Manufacturing Institute at HKUST. ZAMI has now developed executive training programs, technology transfer and workshops for mainland industry leaders. In 2011, in association with six engineering school departments and 11 research laboratories, ZAMI launched the HKUST Hangzhou Internet of Things Intelligent Technology Center. The center seeks to integrate capabilities and create breakthrough core technologies and applications for the Internet of Things (IoT).

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Local Input

Reaching out to different sections of the community and alumni has continued to raise the School's profile.

Boosting Pre-entry Interest

Moves to enable high school students to gain more insight into the world of engineering have led to an increasing number of activities between different members of the School and potential applicants. Such events have met with an enthusiastic response from secondary school students.



The School worked with IBM to build interest among secondary school students in technology and the work of engineers. In 2009, the ongoing collaboration resulted in a series of Engineering Week programs while in 2010 the School provided day camps over the summer for secondary school students and teachers. The Technology Exploration Camp 2010 saw 800 students from 40 secondary schools take part in hands-on laboratory sessions, including building electronic dice, creating flash animations and making skincare lotion. Students gained additional inspiration through interaction with HKUST academics and IBM experts.



Students from Christian Alliance SW Chan Memorial College helped to produce a fluorescent pen to monitor cleanliness in hospitals in a hands-on project in 2010-11 with Prof King Lun Yeung, Chemical and Biomolecular Engineering. When run over any surface in the hospital, the pen can show if the area meets the appropriate hygiene standard. The marker was the first of its kind in Hong Kong. The following year, students field tested a smart antimicrobial coating in a school setting with Prof Yeung.



An interactive workshop provided a fascinating introduction to multi-image panoramas for 50 high-flyers from local and international schools in Hong Kong. The event was led by Prof Pedro Sander, Computer Science and Engineering. Prof Sander broke the world record in September 2010 when he produced the world's largest digital photo with a resolution of 150 billion pixels.



The School ran its first photo contest in 2010 to encourage secondary and tertiary students to see the connections between engineering and daily life. The contest received a total of 775 photo submissions from more than 375 contestants, with 46 pictures finally selected as winners. The first round of judging was through an online poll on Facebook. The final judging was provided by a panel comprising Ir Dr Andrew Ka Ching Chan, then President of The Hong Kong Institution of Engineers, Mr Sui Kou Ng, then Vice Chairman of the Hong Kong Association of the Heads of Secondary Schools, and Mr Bobby Yip, former President of Hong Kong Press Photographers Association.

Involving the Community

Members of the public were brought face to face with the world of innovation through an exciting display of the School of Engineering's work at the Hong Kong Science Museum in October 2011. The *Bring Technology to Community* exhibition showed a variety of projects by faculty members, students and alumni, demonstrating how technology creates change and has an impact on people's lives. Items included an underwater robot, a mini smart car, and a digital photo frame designed to offer cognitive therapy for Alzheimer's sufferers.

The School also actively participated at the annual InnoCarnival, organized by the Innovation and Technology Commission since 2008. The event is held at the Hong Kong Science Park to generate interest in innovation, technology and design among young people and their families.





Building Alumni Relations

The School worked hard to strengthen ties with alumni, with a number of new associations formed for postgraduate programs. These include the Engineering Enterprise Management Alumni Association, MSc in Telecommunications Alumni Association and Civil and Environmental Engineering Postgraduates and Scholars Association.

To keep alumni in touch with the latest developments at the School and with each other, a series of celebratory dinners was organized during the period under review. Among these happy and well-attended events were alumni dinners arranged by the Department of Industrial Engineering and Logistics Management in February 2009 and 2010; Electronic and Computer Engineering alumni dinners, organized by the Department annually in November; the homecoming reunion dinner for alumni of the Department of Civil and Environmental Engineering in June 2010; and the Department of Mechanical Engineering 20th Anniversary dinner in November 2011.

Over 330 of the School's graduates and their families also took part in the Engineering Alumni Fun Day in May 2011. This was followed by a homecoming dinner to celebrate HKUST's 20th Anniversary.

熱烈祝賀 香港科技大學上本及環境工程研究生及學者校友會成立 Congratulations on the Fourtidation of the HKUST Civic and Environmental Engineering Port-Graduates and Scholars Association 54 March 2019





Empowering Excellence

Driving the Future

EMPOWERING EXCELLENCE

Department of Chemical and Biomolecular Engineering (CBME) Department of Civil and Environmental Engineering (CIVL) Department of Computer Science and Engineering (CSE) Department of Electronic and Computer Engineering (ECE) Department of Industrial Engineering and Logistics Management (IELM) Department of Mechanical Engineering (MECH)


Department of Chemical and Biomolecular Engineering

The past three years have proved highly productive in the Department of Chemical and Biomolecular Engineering, which is the first and only department of its kind in Hong Kong.

A key objective has been to ensure continuity between the three-year degree and the new four-year system being introduced in September 2012. Our discipline can contribute to many areas. In redesigning our curriculum – a task which engaged us for 18 months – we have placed particular emphasis on increasing the interdisciplinary nature of our programs to keep the Department at the forefront of change.

Internationalization of the Department has advanced considerably. We have achieved our 20% non-local undergraduate quota and recruited a broader range of nationalities to our programs, including students from Asia, the Middle East, and North America, as well as Mainland China.

We have also boosted the number of female students, with the proportion rising from around 20% of our intake five years ago to 40% in 2011. Our enterprising undergraduate programs have undoubtedly helped draw the attention of women. In addition to our core chemical engineering bachelor program, we offer degrees in chemical and environmental engineering and chemical and bioproduct engineering. These combined programs clearly connect with areas such as healthcare, pharmaceuticals, and safety and health, broadening the field's appeal.

Indeed, prospective jobs for graduates have burgeoned in recent years along with product differentiation, sustainability issues, and concerns over energy. Such vibrancy has seen the Department expand its student intake over the past three years as HKUST is optimally placed to maximize the opportunities arising from this situation.

The University is situated in Hong Kong next to Southern China and its huge chemical complex, which is currently among the world's largest. Hong Kong is also located at the heart of Asia, a region where many significant research activities in areas such as biofuels are ongoing. The Department's unique position in Hong Kong's tertiary sector further adds to career prospects for our graduates.

While we remain a relatively small department in size, the impact of our 15 internationally recognized faculty members

remains far-reaching outside and inside HKUST. Our size also enables us to build close links between undergraduates, postgraduates and faculty members.

We are noted for our research output, publications, and quality of work; and facilities within the Department have remained outstanding, with great support from the University, Hong Kong government, and industry.

In addition, our academics play leading administrative roles in HKUST's Nano and Advanced Materials Institute, Interdisciplinary Programs Office, and the recently established Division of Environment (2009) and Division of Biomedical Engineering (2011).

With my own term as Head of Department ending in early 2012, the Department carried out a worldwide search for a replacement during the period under review. I am very pleased to report that the new head is Prof Guohua Chen, a renowned environmental and energy researcher and a long-time member of our own Department.

Prof Gordon McKay

Head of Chemical and Biomolecular Engineering

Major Research Areas

Advanced Materials

- Exploration of polymer and polymer composites including polymer bamboo composites.
- Development of ultra-high strength polymers.
- Membranes for fuel cells and water treatment.
- Advanced catalytic materials, for SOX and NOX destruction and Fenton's reagents for water pollution treatment.
- Novel adsorbents derived from wastes such as bagasse pith, vehicle tires, plastics, waste construction wood and bamboo.
- Ion exchangers for metal removal from effluents using e-waste.
- Packaging materials.
- Nanochitosans for pollution treatment, dairy waste treatment and textile applications.
- Nano-porous MCM-41 and derivatives for metal ion removal from effluents, selective metal separations and health product.
- Use of DNA and engineering materials for templates for the applications of controlled drug delivery and biomacromolecular characterizations.
- Nano product transdermal microneedles made from nanoporous zeolite-polymer composites for controlled and sustained drug delivery are being developed, translated into patches, and tested for insulin delivery.
- More than 10 research projects covering applications in a range of fields, including health, environment, medical, microelectronics, textiles, catalysts, and polymers.





Biochemical

Biofuels

- The production of biofuels from algae, agricultural plants including jatropha and sugarcane.
- Conversion of bio-mass such as wood, bamboo, jatropha seedcake into biofuel by pyrolysis.
 Computer models to predict the production yield as well as energy consumption of the process, allowing better design and operation of the pyrolysis plant.
- Conversion of algae into biodiesel, including the mechanism of transesterification reaction from lipid to oil, and extraction and separation techniques. Six patents have been filed to date on processing and algae cell culture.

Bioprocessing

• Uses quantitative design methods including SuperPro and software developed in-house for specialized applications related to biochemical and environmental biotechnology. Applications include drying wastes and antibody production.

Drug Delivery

• Design of biomaterials and nanocarriers for drug delivery, with applications in ocular and cancertargeted delivery.

Microsystems

- Development of new DNA-based sensing technologies and integrated device platforms for point-of-care application.
- Widely recognized research in electrochemistrybased real-time polymerase chain reaction (PCR) technology. This e-approach promises a new diagnostic product competing with existing fluorescence based counterparts.
- Microbial engineering using a synthetic biology approach. Microorganisms can be reengineered or re-assembled for interesting applications in bioenergy and bioassay.

Proteomics and Metabolomics

• Enhancement of technology through method developments in sample preparation, mass spectrometer instrumentation, data analysis and integration.





Energy

Energy Efficiency

 Increasing energy efficiency of chemical processes by process integration, with research extended from single production processes to large-scale chemical production sites.

Fuel Cells

- Miniature fuel cell devices based on new nano-confined membranes that allow fuel cells to operate at high temperature and in dry conditions resulting in higher energy conversion efficiency.
- Novel catalysts and reactor architecture for artificial photosynthesis system for conversion of water and carbon dioxide at low temperature into value-added chemicals and fuels are being developed.







Environmental

Atmospheric

 Research to study, identify and characterize atmospheric particulate material. Air pollution monitoring and minimization performed during waste combustion studies.

Solid Wastes

- Development of value-added products from e-waste.
- Production of chitin and chitosan from prawn waste.
- Sewage sludge dried into high calorific-value (CV) fuel and use of sewage sludge ash for cement production.

Waste Effluents

• Advanced ozone membrane reactor for highefficiency treatment of emerging micropollutants, in particular endocrine-disrupting compounds and refractory organics.

- Visible light photocatalyst that effectively degrades problematic organic compounds in water and air into harmless minerals.
- Several projects in electrochemical wastewater treatment. One group is working on electrochemical methods such as electro-coagulation, electro-flotation and electro-osmosis.

Waste to Energy

- Several large research or industrial projects covering waste-to-energy or waste-to-products.
- Integration of municipal solid waste incineration with cement production, significantly reducing energy input of the cement process and minimizing pollution.
- Conversion of waste tires or waste plastics into fuels.



Process Systems Engineering

- The development of novel kinetic and diffusion mass transfer models for reactions, adsorption and ion exchange processes, using mathematical modeling and computer simulation techniques.
- Novel pseudo-first order irreversible and reversible kinetic models developed.
- Pore, branched multi-pore and solid diffusion models developed.
- Other areas include process control, polymer processing, process simulation, product development and crystallization.





Research Highlights

Novel Fibers Herald Change

Prof Ping Gao and her research group have continued to work on the development of novel high-performance polymer nanocomposite materials. With support from the Nano and Advanced Materials Institute Ltd, hosted at HKUST, the group developed a novel carbon nanotube reinforced thermotropic liquid crystalline polyester fiber for high-performance headphone cables and fiber optic cables. Newly developed biaxially oriented ultra-high molecular weight polyethylene microporous membranes are being tested as separators in lithium-ion batteries, fuel cell batteries and possibly solar cell batteries. These microporous membranes are also being investigated in relation to smart windows, water desalination processes and micro-filtration applications.

Supersite Helps to Clear the Air

Prof Chak Keung Chan led a team of HKUST researchers in developing the HKUST Air Quality Research Supersite, which uses state-of-the-art real-time air quality instruments to understand the characteristics and formation pathways of atmospheric pollutants in Hong Kong and the Pearl River Delta. Launched in 2011, the site is being used as part of a major study seeking to find solutions for effective managemen of particulate matter exposure in Hong Kong. The 1,000m²plus Supersite facility is located at the shorefront of HKUST's campus. Equipment includes an automatic weather station tower and outdoor plinths for samplers and equipment, a weather-proof air-conditioned modular house with multiple sample inlets and a sky-window for instrumentation. Many of the instruments are exclusive and the most advanced in the region.



Moving Ahead in Battle Against Infection

A smart anti-microbial coating developed by Prof King Lun Yeung and an was unveiled in 2010. The revolutionary colorless and odorless, and can be sprayed onto a wide range of different least 30 days. Tests showed the HKUSTdeveloped coating can kill 99.9% of bacteria within one minute. It can releasing a larger amount of disinfectant to inactivate the disease-causing microbes and protecting other people touching the same surface. It can be washed off by using a solution of water and detergent. Patent applications are underway in the US, Europe, India, Mainland China and Taiwan. Clinical field tests started in 2011







Citation Record

Prof Gordon McKay's paper "Pseudo-Second Order Model for Sorption Processes," co-authored with post-doctoral fellow Y S Ho and published in *Process Biochemistry* (Vol 34 pp. 451-465 [1999]) has received over 1,600 citations and was the most highly cited paper in the Science Citation Index (SCI) Chemical Engineering section from 2008-11. It was also the only paper in the section in both 2010 and 2011 to be cited more than 300 times in any one year. Dean's Message

Generating Global Impact

Inspiring Future Leaders



Department of Civil and Environmental Engineering

The Department of Civil and Environmental Engineering has used the forthcoming introduction of the four-year degree program in Hong Kong to completely revamp our undergraduate curriculum and teaching methods during the period under review. It has been an exciting if demanding time for colleagues working on the redesign.

We already provide students with a useful choice of focus through our two undergraduate degree programs: one centered on civil and structural engineering; the other on civil and environmental engineering. Locating these programs within a broader, more flexible educational framework and outcomebased learning, we fully expect the result to be dynamic, innovative civil engineers with wide understanding of how the world works and confident written and oral communication skills in English and Chinese. Our approach to research has also taken significant steps forward. The Department's productive and diverse faculty members have established a strong reputation for their academic research. Over the past three years, the Department has continued to be engaged in solving real-world issues. Green slope engineering – the use of plants to stabilize slopes instead of concrete – is one of the important initiatives being undertaken. Hazard risk and mitigation, sustainability in urban environments, and underground engineering are other key areas to which we are contributing.

We have been assisted in such endeavors by HKUST's excellent research facilities. These include a geotechnical centrifuge, equipped with the first biaxial servo-hydraulic shaking table and the second four-axial robotic manipulator in the world, and an environmental wind/wave tunnel. Such facilities enable us to increase knowledge of the impact of earthquakes and how soil structures behave, and engage in real-world testing for important structures in Hong Kong and beyond.

In addition, our location has proved an enormous asset for our researchers and students in terms of projects and job prospects. Hong Kong's special East-West orientation has enabled the Department to develop a great network with the international community and at the same time close China ties. And with its rapid urbanization, infrastructure development, and sustainability issues, I would say China is one of the places that currently needs civil and environmental engineers the most.

Thus, the Department has had many opportunities to put what we do into practice or work with China counterparts on largescale meaningful projects. Air quality research within the Pearl River Delta is one area where we have made significant impact. In Hong Kong, our graduates can also gain the experience they need to launch their careers in the major league given the huge infrastructure projects planned, such as the Hong Kong-Zhuhai-Macau Bridge and the Guangzhou-Shenzhen-Hong Kong Express Rail Link.

These factors, along with our strong record of achievement, have helped our drive in the past three years for greater student diversity through international recruitment and exchanges. Creating a more international body within the Department allows students to learn about intercultural issues first-hand. As civil engineers, there is a high chance that our graduates will spend part of their careers overseas and a multicultural experience at university is excellent advance preparation.

I am also particularly keen to strengthen our links with industry and alumni and have been proactively working to achieve this over the past three years. By listening to their problems, sharing our findings, and working together to develop research projects with practical applications, the Department should be able to work effectively toward our goal of making more impact on society.

> Prof Christopher Leung Head of Civil and Environmental Engineering

Major Research Areas

Construction Management

Project delivery systems; construction law and contract administration; construction methods; construction information technology and knowledge management; construction supply chain management; service computing in construction; risk analysis and management; highway asset management; construction waste management; construction logistics management; earned value management.

Construction Materials

- Development of construction materials and related technologies to enhance the sustainability of construction activities.
- Multi-scale study of cementitious materials for mix optimization; use of wastes and by-products in concrete; concrete with enhanced thermal performance for building energy-saving; non-destructive testing methods for construction materials; optical fiber and piezoelectric sensors for structural health monitoring.





Environmental Engineering

- Water and wastewater treatments; geo-environmental problems; atmospheric modeling and air pollution.
- Development of energy efficient and space-saving treatment technology for saline sewage; control and removal of harmful disinfection by-products in drinking water supply; reuse of effluent water; environmental system analysis; air quality modeling of the Pearl River Delta Region and urban environment in Hong Kong.

Geotechnical Engineering

Unsaturated and soil mechanics; constitutive and physical modeling of soil behavior; multi-scale simulation; multiphase flow in soil; thermal-bio-physico-chemical soil behavior; earth-atmosphere interaction; soil-structure interaction; green slope engineering; soil testing techniques; wave-based characterization of geomaterials; geotechnical risk and reliability.

Driving the Future

Hydraulics and Hydrology

- Water resource and water supply; coastal engineering; urban air quality.
- Stochastic analysis and modeling of temporal and spatial rainstorm characteristics; uncertainty and reliability analysis techniques for design of hydrosystem infrastructures; leakage detection; beach erosion; analysis of wind flow over complex terrain for wind power generation and microclimate analysis; the effect of wind on air quality in urban environments.

Structural Engineering

- Design, analysis, assessment and mitigation of civil engineering structures under environmental and man-made hazards.
- Seismic and wind design of tall buildings and structures; structural optimization under seismic and wind loadings; condition assessment and mitigation of buildings and bridges under ambient and hazardous condition; smart structural technology; non-smooth mechanics for bridge engineering.

Transportation Engineering

Dynamic traffic assignment and dynamic traffic control; road pricing; public transport services planning and management; taxi industry; transportation network design and optimization; transportation system reliability.





Research Highlights



Green Slope Engineering

A research team led by **Prof Charles Ng**, Chair Professor and Director of the Geotechnical Centrifuge Facility, received a Collaborative Research Fund grant of HK\$6.7 million from Hong Kong's Research Grants Council in 2010 for a three-year project on "Green Slope Engineering for Hong Kong".

The prime objectives are to investigate and improve our fundamental understanding of root-soil-water interactions and to develop an innovative and environmentally friendly reliability-based preliminary design framework for an "integrated bioengineered live slope cover" for shallow soil slopes in Hong Kong.

Compared to conventional technology, there is a reduction of 90% in sludge, 50% in space and operational cost, and 36% in CO₂ emissions. A full-scale demonstration plant is being designed by the group and will be constructed at Sha Tin Sewage Treatment Works by the Hong Kong government. The invention provides an opportunity to re-design 100 years of practice in biological wastewater treatment.

Deck

Beam

Revolutionizing Wastewater

developed by a research group led by **Prof Guanghao**

Treatment Technology

Drainage Services Department.





Environmentally Friendly Contemporary Concrete

Prof Zongjin Li became the Chief Scientist for a prestigious Mainland China 973 project aimed at achieving better understanding of the fundamental hydration mechanism of contemporary concrete, the microstructure formation and its impact on the performance of concrete, as well as deterioration mechanism of concrete under the combination effect of loading and environmental factors.

The project started in 2009 and runs until 2014, with total funding of RMB31 million. The research team comprises 60 academics from eight universities and institutions, including five professors from HKUST. The project has already achieved important results in microstructure modeling for concrete hydration products, concrete service life design theory development, and toughness enhancement for concrete.

Some of the research findings have been applied in the construction of the Suzhou subway and Taizhou Yangtze River Bridge to enhance the durability and service life of the structures.



Department of Computer Science and Engineering

The Department of Computer Science and Engineering is one of the leading departments of its kind in Asia and the world.

According to Academic Ranking of World Universities (ARWU) surveys, the Department was No. 1 in Asia and No. 26 globally in 2010, and No. 1 in Asia and No. 21 in the world in 2011. In the

QS rankings, the Department was No. 1 in Greater China and No. 26 globally in 2011.

Computer Science and Engineering research has an average citation of more than 1,800 per faculty member. Our academics have received many prestigious awards and other recognition for their research achievements, becoming Institute of Electrical and Electronics Engineers (IEEE) Fellows, highly cited researchers, founding editor-in-chief of a major computer science and engineering journal, and gaining numerous best awards. They also held editorships of 54 international journals and chaired 65 international conferences and workshops in the period under review.

The Department is large, with our diverse, world-class faculty members representing over 12 different nationalities. We cover all the important areas in computer science and engineering in education and research, and have established strong collaborations with leading universities, research laboratories and industry from all over the globe. Our research is well funded by Hong Kong's Research Grants Council (42% success rate in 2011) and Innovation and Technology Fund. In addition, our Department is extremely well supported by industry, with numerous projects from Microsoft Research Asia, Google, Huawei, Alcatel, NEC, Tencent, to name but a few.

Over the past three years, we have been involved in 30 projects with industry. Through such partnerships, we work on realworld problems that have an effect on society overall as well as industry. Faculty members find it personally satisfying to contribute to meaningful change through such endeavors.

We place high priority on the teaching and learning of our undergraduates and have worked hard to redesign our curriculum for the four-year degree system starting in September 2012. This will see the introduction of many cutting-edge courses and specialty streams, enabling students to specialize their career trajectories and choose their study path accordingly. Whether a student wants to be a software engineer, entrepreneur, or researcher, our new curriculum will cater for those needs.

In working out the content, we looked at curricula from all over the world as well as organizations such as IEEE and the Association for Computing Machinery (ACM). We then drew on the best from all of them that suited our needs to develop what we really think is a novel and forward-looking undergraduate education.

In following this new curriculum, students will gain a global view of computer science from the very beginning before deciding on the specialty they would like to study in more detail. Furthermore, it is a curriculum that can evolve with the field so we can rapidly respond to emerging areas. With the field of computer science moving fast in many different directions, this is a highly advantageous innovation.

In research, we have also sought to position ourselves well in relation to key developments, for example, with respect to "Big Data". This is of critical relevance to many trends in computer science, including cloud computing, social networking, and mobile networking. Our aim in research in this area is to take the state of the art further. We would thus have tremendous impact.

The large size of our Department enables us to have faculty working in groups of critical mass on various research areas. In computer science and engineering, such an approach is important to achieve meaningful advances. All our different research groups – artificial intelligence, data and knowledge management, networking and computer systems, software technologies, theoretical computer science, and vision and graphics – have made significant research contributions to their respective areas. Among new issues we are looking at are social networking, data mining, security, and sensor networks.

The Department seeks to work at the forefront of research and education to foster global engineers and researchers whose technical and communication skills, innovative thinking, and all-round vision allow them to work and be competitive anywhere in the world. Computer science and engineering is becoming more important by the day. As a result, we have substantially furthered our education and research's leading position to be a catalyst in this area.

> **Prof Mounir Hamdi** Head of Computer Science and Engineering

Major Research Areas

Artificial Intelligence

Knowledge Representation and Planning

 Learning very large Bayesian networks, answerset logic programming, exploring how to acquire plans from observed action sequences via sensor based activity recognition.

Machine Learning and Data Mining

 Developing adaptive learning systems that can learn from examples efficiently and effectively, and developing data-mining algorithms to uncover knowledge from complex and big data such as social media and social networks, streams, and multimedia.

Speech and Natural Language Understanding

 Applying statistical methods to enable more effective techniques to understand human speech and translate between different natural languages.

Data, Knowledge and Information Management

Querying

 Applying query processing and knowledge-based techniques as well as integrating database and information retrieval querying paradigms including data/web mining, web query processing, XML query processing, spatial-temporal query processing, and uncertain data processing.

Modeling

• Aiming to improve the representational capabilities of database systems including modeling data quality, object-orient data, semantic data, and temporal data.

Distribution and Parallelization

• Extending and applying database technology to parallel and distributed scenarios for both traditional database applications and newer applications such as support for e-commerce, e-science, and spatial data.

Theoretical Computer Science

Algorithms

• Algorithms for massive data sets, design and analysis of algorithms.

Geometry

• Computational geometry, data structures.

Theory

• Information theory, online algorithms.

Vision and Graphics

Computer Vision

• Vision geometry, 3D reconstruction from image sequences, image-based modeling, and rendering.

Computer Graphics

 Geometric modeling, real-time rendering, new computer graphics tools, and image and video analysis concentrating on medical image segmentation and analysis, biometrics, and video editing.

Visualization

• Visual analysis of medical data, urban environment data, vehicle trajectories, and text streams.



Networking and Computer Systems

High Speed Switches and Routers

 Architectures, analysis and design of high-performance switches and Internet routers, scheduling algorithms, traffic management, memory architectures, and quality of service guarantees.

Wireless Technologies

 Next-generation wireless networks and systems, cognitive and cooperative wireless networking, sensor networking, large-scale peer-to-peer systems, and multimedia communications.

Distributed Systems

• Large-scale content distribution in the Internet, peer-to-peer media streaming, the Internet topology, cloud computing, video delivery and multicasting, capacity provisioning and resource management in cellular networks, green computing and communications.

Software Technologies

Software Engineering

• Software analysis and testing, software analytics, ubiquitous software development.

Computer Music

• Computer music and audio engineering.

Software Theory and System

 Cryptography and coding theory, mining software repository, multimedia and Internet computing, embedded systems and software, services computing.

Research Highlights

3D Digital City Modeling

The vision and graphics group, led by **Prof Long Quan**, has worked on 3D reconstruction and modeling from images at the confluence of computer vision and computer graphics. The group has contributed the state of the art quasi-dense approach to three-dimensional reconstruction and structure from motion from images. The group then developed a series of modeling applications, ranging from smooth surface modeling to prior-based hair and tree modeling. Most recently, the group has been developing reconstruction and modeling approaches to large-scale three-dimensional city modeling from two-dimensional Google Earth Street View and Microsoft Virtual Earth Streetside imagery.

Landmark Photography

Prof Pedro Sander worked with a team of researchers to develop the world's largest digital photograph in September 2010. The photograph, depicting the city of Rio de Janeiro, Brazil, had a resolution of 150 billion pixels. The picture was the result of using cutting-edge technology to stitch together 11,000 photographs, each of 18 megapixels. Using very high quality printing, it would occupy the size of a football field, and with standard quality printing it would be at least twice that size.

The researchers used a GigaPan robotic arm to position and take the photographs from the Sugar Loaf – a landmark in Rio de Janeiro, Brazil. The entire process took about four hours. The stitching process was challenging due to the large amount of data processing involved. Many stitching solutions were attempted to reduce the seam artifacts across images and the final process took several weeks. It took another full week just to upload the picture to the website over the Internet.



Recommendation Technology for Social Media

A joint departmental team and Shanghai Jiao Tong University researchers and students won third place in the Knowledge Discovery and Data Mining competition 2011 (KDD-Cup 2011). The international competition attracted more than 1,000 teams. The Computer Science and Engineering team consisted of postgraduates Nathan Liu and Bin Cao, research assistant Luheng He, and **Prof Qiang Yang**. The theme of the contest was prediction models for personalized recommendations for musical items based on billions of user ratings amassed at Yahoo! Music over the years. The Computer Science and Engineering team and their mainland peers proposed an ensemble of large-scale machine learning and data mining techniques to tackle the challenge. The algorithm was rated the best among all the submissions for the single-model category. In addition, a team of students supervised by Prof Qiang Yang won first place in two tracks of a recent Nokia Mobile Data Challenge (Nokia MDC). Two hundred teams participated from around the world.

Statistical Summary Algorithms

Google's MapReduce programming model has become the most popular framework for storing and processing massive data, due to its excellent scalability, reliability, and elasticity. Several commercial and open-source systems have been developed and put to use by large enterprises and government agencies for analyzing massive amounts of data. One of the most important tasks in analyzing massive data is to compute concise summaries that convey various statistical properties of the underlying data, such as means and medians, frequent items and data distributions. In this project funded by Google, **Prof KeYi** is seeking to design algorithms under MapReduce to compute statistical summaries that are efficient in terms of running time and network communication cost. Prof Yi, his students and collaborators have already obtained exciting initial results which were published at the Association for Computing Machinery (ACM) SIGMOD'11 and VLDB'12.

Crowdsourcing on Social Media

Crowdsourcing, partially categorized as human computation or social computation, is an emerging computation paradigm. But it is currently confined on specially designed platforms. In this project, **Prof Lei Chen** and his team explore the possibility of transferring the magic power of crowdsourcing onto social media networks by implementing a prototype system. The system is designed for decision-making tasks and built on the Twitter network for both altruistic and incentive-wise users. Prof Chen leads the study of modeling and algorithms for jury selection, a fundamental project problem. Series of experiments also validate the performance

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of the system and algorithms. The research record of this project has been accepted by International Conference on Very Large Databases (VLDB'12).



Welcome to Twitter Cube!

Twilter Cube is built by HKUST students and is a magic place where you can find amazing things using



Asking Experts

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Or you have any applications that you don't know arise pair that to ask? Came from this can that these anywhy townership your positions to builde!

Exploring Take you does residened what a teller society takes that to provide the decover new privating shall put by stating your reduce?



Empowering Excellence

Driving the Future



I believe that our undergraduate curriculum review in preparation for the move to the four-year degree system in Hong Kong came at the perfect time for the Department of Electronic and Computer Engineering.

In today's evolving world where communication and people's interactions with each other are undergoing fundamental change, teaching and learning methods of the past need to be revisited. As the move to a four-year degree is a Hong Kong-wide reform, it meant extra government funding has been available to support the new degree system. This has helped us to undertake all the changes we would like to make at one time rather than in stages.

One major goal in revitalizing our undergraduate curriculum was to encourage students to become more curious. For example, the Department will offer an introductory course on making a mobile phone and another on creating a robot. The aim is to first motivate and engage students in finding out more about electronic and computer engineering. Math and equations will be explored later once students are aware of the purpose of studying them.

In adopting this approach, we are seeking to produce the innovators and creators of tomorrow who will ask questions that no one else has asked before and in answering them go on to generate new products, devices and developments.

During the period under review, we also formed a committee to increase channels of communication between students and faculty. As one of the largest departments in the University, we are responsible for nurturing many students each year and strive to create a fostering environment that encourages people to make the most of their potential.

We fully intend to maintain our leading position in research and to inspire the next generation of academics, entrepreneurs and executives. We have 250 PhD students, the highest number of any department at HKUST, and many of the University's start-ups originate from our Department. Further links and partnerships with industry have also started to be explored in the form of an Electronics and Computer Engineering Consortium.

To assist our frontier research, the Department added to its 40 laboratories during the period under review by setting up the first social media laboratory in Asia, as noted in our Research Highlights. Major companies have already shown great interest in the lab.

We are also pioneering the way in "ecotronics", a term we created to encompass electronics research that seeks to address environmental and energy concerns. This significant work is based on our comprehensive semi-conductor activities, including integrated circuit design and fabrication. The Department contains a group of chip designers – in short supply globally, with most based in California – giving us a special edge in Asia in programs for our students and research. Projects include smart lighting, solar cell research, and power consumption reduction for electronic devices such as servers, computers and mobile phones.

The Department seeks to inspire our students to have the ambition to change the world through the systems and devices they engineer and to support our faculty members' drive for world-class achievements and impact. We look forward to the developments set in motion during the past three years making a significant contribution to these goals.

> **Prof Ross Murch** Head of Electronic and Computer Engineering

Dean's Message Generating Global Impact Inspiring Future Leaders Tackling the Grand Challenges Cultivating Wider Vision

Major Research Areas

Biomedical Electronics

Research includes: development of silicon models of multidimensional selectivity in the visual cortex, modulatory feedback in multi-chip neuromorphic networks, microelectro-array technology for cell level biological signal processing, micro-electro-DNA detection system by microfabrication techniques, non-invasive imaging technology for early detection of cancers, sensors for non-invasive quantification of important biological analytes, visual information processing and its applications in medicine, system modeling of physiological functions, optical coherence tomography for in vivo imaging human tissue, ultrasound image analysis, genome-wide SNP data analysis, and computational proteomics.

Ecotronics

Research in solid-state electronics, including both devices and circuits, is a core strength of the Department. Ecotronics, a new focus area of the Department, encompasses the research and application of solid-state electronics to address environmental and energy-related engineering problems. Projects being pursued are solid-state lighting, solar cells, smart grids, energy-efficient electronics and electronics for the smart use of energy and power saving (green) LCDs including E-paper LCDs (FLC, ORW).

Embedded Systems

Research focuses on: embedded system architecture including hardware/software balance and tradeoff, system evaluation and integration, network-on-chip and multi-core system-on-chip, mobile embedded systems, cyber physical systems, computer vision and sensing systems with application to instrumentation and control, data-domain conversion between analog and binary or multiple-valued digital signals, man-machine systems, low-power low-energy embedded system design, and VLSI design targeting mobile computing, multimedia, and high-speed network applications.



IC Design

Research focuses on: advanced digital and analog integrated circuit designs for use in a variety of applications including wireless communications, power electronics, smart sensing, embedded systems and control. Particular examples are advanced techniques for digital signal processing, image and speech processing, telecommunications, biomedical electronics, image sensors, temperature sensors, electronic nose, integrated power electronics, analog implementation of biologically inspired vision processors, and high performance analog integrated circuits for wireless communications such as RFID, Wifi, LTE and biomedical applications.



Microelectronics

- In this area we fabricate real devices for applications and advances at the frontiers of nanotechnology and electronics research. Our work leverages the university's Nanoelectronics Fabrication Facility (NFF), which is a complete facility capable of handling four-inch wafers.
- Research includes: advanced semiconductor materials preparation and characterization, microwave and high-frequency semiconductor devices, power semiconductor devices and technology, thin film and display devices, advanced

integrated circuits fabrication technology, integrated sensor and transducer technology, and micro-electro-mechanical systems (MEMS).



Photonics

- Photonics technology is important in displays, lighting, solar energy, biomedical diagnostic, sensing, optical communications and nextgeneration data centers and computing. Our Photonics Group spearheads research in all these high-impact areas, with emphasis on display technology and solid-state lighting.
- The Nanoelectronics Fabrication Facility assists in fabricating many of our photonic devices.
- The Center for Display Research coordinates activities for faculty members engaged in display-related subjects.
- Research topics include: biophotonics, bistable liquid crystal displays, electro-optic thin film materials, GaN-based lightemitting diodes, liquid crystal optics, low-temperature polycrystalline thin-film transistors, optical microcavities, organic light-emitting diodes, sensing, silicon microdisplays, silicon photonics, optical trapping and manipulation, optical interconnects for next-generation data centers and computing, liquid crystal photonics devices, optical communications, and solar energy.

Signal and Information

- Signal and information refers to information represented in multiple forms, including video, image, graphics, audio, speech, and text. It has a large number of important applications including multimedia, financial engineering, bio-informatics and speech recognition.
- Areas under study include: 3DTV, multiview processing, computer vision, image/video compression, standards, software/hardware co-design, sparse coding, stereo and motion processing, visual color capture/display, watermarking, forensics, security and encryption. These areas have diverse applications in telecommunications, robotics, assistance to doctors, automobiles and telematics.





Research covers advanced topics in robotics, CAD/CAM, and control, including: design, analysis and control of multi-robot manipulation systems, robot sensing, gross/fine motion and task planning, intelligent control of robots, applications of robotic technologies to manufacturing and industrial automation, intelligent manufacturing systems including design and development of sensor-based advanced controllers for machine tools, computer-aided setups and online quality inspection systems, CAD/CAM integration, man-machine interface, theory and application of robust control, computer control systems, optimal control, nonlinear control and applications of non-linear control techniques to robotics and manufacturing adaptive control, and intelligent control.

Wireless Communications and Networking

- There are a large number of active research projects in advanced communications and networking areas, Internet of things, machine-to-machine communications as well as cutting-edge research in social networking and big data systems.
- Key areas under study include: next-generation wireless communications and networking architecture for green and interference mitigation, large MIMO networks, cloud radio access networks, cooperative sensing, heterogeneous networks, stochastic network optimization, distributive algorithm designs and optimization, dense small cell and femto cell architecture for nextgeneration networks, robust cross layer radio resource management, optical communication systems and visual light communications, communications detection algorithms, coding and error-control mechanisms, data encryption and system security, and multi-user information theory as well as social media, cyber physical systems, and social networking analytics.



Research Highlights

RFID Breakthroughs Drive Change

Prof Howard Luong and his researchers successfully designed and demonstrated a single-chip RFID reader and a systemon-chip (SOC) passive UHF RFID tag with an embedded temperature sensor. Both achieved state-of-the-art performance in terms of low power, high integration, high performance, and low cost. In particular, the battery-less SOC RFID tag



embedding an ultra-low-power temperature sensor was the first of its kind and is currently still not available in the market. This multi-disciplinary mega-scale project team comprised nine faculty members from the Department, one academic from Mechanical Engineering, and more than 15 research assistants.



Leaping the Boundaries with Smart Power Platform

Prof Kevin Chen and his research team have developed a robust technology platform for implementing wide bandgap GaN smart power integrated circuits. GaN power electronics is emerging as the technology that breaks the fundamental limits of silicon power devices in power conversion efficiency and switching speed. With this newly developed technology, fully integrated GaN power integrated circuits can be realized by integrating the core power components and digital/analog sensing/control/protection blocks. Successful demonstrations have been carried out in single-chip boost converters, ring oscillators, voltage reference generators, and high-gain wide-bandwidth comparators.



Video Coding Contributions Fast Forward the Future

The research group led by **Prof Oscar Au** is among the few university teams contributing to the competitive Joint Collaborative Team on Video Coding (JCTVC), which is developing the next-generation video coding standard called High Efficiency Video Coding (HEVC). JCTVC was jointly established by ITU-T VCEG and ISO/IEC MPEG, two international standard organizations. Prof Au's team has been involved in HEVC development since October 2009. They have made a total of 57 technical contributions, including three to MPEG in October 2009, four to VCEG in January 2010, and 50 to JCTVC since October 2010. Many patents have been filed. To date, three of their patented technical tools have been accepted. Currently, Prof Au is organizing a special issue on HEVC and related technologies for *IEEE Transactions on Circuits and Systems for Video Technology*, the leading international peer-reviewed journal on video coding technologies.

Separately, Prof Au's team is also following the development of the China Audio Video Coding Standard (AVS).

Pioneering Next Generation Social Media Systems

Prof James She launched Asia's first social media lab, HKUST NIE Social Media Lab, to pursue multi-disciplinary research and design of next-generation social media systems, networks, and

applications in emerging cyber-physical societies. Just to name a few of the many possibilities in the commercialization of the research and development in the lab's research areas, Prof She and his lab associates collaborate with mathematicians, media technologists, practitioners and artists to analyze big data from social networks for viral marketing, build innovative portable multi-touch screen devices for cyber-physical media sharing, and invent new media technologies for smart signage- the out-of-home interactive displays that give the physical world a brand new way to get engaged in the cyber space.

Socia N

Driving the Future



 Department of Industrial Engineering and Logistics Management

As our name suggests, the Department of Industrial Engineering and Logistics Management has two major focuses. Over the past three years, we have continued to develop both these areas, achieving high international recognition and global rankings.

In the mid-1990s, our department was the first in Hong Kong to introduce a logistics management degree to fulfill the city's need for professionals and research input as a global logistics hub. Engineering management is another key aspect of our work given China's global position as the world's factory.

Although our undergraduates choose to focus on either logistics management or industrial engineering, core courses overlap, enabling them to seek work in both fields and the business sector. Such flexibility should be enhanced under the revised curriculum for the new, four-year undergraduate degree program. We have also been promoting the outcome-based education approach for courses.

As part of our drive for continuous improvement, the Department has established a new interdisciplinary option in design and marketing in collaboration with the Department of Marketing at HKUST Business School. Another interdisciplinary program in financial engineering is also under preparation and we have employed two faculty members to assist with this development.

Our research has continued to be successful in gaining funding, as our Research Highlights show. In addition, senior colleagues have been involved in industrial interaction, technology transfer and human resource development, in particular at the Zhejiang Advanced Manufacturing Institute (ZAMI) of HKUST, which tackles projects and offers research opportunities on Mainland China issues. During the period under review, ZAMI worked with the local government in Zhejiang Province to organize a well-received corporate leadership training program for mainland manufacturing industry leaders.

In my four years as Head of Department, I have initiated a postgraduate student association to enhance research interaction and social life and made outreach to our alumni a specific goal. Although we are still a relatively young department, our alumni have made strides in their careers and have much to share with our current students and faculty. In addition, my own research is focused on quality and I am interested in after sales!

With the building up of the alumni network, we have found student internships and industrial support much easier to obtain. We have enriched our mentorship program with participation rising to 120 by 2011-12. Meanwhile, alumni in top universities overseas and in China, have helped us to build up our academic networks. This is important to keep us at the forefront of developments in Asia and beyond.

One highly positive characteristic of our Department is the close links our professors maintain with graduates who are starting out in academia. Such mentoring applies to junior faculty joining

our department as well and helps us to attract high-quality postgraduate students from Mainland China and around the world.

Internationalization has been ongoing in the period under review. Although we are one of the smaller departments within the School of Engineering, our students are among the most enthusiastic in joining the exchange program.

Our popular Stanford-HKUST Joint Global Manufacturing Course, organized since 1995, has also continued to be offered. This innovative annual program brings students of both universities together to work on team-based solutions to a real-world corporate challenge.

To enhance overall education and research, I founded the Council of Industrial Engineering Department Heads in Greater China (CIEDHC) and have teamed up with industrial engineering leaders in Asia to form the virtual Asia Network for Industrial Engineering (ANIE). These initiatives seek to develop industrial engineering and have clearly positioned our Department as a leader and key player in the region.

> **Prof Fugee Tsung** Head of Industrial Engineering and Logistics Management

Major Research Areas

Design, Ergonomics and Human Factors

Product design is essential in industrial engineering. It involves the entire lifecycle management of a product, from concept to detailed design and marketing strategies. Research covers computer-aided design, ergonomics, and human factors.



Mass Customization and Advanced Manufacturing

Advanced technology for enhancing the performance of manufacturing enterprises, including product family development, high mix low volume production technology, and customer selection of products. Faculty members work on mass customization and other manufacturing technologies and are making the University the knowledge leader and technology pioneer in the transformation of modern manufacturing.

Financial Engineering and Risk Management

Use of advanced mathematical tools to analyze the performance of financial markets and evaluate associated risks. Financial engineering has gained new importance in today's fluctuating economy and the IELM Department is playing a leading role in its development at HKUST.

Logistics Management

Logistics has been identified as one of the four pillars of the Hong Kong economy. Logistics management studies how to effectively manage various logistics activities and resources. Examples include transportation, seaport and airport operations, warehouse management, and network design.

Quality Control and Six Sigma

Focuses on quality improvement in various manufacturing and service processes, using statistical modeling, data analysis, knowledge discovery and an emphasis on Six Sigma quality excellence. Faculty members conduct world-leading research on quality control, with applications in the Greater China area.









Making Waves in Shipping

Prof Chung Yee Lee, Chair Professor, is leading significant research for Hong Kong's Network". The study takes a broad perspective on ocean container transport in the global supply chain, exploring how Hong Kong can upgrade its global ocean logistics and leverage the huge productivity of the Pearl River Delta region to develop new services.

Customized Apartment

Efficient Customization

High-Rise Product Platform

igh-rise Platform

Mass customization and personalization technology aim to satisfy individual customer needs by providing customized products with near mass production efficiency. HKUST's Advanced Manufacturing Institute is a recognized world leader in such technology, working closely with various industries from industrial infrastructural equipment such as elevators, planes and refrigeration systems, to buildings to consumer products such as shoes, apparel and consumer electronics. This technology helps companies to take proactive approaches to customers' needs, without adding excessive costs. Research involves product family development, customer buying decisions, product configuration and the fulfillment process.





Department of Mechanical Engineering

I was the fourth person recruited by the Department of Mechanical Engineering and during my 20 rewarding and happy years at HKUST I have seen colleagues and students from our Department grow and do well at local, national, and international levels.

During the period under review, our faculty members continued to garner academic accolades for their achievements, including the election of two of our professors to the Chinese Academy of Sciences in 2011, while the Department as a whole has achieved high rankings in international surveys.

We have added to our strong research track record by enhancing our infrastructure through signature programs in areas where we can make an impact in basic and applied research, such as energy, bio-materials, precision engineering, microsystems and sensor networks, and electronic packaging. The Department has also been proactive in building a presence in the Pearl River Delta area of Mainland China. Along with two established research centers at HKUST Fok Ying Tung Graduate School in Nansha, the Department has an LED lighting research center in Foshan, and a mechanical engineering research laboratory in the HKUST Industry, Education and Research Building in Shenzhen.

Never content to rest on the positive feedback from employers on our graduates' innovative capabilities, solid technical training, analytical skills, and problem-solving capabilities, the Department has been moving forward in the education experience it offers students.

The new four-year academic program for undergraduates will add greater flexibility to our curriculum and enable undergraduates to exercise more choice in their studies. To broaden awareness, we now lead an engineering management and law minor program, started in 2010 and open to all HKUST students not only our own. In addition, an interdisciplinary minor program in aeronautical engineering – an area undergoing huge expansion worldwide – will be launched under the administration of the Department in September 2012.

The Department has proved attractive to international students due to our excellent reputation, respected faculty members, significant research, and the outstanding career opportunities for graduates in Hong Kong, Mainland China and Asia in general. We are already on the map for Asian students and have gradually been extending our reach to Europe and North America. Our graduates enjoy their careers as researchers and mechanical engineers, and make their mark on the communities in which they work. To boost ties with our increasing numbers of alumni, the Department has put a great deal of effort into building relationships between alumni and the Department and to help alumni stay in touch with each other. Our 20th Anniversary Dinner in November 2011 attracted more than 200 alumni and their families and friends, with four Distinguished Alumni Awards presented.

Two further developments have helped to forge bonds between students and the community and students themselves. The Department launched a mentoring program in 2009, attracting over 40 mentors from the start. The program gives undergraduates insight and links with professionals already in the field, including our alumni. Mentors act as role models and give guidance, boosting students' personal development and career prospects. The Mechanical Engineering Postgraduates' Society, formed shortly before the period under review and the first such association at HKUST, has also strengthened communication among members of the Department and encouraged students to cherish their time at HKUST.

All these moves are in line with building a unified culture within the Department. The supportive environment within the Department is a key factor in developing an attachment to it and our accomplishments during this reporting period have definitely brought us closer to this objective.

> **Prof Matthew Yuen** Head of Mechanical Engineering

Driving the Future

Materials Technology

SEI

HKUST

Major Research Areas

Design and Manufacturing Automation

- Mechanical design and manufacturing automation lie at the heart of mechanical engineering in which engineers conceive, design, build and test innovative solutions to "real world" problems.
- Areas of research include: geometric modeling: intelligent design and manufacturing process optimization; in-process monitoring and control of manufacturing processes; servo-system

control; robotics; mechatronics; primemover system control; sensor technology and measurement techniques; biomedical systems design and manufacturing.





Energy/Thermal Fluid and **Environment Engineering**

Microsystems and Precision Engineering

5.0kV X60,000 100nm WD 6.4mm

- Micro ElectroMechanical Systems (MEMS) is a multidisciplinary research field which has been making a great impact on our daily life, including various microsensors used in personal electronics, transportation, communication, and biomedical diagnostics.
- Fundamental and applied research work is being conducted in this area, with studies on basic micro/nanomechanics, such as fluid and solid mechanics, heat transfer and materials problems unique to micro/nanomechanical systems. Exploration of new ideas to produce microsystems for energy, biomedicine and nanomaterials, microsensors and microactuators. Technology issues related to the micro/nanofabrication of these devices are also being





Solid Mechanics and Dynamics

- The Department has a diverse collection of faculty with expertise in these fields. Activities range from applied to theoretical problems, and are extremely multidisciplinary, involving applied mathematics; solid mechanics; nonlinear dynamics; computations; solid state physics; material science and experiments for various kinds of solid materials/ systems and mechanical behaviors.
- Researchers work on problems of both static and dynamic natures with different types of evolutions. These problems also involve multi-fields coupling at different time and length scales, from micro-second to long-time creep processes and from a very small carbon nanotube or cell to macroscopic-scale composite materials and electro-mechanical devices/ systems.







Research Highlights



Pushing Back the Frontier on Miniaturization and Integration

The popular trend for personal equipment and portable device market has encouraged miniaturization and integration in microelectronic products, boosting the need for high density packaging and assembly technologies. In a project entitled "3D Packaging with Silicon Chip Carriers and Through Silicon Vias (TSVs) for System in Package (SiP)", **Prof Ricky Lee** and his team are seeking to develop design rules and fabrication processes for silicon chip carriers with TSVs for underfill encapsulant dispensing.

The project's goal is SiP modules with very high silicon density. For example, four to eight IC devices may be arranged in two to three vertical stacks using one or two silicon chip carriers with TSVs. The total thickness may be between 1.0mm and 1.5mm and the footprint of the whole package is relatively small. Such miniature SiP modules should be highly suitable for portable devices and mobile equipment.



Boosting the Use of Carbon Nanotubes

Carbon nanotubes are among the strongest and stiffest fibers currently known. The features of carbon nanotubes offer opportunities to produce nanocomposites that possess excellent mechanical properties combined with unique multi-functional characteristics, such as enhanced electrical and thermal conductivities. However, carbon nanotubes' potential has been severely limited to date because of difficulties associated with dispersion of entangled carbon nanotubes during processing and poor interaction with dispersion media or matrix.

Prof Jang Kyo Kim and his research team have been exploring novel ways to improve battery performance to a level that next-generation electric vehicles require and to make it possible to realize the full potential of carbon nanotubes for developing new nano-structured electrode materials. The project showed significant improvements both in energy and power densities of several different electrode materials by optimizing the carbon nanotube content and their properties. The research, supported by the Hong Kong government's Innovation and Technology Fund and completed in September 2011, generated 10 refereed journal papers in top energy journals and several patents are pending approval.

Microfluidic CTC Device Assists Cancer Diagnostics

Prof Yi Kuen Lee, in collaboration with the David Geffen School of Medicine at the University of California, Los Angeles, has developed a novel silicon nanostructured Circulation Tumor Cell (CTC) chip with an integrated micro chaotic mixer for cancer diagnostics. The CTC capture technology is faster and cheaper than existing methods. The research was selected as the cover story of the world's leading journal *Angewandte Chemie International Edition* (March 21, 2011, doi:10.1002/ anie.201005853) and this technology was also highlighted in *Nature Medicine* (March 2011).





Powering Ahead with Clean and Sustainable Energy

Finding the next generation of efficient, clean, energy-conversion technologies that operate without the use of fossil fuels is one of the grand challenges of this century. **Prof Tianshou Zhao** and his research team are pioneering development of direct alcohol fuel cells (DAFCs), which can convert the chemical energy of liquid methanol or ethanol directly into electricity. This type of fuel cell creates the potential for a cost-effective, energy-conversion system that is highly efficient and low in emissions.

Prof Zhao's recent publications in first-rate energy journals, such as *Energy & Environmental Science* and *International Journal of Hydrogen Energy*, have led to significant advances in understanding coupled physical and chemical phenomena in fuel cells, along with many innovations in the design and optimization of next-generation direct alcohol fuel cells with excellent working efficiency. Among other achievements, his group holds the internationally acknowledged world record for power density of direct ethanol fuel cells.



Honors and Achievements (2009-11)

Faculty

Prof Oscar Au (ECE)

Prof Khaled Ben Letaief (ECE)

- Best Paper Award, IEEE International Communications Conference

Prof Amine Bermak (ECE)

Prof Vijay Bhargava (ECE)

Prof Ning Cai (IELM)

Prof Xiren Cao (ECE)

Prof Chak Keung Chan (CBME)

Prof Christopher Chao (MECH)

Prof Ying Chau (CBME)

60

Prof Guanghao Chen (CIVL)

Prof Guohua Chen (CBME)

Prof Ping Cheng (MECH)

Prof Roger Cheng (ECE)

Prof Shing Chi Cheung (CSE)

State Scientific and Technological Progress Award (Second Class), State Council of the People's Republic of China

Prof Furong Gao (CBME)

Prof Mounir Hamdi (CSE)

Prof Jeff Hong (IELM)

Prof Lambros Katafygiotis (CIVL)

Senior Research Prize, European Association for Structural Dynamics (EASD)

Prof Sunghun Kim (CSE)

Prof Jun Shang Kuang (CIVL)

President, International Society for Computing in Civil and Building Engineering (ISCCBE)

Prof Hoi Sing Kwok (ECE)

Prof Henry Lam (CBME)

Prof Vincent Lau (ECE)

Prof Chung Yee Lee (IELM)

Excellence Service Award, Production and Operations Management Society (POMS)

Prof Dik Lun Lee (CSE)

Prof Joseph Lee (CIVL)

State Scientific and Technological Progress Award (Second Class), State Council of the People's Republic of China

Prof Ricky Lee (MECH)

- Significant Contribution Award for Electronic Packaging Technologies, Chinese Institute of Electronics Electronics Manufacturing & Packaging

Prof Christopher Leung (CIVL)

- Honorary President, International Union of Laboratories and Experts in Construction Materials, Systems and Structures (RILEM)
 Fellow, International Union of Laboratories and Experts in Construction Materials, Systems and Structures (RILEM)

Prof Bo Li (CSE)

Prof Yunhao Liu, Prof Lionel Ni and Dr Mo Li (CSE)

Award for Research Excellence in Natural Sciences (First Class), Ministry

Prof Yunhao Liu, Prof Lionel Ni, Dr Mo Li

and Dr Zheng Yang (CSE)

State Natural Science Award (Second Class), State Council of the People's Republic of China

Prof Irene Lo (CIVL)

Prof Matthew McKay (ECE)

- Young Author Best Paper Prize, IEEE Signal Processing Society

Prof Ross Murch (ECE)

Prof Charles Ng (CIVL)

- Board Member, International Society for Soil Mechanics and Geotechnical Engineering (ISSMGE)

Prof Huihe Qiu (MECH)

Prof Huamin Qu (CSE)

Prof Long Quan (CSE)

Prof Li Qiu (ECE)

Prof David Rossiter (CSE)

Prof Johnny Sin (ECE)

Prof Richard So (IELM)

Prof Chi Keung Tang (CSE)

Prof Danny Tsang (ECE)

Prof Fugee Tsung (IELM)

Prof Gang Wang (CIVL)

Prof Yu Hsing Wang (CIVL)

Teaching Excellence Appreciation Award, SENG

Prof Kam Tim Woo (ECE)

Prof Dekai Wu (CSE)

Prof Hai Yang (CIVL)

State Natural Science Award (Second Class), State Council of the People's Republic of China

Prof Qiang Yang (CSE)

Prof Ke Yi (CSE)

Prof Matthew Yuen (MECH)

Prof Bing Zeng (ECE)

Best Paper Award, IEEE Transactions on Circuits and Systems for Video
Technology

Prof Qian Zhang (CSE)

- ComSoc Distinguished Lecturer, IEEE Communications Society
 Research Excellence Award, SENG

Prof Tongyi Zhang (MECH)

Students

HKUST Robotics Team

Remotely Operated Vehicle (ROV) Team

Robocon Teams

Smart Car Teams

Undergraduate

Team Award

Wing Lam Au, Man Lung Liu, On Lee Sun and Tsz. Wang Wong (IELM)

Bull B Tech Team, led by undergraduate Yik Hei Chan (ECE)

Qifeng Chen, Desmond Hung and Jueyi Wang (CSE)

Qifeng Chen, Yuliang Li and Tsz Yeung Ng (CSE)

Wing Yee Choi, Hei Yan Ip, Pui Sum Kwok, Tsz Hang Tsang and Chiu Fai Wong (IELM)

Championship, Chartered Institute of Logistics and Transport in Hong Kong (CILTHK) Student Day Competition, 2009

Ye Gong, Long He, Miu Yin Ma, Yang Yang and Alex Shaw Liang Yap (IELM)

Championship, Chartered Institute of Logistics and Transport in Hong Kong (CILTHK) Student Day Competition, 2010

Wing Yin Kong, Ki Kong Tang, Chi Yan Tso and Man Tung Yip (MECH)

Yun Man Lau and Ghee Leng Ooi (CIVL)

Patrick Kwan Pak Lee and Matthew Kin Man Ting (ECE), together with other classmates, won multiple honors for their Braille Embosser final year project:

Kit Yi Leung, Ho Yan Tse, Nok Kwan Wong and Hok Ting Yau (CBME)

Siwan Lu, Weicheng Luo, Leiting Zhang and Yuan Zhong (CBME)

Mingyu Wang (ECE) and Shucheng Zhu (CPEG)

Individual Award

Yaxiong Cai (MECH)

Yun Kwan Chan (CSE)

Howard Cheung (MECH)

Students

Siu Yeung Cheung (CBME)

 Second Runner-up, Mr Armin and Mrs Lillian Kitchell Undergraduate Research Awards 2011, HKUST

Hin San Hung (IELM)

 Stephen Cheong Kam-chuen Medal for Distinguished Service to the Student Body 2011, HKUST

Yuen Man Ip (CBME)

 Paul and May Chu Sportsman/Sportswoman of the Year Award 2010-11, HKUST

Chun Hei Lam (MECH)

 Had a newly discovered planet named after him for research on a novel approach to recycling plastic when he was a secondary school student. The accolade was initiated by the International Astronomical Union.

Xiaoyu Li (ECE)

Silver Award, President's Cup 2010, HKUST

Yangyang Liu (ECE)

- First Runner-up, Mr Armin and Mrs Lillian Kitchell Undergraduate Research Awards 2010, HKUST
- Gold Award, President's Cup 2010, HKUST

Ho Yee Poon (CBME)

 Second Runner-up, Mr Armin and Mrs Lillian Kitchell Undergraduate Research Awards 2010, HKUST

Yik Ching So (IELM)

 Stephen Cheong Kam-chuen Medal for Distinguished Service to the Student Body 2010, HKUST

Ka Yeung Wong (MECH)

 Gold Award, American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE) Hong Kong Chapter, 2010

Yang Yang (IELM)

 First Runner-up, Mr Armin and Mrs Lillian Kitchell Undergraduate Research Awards 2010, HKUST

Chi Yung Yeung (ECE)

 Stephen Cheong Kam-chuen Medal for Distinguished Service to the Student Body 2009, HKUST

Leiting Zhang (CBME)

 First Runner-up, Mr Armin and Mrs Lillian Kitchell Undergraduate Research Awards 2011, HKUST

Postgraduate

Team Award

Wenqi Du, Sung Hei Luk, Po Chi Suen and Zhe Wang (CIVL)

Best Presentation Award, Introducing and Demonstrating Earthquake
Engineering Research in Schools (IDEERS), Taipei, 2011

Qingxu Jin, Yiqiang Wang, Changli Yu and Zhiyuan Zhao (CIVL)

 Second place, Introducing and Demonstrating Earthquake Engineering Research in Schools (IDEERS), Taipei, 2009

LEDoS Team, led by Prof Kei May Lau (ECE)

• First Runner-up, HKUST 2011 Entrepreneurship Competition

Frank Wang, Jianyu Song and Prof Zexiang Li (ECE)

- Succeeded in sending an unmanned miniature helicopter to Mount Everest in 2009, a milestone in unmanned aviation
- Sent an unmanned helicopter across Yarlung Zangbo Grand Canyon, the world's deepest canyon, in 2010

Individual Award

Wenqi Du (CIVL)

Arup Research Prize 2011, Ove Arup & Partners Hong Kong Ltd

Huanfeng Duan (CIVL)

PhD Research Excellence Award 2011, SENG

Shammi Akter Ferdousi (CBME)

Gold Award for the Best Poster Presentation, Asia Nanotech Camp 201

Yong Lin (CBME)

 nominated for the Excellence in Graduate Polymer Research Symposium 2009, Salt Lake City, US

Daniel Yiu Wing Mo (IELM)

Sir Edward Youde Memorial Fellowship 2010-11

Zhiliang Qian (ECE)

RGC-Fulbright Hong Kong Junior Scholar Award 2011-12

Lu Wang (CSE)

Fellow, Microsoft Research Asia Fellowship Program 2010

Weiping Wang (CBME)

- Young Investigator Award, 5th World Association for Chinese Biomedical Engineers (WACBE) World Congress on Bioengineering, Taiwan, 2011
- PhD Research Excellence Award 2011, SENG

Yu Zhang (CSE)

PhD Research Excellence Award 2011, SENG

Alumni

Cheryl Suet Ying Cham, *BEng&BBA (CIGBM)*, and Prof Kenny Kwok

Outstanding Paper Award for Young Engineers/Researchers, The Hong Kong Institution of Engineers

James Cheng, BEng (COMP), MPhil (COMP), PhD (COMP)

 Young Scientist Award in Physical/Mathematical Science, Hong Kong Institution of Science

Prof Jack Lau, PhD (ELEC)

- Consumer electronics solution specialist Perception Digital Holdings Limited, founded by Prof Lau, Prof Roger Cheng and Prof C Y Tsui, Electronic and Computer Engineering, went public in 2009 and transferred its listing from the Growth Enterprise Market (GEM) Board of the Hong Kong Stock Exchange to the Main Board in 2011
- Ernst & Young Entrepreneur of the Year award
- "Excellence in Achievement of World Chinese Youth Entrepreneurs" Award
- Grand Prize (all categories) and Gold Award (Consumer Electronics), Hong Kong Electronic Industries Association Award for Outstanding Innovation and Technology Products
- Directors of the Year Award, Hong Kong Institute of Directors
- Honorary Fellowship, HKUST

Harry Lee, BEng (CENG), MPhil (CENG)

Young Engineer of the Year Award, The Hong Kong Institution of Engineers

Owen Ka Fai Luk, BEng (CENG), MPhil (BIEN)

Trainee of the Year Award, The Hong Kong Institution of Engineers

Pengcheng Ma, PhD (MECH)

Humboldt Research Fellowship, Alexander von Humboldt Foundation, Germany

Kelvin T W Ng, PhD (CIVL)

 Grand Prize, The Hong Kong Institution of Engineers Innovation Awards for Young Members

Fubin Song, *PhD (MECH)*, Chaoran Yang, *MPhil (MECH)*, and Prof Ricky Lee

 Best Paper Award, Surface Mount Technology Association (SMTA) China South Technology Conference, Shenzhen

Nicholas Tsz Wo Sze, BEng (COMP), MPhil (COMP)

 Broke the record on computing specific bits of the mathematical constant Pi. The new record consisted of 256 bits of Pi around the two quadrillionth bit position.

Kevin Tsia, BEng (EEIC), MPhil (ELEC)

 Harry M Showman Prize, Henry Samueli School of Engineering and Applied Science, University of California, Los Angeles

Simon Wong, BEng (CIVL), MPhil (CIVL), PhD (CIVL)

Building Structures Design Award, The Hong Kong Institution of Engineers Joint Structural Division

Sai Kit Yeung, *BEng (CPEG), MPhil (BIEN), PhD (ELEC),* and Craig Yu, *BEng&BBA (COGBM), MPhil (CSE)*

Paper on Make It Home software accepted for SIGGRAPH 201

Kany S Y Zhou, MPhil (MECH)

President's Protégé, The Hong Kong Institution of Engineers



School of Engineering Advisory Committee

Academic Advisors

Prof Eduardo D Glandt

School of Engineering and Applied Science Robert D Bent Professor of Chemical and Biomolecular Engineering

Prof Nicholas P Jones

Prof M Tamer Özsu

Professor and Director David R Cheriton School of Computer

Prof Vincent Poor

School of Engineering and Applied Science Michael Henry Strater University Professor of Electrical Engineering Director, Princeton Center for Innovation in

Prof King-Ning Tu

Department of Materials Science and Henry Samueli School of Engineering and

Prof David Wu

lacocca Professor and Dean P.C. Rossin College of Engineering and

Industrial Advisors

Dr Andrew Ka-Ching Chan

Ove Arup & Partners Hong Kong Ltd Hong Kong

Mr Ben Chang

Group Managing Director iDS Group

Ir James Y C Kwan, JP

Executive Director and Chief Operating Officer The Hong Kong and China Gas Co Ltd

Mr Sunny Lee

Executive Director, The Hong Kong Jockey Club Hona Kona

Mr Humphrey Leung

President and Managing Director Hona Kona

Mr Joseph Wong

(Retired from Du Pont China Limited, Hong Kong)



Faculty Appointments

Chair Professor

2009 Ross Murch, EC

2010 Mounir Hamdi, CSE

2011 Charles Ng, CIVL Tianshou Zhao, MECH

Promotion

Professor

2009

Gordon McKay, CBME Guanghao Chen, CIVL Lambros Katafygiotis, CIVL Jun Shang Kuang, CIVL Siu Wing Cheng, CSE Bo Li, CSE Chi Keung Tang, CSE Nevin Lianwen Zhang, CSE Roger Cheng, ECE Jianan Qu, ECE Ravindra Goonetilleke, IELM Christopher Chao, MECH Ricky Lee, MECH Jingshen Wu, MECH

2010

Ping Gao, CBME Xijun Hu, CBME King Lun Yeung, CBME Limin Zhang, CIVL Shing Chi Cheung, CSE Oian Zhang, CSE Oscar Au, ECE Wing Hung Ki, ECE Vincent Lau, ECE Philip Mok, ECE Rachel Zhang, IELM

2011

James Kwok, CSE Amine Bermak, ECE Kevin Chen, ECE Chi Ying Tsui, ECE Jeff Hong, IELM Richard So, IELM Huihe Qiu, MECH Kai Tang, MECH

Associate Professor

2009

Yunhao Liu, CSE Qiong Luo, CSE Jeff Hong, IELM Xiangtong Qi, IELM

2010

Huamin Qu, CSE Daniel Palomar, ECE

2011

Xiangru Zhang, CIVL Lei Chen, CSE Weichuan Yu, ECE

New Appointments

Chair Professor

2010

Joseph Lee, CIVL (PhD, Massachusetts Institute of Technology) (Also Vice-President for Research and Graduate Studies) Wei Shyy, MECH (PhD, University of Michigan) (Also Provost)

Professor

2011 Patrick Yue, ECE (PhD, Stanford University)

Assistant Professor

2009 Sunghun Kim, CSE (PhD, University of California, Santa Cruz) Ho Yin Mak, IELM (PhD, University of California, Berkeley) Jiheng Zhang, IELM (PhD, Georgia Institute of Technology)

2010

Jack Cheng, CIVL (PhD, Stanford University) Gustaaf Kikkert, CIVL (PhD, University of Canterbury) Jui Pin Wang, CIVL (PhD, Columbia University) Zhiyong Fan, ECE (PhD, University of California, Irvine) Levent Yobas, ECE (PhD, Case Western Reserve University Baoling Huang, MECH (PhD, University of Michigan)

2011

Ilias Dimitrakopoulos, CIVL (PhD, Aristotle University of Thessalor Tze Ling Ng, CIVL (PhD, University of Illinois at Urbana-Champaign)

am IIm Ise, CIVL PhD, HKUST)

PhD, Stanford University) rancesco Ciucci, MECH

(PhD, California Institute of Technology (Also jointly appointed in CBME)

Administrative Appointments

2009

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School of Engineering

ed Ben Letaief stopher Leung	 Chair Professor of Electronic and Computer Engineering, appointed Dean of Engineering Professor of Civil and Environmental Engineering, appointed Head of the Department of Civil and Environmental Engineering
lon McKay	- Professor of Chemical and Biomolecular Engineering, appointed Acting Head of the Department of Chemical and Biomolecular Engineering
Murch	- Chair Professor of Electronic and Computer Engineering, appointed Head of the Department of Electronic and Computer Engineering
e Tsung	 Professor of Industrial Engineering and Logistics Management, appointed Head of the Department of Industrial Engineering and Logistics Management
	Interdisciplinary Programs Office
Ving Chan	- Chair Professor of Chemical and Biomolecular Engineering, appointed Director of Interdisciplinary Programs
Keung Chan	 Professor of Chemical and Biomolecular Engineering, appointed Acting Head of the Division of Environment
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	School of Engineering
er Cheng stopher Chao	 Professor of Electronic and Computer Engineering, appointed Associate Dean of Engineering Professor of Mechanical Engineering, appointed Acting Head of the Department of Mechanical Engineering
ond Ko*	- Adjunct Professor of Chemical and Biomolecular Engineering and Senior Advisor to the Provost, appointed Director of Center for Engineering Education Innovation
	Interdisciplinary Programs Office
Keung Chan	 Professor in the Division of Environment and Department of Chemical and Biomolecular Engineering, appointed Head of the Division of Environment
	Fok Ying Tung Graduate School
el Ni	 Chair Professor of Computer Science and Engineering, appointed Acting Dean of Fok Ying Tung Graduate School
1	
	Office of the Provost and Office of the Vice-President for Research and Graduate Studies
decai Golin	 Professor of Computer Science and Engineering, appointed Associate Vice-President for Postgraduate Studies
	Office of the Vice-President for Research and Graduate Studies
hell Tseng	- Chair Professor of Industrial Engineering and Logistics Management, appointed Associate Vice- President for Research and Innovation
	School of Engineering
stopher Chao g Kam Lo	- Professor of Mechanical Engineering, appointed Associate Dean of Engineering - Professor of Civil and Environmental Engineering, appointed Associate Dean of Engineering
Tim Woo	 - Visiting Assistant Professor of Electronic and Computer Engineering, appointed Director of Global and Community Engagement Program
	Interdisciplinary Programs Office
ng Hsing	 Professor in the Division of Biomedical Engineering and Department of Chemical and Biomolecular Engineering, appointed Acting Head of the Division of Biomedical Engineering
	Fok Ying Tung Graduate School
el Ni ng Gao	Chair Professor of Computer Science and Engineering, appointed Dean of Fok Ying Tung Graduate School Professor of Chemical and Biomolecular Engineering, appointed Associate Dean of Fok Ying Tung Graduate School

*deceased April 201







Donations and Sponsorships

Mr Siu Ming Kwok and Ms Eleanor Kwai Chun Law of Sa Sa International Holdings Ltd generously supported a Department of Mechanical Engineering project focusing on advanced medical devices for treatment of intracranial aneurysms with a donation of HK\$5 million.

Prof James She, Electronic and Computer Engineering, received over HK\$3 million in donations to establish the HKUST NIE Social Media Lab. One of the major donors was Mr Bill Nie, Chief Executive Officer, TS First Fortune Asset Management.

Dr Fu Wing Lau, Managing Director of Chiu Hing Construction and Transportation Company Ltd, provided scholarship funding of \$500,000 per year to support high-achieving Civil and Environmental Engineering students in genuine financial need. Each student receives up to HK\$50,000. By 2011, the Department had received a total of HK\$2.5 million.

Chiaphua Industries Ltd continued its research equipment donation to the Department of Chemical and Biomolecular Engineering. The company gave HK\$2 million spread over five years until 2011-12. The donation provided additional resources for the Department to purchase or upgrade equipment and facilitates its long-term planning on equipment acquisition.

HKUST received a grant of US\$150,000 (around HK\$1.17 million) for participation in Hewlett Packard's Catalyst Initiative, a global social innovation program designed to develop more effective approaches to science, technology, engineering, and math (STEM) education worldwide. HKUST was one of the 35 educational institutions across 11 countries that were selected by Hewlett Packard to receive the grant in 2010. The University set up a new teaching laboratory for Computer Science and Engineering students, equipped with high-end computers.

- DHL Express offered logistics consultancy and sponsorship for air express transportation of robots weighing more than 85kg, facilitating the participation of the School's Remotely Operated Vehicle (ROV) Team at the International Student ROV Competition for underwater robots at NASA Johnson Space Center in Houston. The team was representing Hong Kong. The service was equivalent to HK\$280,000.
- Prof Mansun Chan, Electronic and Computer Engineering, obtained a donation of HK\$200,000 from the Li Ka Shing Foundation to promote technology education.
- Prof Albert Wong, Electronic and Computer Engineering, received a donation of HK\$110,000 from mobile handset manufacturer Shenzhen Huarui Company through its Hong Kong subsidiary, Hong Kong Crown Company. The money was used mainly for student support, and for travel and attendance at conferences.
- Prof Louis Lam, Chemical and Biomolecular Engineering, obtained a donation of HK\$90,000 from Active Tools International Ltd, a division of the world's largest barbecue stove manufacturer. The donation was used to initiate more collaborations with industrial partners in Hong Kong.
- Hong Kong LCD manufacturer Varitronix Ltd continued its donation to the Department of Electronic and Computer Engineering for the Varitronix Scholarship for Best Final Year Project on Display Technology. A sum of HK\$30,000 is available each year for five years, with the Department receiving a total of HK\$90,000 by 2010-11.
- Google (Hong Kong) Ltd gave HK\$48,400 to support Prof Jogesh Muppala, Computer Science and Engineering, in the development and publication of Android curriculum-related materials and the provision of courses during 2011-12.
- Prof Louis Lam, Chemical and Biomolecular Engineering, received a HK\$25,000 donation from Harvest Investment Holdings Ltd for the development of chemical processing simulations for Hong Kong industries.
- Air Products donated HK\$20,000 to set up the Air Products Award for the Best Chemical and Biomolecular Engineering Postgraduate Student. The honor recognizes the research excellence of the Department's postgraduates, with the HK\$5,000 award presented annually to one student.
- Prof Zhiyong Fan, Electronic and Computer Engineering, received a donation of US\$2,000 (around HK\$15,600) from US firm EMD Chemicals Inc for the project "Surface Doping of Si Nanowires".

Teaching and Research Laboratories

Department of Chemical and Biomolecular Engineering

- Advanced Materials for Environmental Protection Lab
- Aerosol Laboratory
- Analytical Laboratory
- Bioprocessing and Biocomputation Laboratory
- Catalysis, Adsorption and Nanomaterials Laboratory
- Center for Green Products and Processing Technologies*
- Center for Polymer Processing and Systems*
- Drug Delivery and Biomaterials Laboratory
- Laboratory of Biological and Electrochemical Micro Systems
- Liquid Adsorption and Environmental Materials Lab
- Micro and Nano Systems and Materials Laboratory
- New Energy and Intelligent- and Bio-Materials Laboratory
- Physical Properties Characterization and Materials Processing Laboratory
- Polymer Processing and Systems Laboratory
- Polymer Rheology and Nanocomposite Laboratory
- Polymer Surface and Interface Analysis Laboratory
- Process Systems Engineering Laboratory Catalysis and Reaction Engineering
- Proteomics and Metabolomics Laboratory
- Reactors Lab
- Surface and Materials Characterization Laboratory
- Teaching Laboratory



Department of Civil and Environmental Engineering

- CLP Power Wind/Wave Tunnel Facility
- Computational Lab
- Concrete and Construction Lab
- Construction Materials Lab
- Environmental Engineering Lab
- EVNG Lab
- Geotechnical Centrifuge Facility
- Geotechnical Engineering Research Lab
- Geotechnical Engineering Teaching Lab
- Intelligent Transportation Systems Lab
- Smart and Sustainable Infrastructure Research Center
- Surveying Lab
- Water Resources Research Lab
- Water Resources Teaching Lab

Department of Computer Science and Engineering

- 2 PC Labs
- Center for Visual Computing and Imaging Science
- Computer Engineering Lab
- Cyberspace Center
- Database Lab
- Digital Life Research Center*
- Human Language Technology Center
- IT Key Lab
- Linux Lab
- Multi-media Lab
- New Element HKUST Digital Healthcare Joint Research Center
- Pervasive Lab
- RFID Center
- Sino Software Research Institute
- Vision and Graphics Lab
- * located in Nansha, Guangzho



Department of Electronic and Computer Engineering

- Advanced Electronic Packaging and Assembly Cooperative Research Center
- Advanced VLSI Design and Test Laboratory
- Analog Research Laboratory
- ATM/IP Telephony Solution Cooperative Research Center
- Automatic-Control Laboratory
- Automation Technology Center
- Biomedical Engineering Laboratory
- Broadband-Network Laboratory
- Center for Display Research
- Center for Medical Diagnostic Technology
- Center for Networking
- Center for Wireless Information Technology
- Chemical-Mechanical Polishing Laboratory
- Cooperative Research Center for MPEG-4 Based Information Technology
- Device-Characterization Laboratory
- Digital-Electronics and Microprocessor Laboratory
- Electro-Optics Laboratory
- Fine-Line Lithographic Laboratory
- Hongkong Telecom Institute of Information Technology
- Huawei-HKUST Innovation Laboratory
- Human Language Technology Center
- Integrated Power Electronics Laboratory
- Internet Switching Technology Center
- Kirchhoff and Shannon Lab
- Machine-Intelligence Laboratory



Department of Industrial Engineering and Logistics Management

- Advanced Audio and Visual Laboratory
- Advanced Manufacturing Institute
- CAD/CAM Laboratory
- Computational Ergonomics and Simulation Laboratory
- Financial Engineering Laboratory
- Human Performance Laboratory
- Industrial Automation Laborator
- Information Systems Laboratory
- Logistics and Supply Chain Management Institute
- Manufacturing Processes Laboratory
- Manufacturing System Design Laboratory
- Precision Manufacturing Laboratory
- Quality Laboratory
- Simulation and Optimization Laboratory
- Transportation Logistics Laboratory
- Zhejiang Advanced Manufacturing Institute
- Materials Characterization and Preparation Facility
- Mobile Computing System Laboratory
- Multimedia Technology Research Center
- Nanoelectronic Circuits and Gigascale Systems Laboratory
- Nanoelectronics Fabrication Facility
- Networked Control Laboratory
- Optical Device-Characterization Laboratory
- PC CAD Laboratory
- Photonic Device Laboratory
- Photonic Materials Laboratory
- Photonics Technology Center
- Robot Manipulation Laboratory
- Robotics Teaching Laboratory
- Semiconductor Product Analysis and Design Enhancement Center
- Sensor and Instrumentation Laboratory
- Signal-Processing and Communication Laboratory
- Smart Sensory Integrated Systems Laboratory
- Social Media Lab
- Wireless-Communication Laboratory

Department of Mechanical Engineering

- Advanced Engineering Materials Facility
- Automation Lab
- Building Energy Research Center*
- Center for Advanced Microsystems Packaging
- Center for Engineering Materials and Reliability*
- Center for Sustainable Energy Technology
- Combustion and Fire Research Lab
- Complex System Modeling and Design Lab
- Control and Robotics Lab
- Departmental Terminal Room
- Design and Manufacturing Services Facility
- Energy Environmental Technology Lab
- FINETEX HKUST R & D Center
- HKUST LED-FPD Technology R&D Center at Foshan
- Hong Kong-Beijing UST Joint Research Center*
- Impact/Structural Dynamics Lab
- Institute of Integrated Microsystem
- Manufacturing Lab
- ME Central Lab
- Mechanical Fabrication Shop
- Mechanics and Materials Lab
- MEMS Lab
- Sample Preparation Lab
- Thermal Systems Lab
- Undergraduate Computer Lab
- Undergraduate Teaching Lab
- * located in Nansha, Guangzhou

Facts and Figures

Faculty (as at 31 Dec 2011)

	CBME	CIVL	CSE	ECE	IELM	MECH	Total
Chair Professor	2	2	3	4	2	3	16
Professor	9	12	18	20	5	10	74
Associate Professor	2	5	14	6	3	3	33
Assistant Professor	2	9	6	7	5	5	34
Professor Emeritus	1	6	2	4	-	5	18
Visiting Professor	-	1	-	-	-	-	1
Visiting Associate Professor	-	-	-	1	-	-	1
Visiting Assistant Professor	1	2	4	6	2	1	16
Adjunct Professor*	1.5	5	2	3	1.5	4	17
Adjunct Associate Professor	3	-	1	-	-	-	4
Adjunct Assistant Professor	3	1	-	1	-	1	6
Senior Lecturer Emeritus	-	-	-	-	-	1	1

* One concurrent appointment is counted as 0.5 in the two departments concerned.

Students

Department/Program	Year	Undergraduate	Taught Postgraduate
CBME	as at 31 Dec 2009 as at 31 Dec 2010 as at 31 Dec 2011	191 215 224	-
CIVL	as at 31 Dec 2009	355	135
	as at 31 Dec 2010	339	161
	as at 31 Dec 2011	368	204
CSE	as at 31 Dec 2009	397	146
	as at 31 Dec 2010	446	175
	as at 31 Dec 2011	434	149
ECE	as at 31 Dec 2009	451	194
	as at 31 Dec 2010	482	141
	as at 31 Dec 2011	452	156
IELM	as at 31 Dec 2009	210	142
	as at 31 Dec 2010	243	147
	as at 31 Dec 2011	241	140
MECH	as at 31 Dec 2009	262	105
	as at 31 Dec 2010	266	94
	as at 31 Dec 2011	265	94
CPEG^	as at 31 Dec 2009 as at 31 Dec 2010 as at 31 Dec 2011	297 248 261	-

Program (MPhil and/or PhD)	Year	Research Postgraduate
Bioengineering [#]	as at 31 Dec 2009 as at 31 Dec 2010 as at 31 Dec 2011	27 32 29
Chemical and Biomolecular Engineering	as at 31 Dec 2009 as at 31 Dec 2010 as at 31 Dec 2011	49 55 58
Civil Engineering	as at 31 Dec 2009 as at 31 Dec 2010 as at 31 Dec 2011	101 119 133
Computer Science and Engineering	as at 31 Dec 2009 as at 31 Dec 2010 as at 31 Dec 2011	172 164 178
Computer Science and Technology	as at 31 Dec 2009 as at 31 Dec 2010 as at 31 Dec 2011	8 6 -
Electronic and Computer Engineering	as at 31 Dec 2009 as at 31 Dec 2010 as at 31 Dec 2011	222 231 250
Environmental Engineering	as at 31 Dec 2009 as at 31 Dec 2010 as at 31 Dec 2011	15 15 20
Industrial Engineering and Logistics Management	as at 31 Dec 2009 as at 31 Dec 2010 as at 31 Dec 2011	45 40 44
Mechanical Engineering	as at 31 Dec 2009 as at 31 Dec 2010 as at 31 Dec 2011	93 87 105

[#] in collaboration with Division of Biomedical Engineering



Academic Programs

Department of Chemical and Biomolecular Engineering		De	gree offe	red	
Chemical and Biomolecular Engineering Chemical and Bioproduct Engineering Chemical and Environmental Engineering Chemical Engineering	- BEng BEng BEng	-	-	MPhil - - -	PhD - - -
Department of Civil and Environmental Engineering		De	gree offe	red	
Civil and Environmental Engineering Civil and Structural Engineering Civil Engineering Civil Infrastructural Engineering and Management Environmental Engineering Environmental Engineering and Management	BEng BEng - - - -	-	- - MSc - MSc	- MPhil - MPhil -	- PhD - PhD -
Department of Computer Science and Engineering	Degree offered				
Computer Engineering ^A Computer Science Computer Science (Information Engineering) Computer Science and Engineering Information Technology	BEng BEng BEng - -	- BSc - -	- - - MSc	- - MPhil -	- - PhD -
Department of Electronic and Computer Engineering		De	gree offe	red	
Computer Engineering ^A Electronic and Computer Engineering Electronic Engineering Electronic Engineering (Information and Communication Engineering) IC Design Engineering Telecommunications	BEng - BEng BEng - -	-	- MSc - MSc MSc	- MPhil - - -	- PhD - - -
Department of Industrial Engineering and Logistics Management		De	gree offe	red	
Engineering Enterprise Management Industrial Engineering and Engineering Management Industrial Engineering and Logistics Management Logistics Management and Engineering	- BEng - BEng	-	MSc - - -	- - MPhil -	- - PhD -
Department of Mechanical Engineering		De	gree offe	red	
Intelligent Building Technology and Management Mechanical Engineering	- BEng	-	MSc MSc	- MPhil	- PhD

^ jointly run by CSE and ECE departments

Graduates

Graduate Numbers						
	2008-09	2009-10	2010-11			
Undergraduate	717	720	754			
Postgraduate - Research	194	174	168			
Postgraduate - Taught	399	509	510			
Total	1,310	1,403	1,432			

Research Funding of Engineering Departments (in HK\$M)

	Year	UGC/RGC [#]	Non-UGC/RGC
CBME	2008-09	13.1	18.4
	2009-10	5.7	30.2
	2010-11	5.6	6
CIVL	2008-09	9.2	0.7
	2009-10	17.1	4
	2010-11	13.2	9.7
CSE	2008-09	12.9	32.4
	2009-10	15.9	16.5
	2010-11	10.3	20.7
ECE	2008-09	31.2	9.9
	2009-10	23.1	35
	2010-11	25	11.7
IELM	2008-09	2.1	0
	2009-10	3.8	0.2
	2010-11	5.9	3.1
MECH	2008-09	8.2	12.2
	2009-10	9.8	3
	2010-11	14.5	21.2

[#] University Grants Committee/ Research Grants Council

Undergraduate Employment*					
	2009	2010	2011		
Employed	82.8%	89.5%	86.8%		
Further Studies	14%	7.6%	10.2%		
Others	3.2%	2.9%	3%		
Employment Sector*					
	2009	2010	2011		
Engineering and Industry	46.7%	42%	55.9%		
Commerce and Business	41.6%	49.1%	35.1%		
Education	7.7%	5.6%	5.6%		
Government and Related Organizations	2.8%	2.3%	2.1%		
Community and Social Services	1.2%	1%	1.3%		

* Figures of 2009 and 2010 include graduates from Dual Degree Program in Technology and Management



SCHOOL OF ENGINEERING

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