PolyU takes top prizes at Geneva's Invention Expo

理大揚威日內瓦國際發明展

At the 41st International Exhibition of Inventions of Geneva, PolyU researchers scooped 10 awards, including one Grand Prize, two Special Prizes, six Gold Medals and one Bronze Medal.

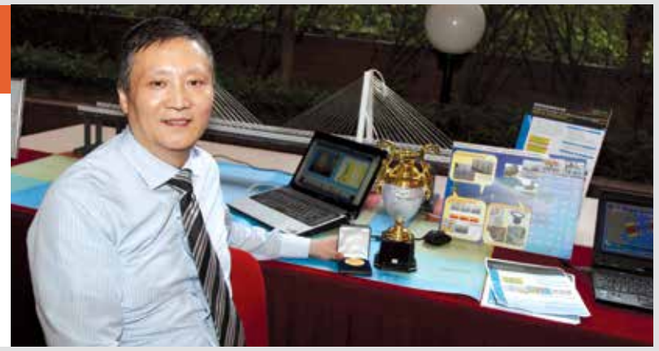
理大科研人員在日內瓦舉行的第四十一屆國際發明展上囊括十獎，包括一項特別大獎、兩項特別獎、六項金獎和一項銅獎。

Grand Prize and Gold Medal
特別大獎及金獎

Intelligent Ship-Bridge Anti-collision Surveillance System
橋樑防船撞智能監控系統

Principal Investigator: Prof. Ni Yiqing, Department of Civil and Environmental Engineering

發明者：土木及環境工程學系倪一清教授



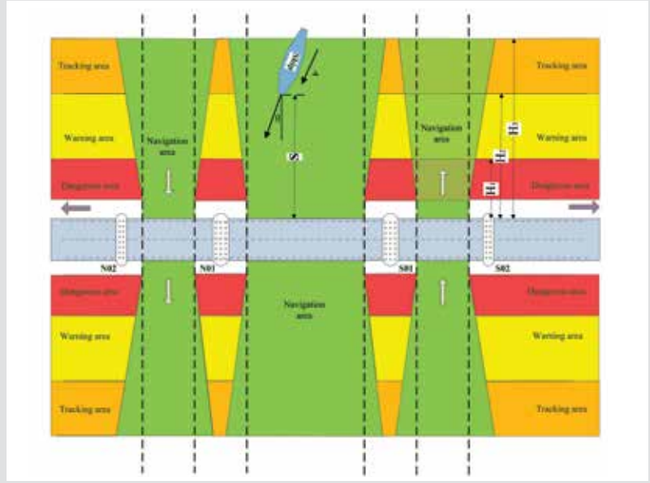
Prof. Ni Yiqing explains the operation of the system with a model.
倪一清教授以模型解釋系統的運作。

This surveillance system functions as a "black box" of a bridge by providing a full record of ship activities near the bridge and any impacts to the bridge structure. By incorporating an Automatic Identification System (AIS) and smart vision-based monitoring technology into the bridge's security, the system can actively monitor marine traffic, evaluate ship movements and send out warning signals to ships likely to collide with the bridge. When collision is unavoidable, the system immediately alerts the vehicles and personnel on the bridge. Novel piezoelectric sensors are embedded in the bridge for impact-force monitoring and collision damage evaluation. The system can be put to good use in both sea- and river-crossing bridge structures.

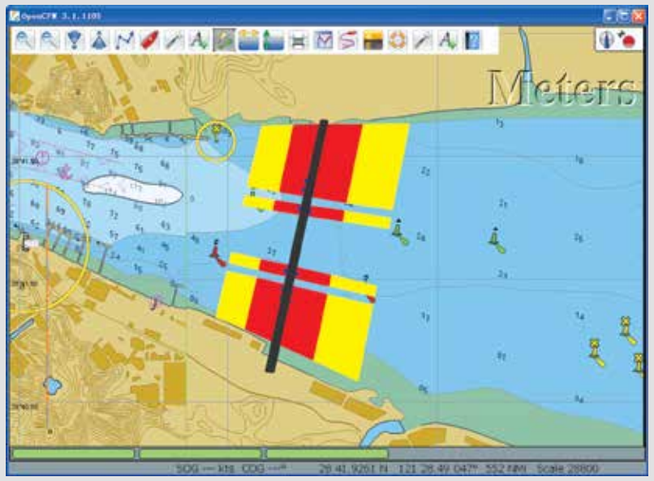
The project was jointly undertaken by PolyU's Department of Civil and Environmental Engineering, the Intelligent Structural Health Monitoring R&D Centre of PolyU Shenzhen Research Institute, and the Zhejiang Provincial Transport Bureau.

這套監控系統可作為橋樑的「黑盒」，提供監測範圍內船舶活動及其對橋樑結構衝擊的全面記錄。系統中，橋樑安全裝置加入了自動識別系統和智能視頻監控技術，能主動監控橋區水域船舶航行，評估船舶移動的路徑，並及時向有撞橋危險的船舶發出警報。在撞橋無可避免的情況下，該系統會即時向橋上車輛和人員發出警示。此外，壓電感測器安裝於橋內，可直接測量船撞力，並評估船撞所引起的橋樑損傷程度。此系統適用於跨海及跨河橋樑結構。

該項目由理大土木及環境工程學系、深圳產學研基地智慧結構健康監測研發中心及浙江省政府交通廳合作研究。



Schematic of surveillance zones
監控區域劃分示意圖



AIS monitoring programme interface
自動識別系統的監控軟件介面

Gold Medal with Jury's Commendation
評判特別嘉許金獎

Fabric Touch Tester
織物觸感測試儀

Principal Investigator: Prof. Li Yi, Institute of Textiles and Clothing
發明者：紡織及製衣學系李翼教授

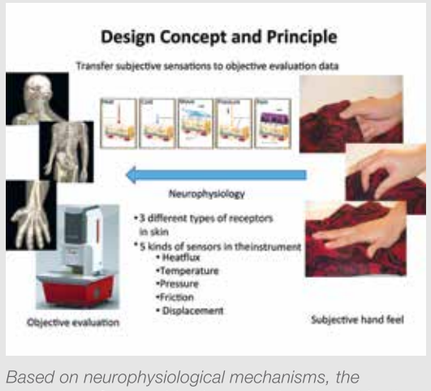
Prof. Li Yi with the Fabric Touch Tester
李翼教授與織物觸感測試儀

The various sensations of fabric touching the skin influence our feelings. Determining how to measure fabric tactile properties quickly is thus important in selecting appropriate fabrics for specific purposes in designing apparel and textile products.

PolyU's Institute of Textiles and Clothing and the Hong Kong Research Institute of Textiles and Apparel (HKRITA) have jointly developed a bionic instrument to simulate how fabrics stimulate human skin sensory receptors, generate signals, transmit them to the brain and formulate sensations such as soft/stiff, smooth/rough and warm/cold and the associated final preferences. Using bionic multisensory measurement technology and computer simulation models, the device can quickly simulate and measure neural responses, sensory perceptions of the body and hand touch comfort sensations on fabrics at a low cost.

布料－皮膚觸覺影響著人們的情緒感受。在設計服裝及紡織品的過程中，如何對布料的觸感進行快速測量，從而為產品選定合適的原料是非常重要的。

理大紡織及製衣學系與香港紡織及成衣研發中心合作研發出新型仿生測試儀器，能夠模擬布料如何刺激皮膚的感知神經元，發射神經信號，並將信號傳遞至大腦，最終形成具體感覺如柔軟感、光滑感、冷暖感和個人喜好。該儀器利用模擬多種皮膚感覺性能測量技術及電腦模擬模型，快速和經濟地模擬人體接觸布料時的神經反應、感官知覺和手感舒適度。



Based on neurophysiological mechanisms, the device transforms subjective sensations into objective evaluation data.
基於神經生理機制，這儀器把主觀感覺轉為客觀數據。

Special Prize and Gold Medal
特別獎及金獎

Novel Flavonoid Dimers for reversing cancer drug resistance
一種新型的腫瘤多藥耐藥逆轉劑——黃酮類二聚物

Principal Investigators: Dr Larry M.C. Chow and Prof. Chan Tak-Hang, Department of Applied Biology and Chemical Technology
發明者：應用生物及化學科技學系周銘祥博士及陳德恒教授

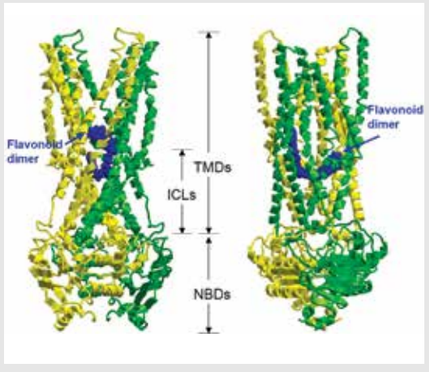
Dr Larry Chow (middle) and research team members
周銘祥博士 (中) 及研究團隊成員

Multidrug resistance is a major problem in cancer treatment, with membrane proteins P-glycoprotein (P-gp) and Breast Cancer Resistance Protein (BCRP) pumping drugs out of cancer cells and reducing chemotherapy efficacy. To combat this process, researchers have designed, synthesized and characterized novel diet-derived flavonoid dimers that can target the dimeric structure of P-gp and BCRP. Due to the unique design of dimeric in structure which can specifically bind to the pseudodimeric P-gp and BCRP, these flavonoid dimers can inhibit P-gp and BCRP, and reverse cancer drug resistance with very high potency and low toxicity.

This project was jointly undertaken by PolyU's Department of Applied Biology and Chemical Technology, McGill University, State Key Laboratory of Chirosciences at PolyU and the Shenzhen-based State Key Laboratory for Chinese Medicine and Molecular Pharmacology.

多藥耐藥性是進行癌症化療的重大難題。研究人員設計並合成了可以逆轉多藥耐藥性的一系列化學小分子。腫瘤細胞上的跨膜蛋白P-糖蛋白和乳腺癌耐藥蛋白能將細胞內的藥物排除，從而減低化療的效力。研究人員因此設計和合成了新型的天然黃酮二聚物。受惠於其結構特點，這類藥物可以靶向識別P-糖蛋白和乳腺癌耐藥蛋白的二聚結構並特異性結合，從而抑制P-糖蛋白和乳腺癌耐藥蛋白的活性，達到有效逆轉腫瘤多藥耐藥性的目的。此外，這類藥物的治療指數很高，而毒性卻非常低。

這個項目由理大應用生物及化學科技學系、麥基爾大學、理大手性科學國家重點實驗室，以及駐深圳中藥與分子藥理學研究國家重點實驗室負責進行。



Molecular modelling of P-gp binding to flavonoid dimmers
分子模擬數據顯示黃酮二聚物結合在轉運蛋白的跨膜區，並由此中斷藥物外排

Special Prize and Gold Medal
特別獎及金獎

Online Monitoring System for High Speed Laser Spot Welding
高速鐳射點焊監測系統

Principal Investigator: Prof. H.C. Man, Faculty of Engineering
發明者：工程學院文効忠教授

Prof. H. C. Man (middle) and team members
文効忠教授 (中) 與研究團隊

Integration of laser welding system and the online monitoring system
線上監測系統整合於鐳射焊接系統上

In the area of industrial micro-joining, laser welding has probably become the most preferred process because it does not involve soldering and offers a high production rate. However, no practical welding monitoring technology suits the stringent requirements of mass-production line.

This real-time, low cost and robust system can monitor welding process quality on very small and sophisticated electronic components and provide traceable weld data. In milliseconds, it can identify the quality of welded spots based on their cooling rates and reflected infra-red signals.

This invention can enhance efficiency and quality in the manufacturing of consumer electronic products such as mobile phones and medical products, for which the micro-welding of metallic parts and hermetic sealing are the most critical factors. It can also be easily adopted in existing laser welding systems to raise their performance standards.

在工業微焊接範疇中，鐳射焊接相信已成為最常用的方法，主要是因為焊接過程不涉及使用焊錫，更可以高速自動化而大大提升生產效率。然而，現時並沒有在線監測鐳射點焊質量的技術可符合批量生產線上的嚴格要求。

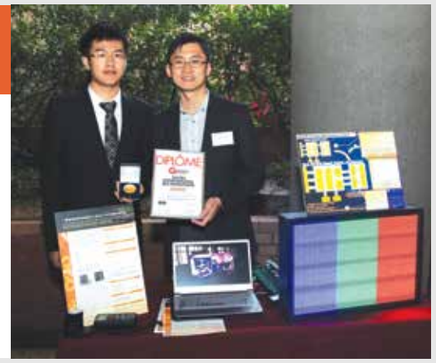
這套實時、低成本及堅固耐用的系統，可監測細小精密的電子部件的焊接質量，並記錄及提供每個焊點品質的可追溯資料。通過收集焊接時熔池的輻射信號及熔池的冷卻信號，系統可在幾毫秒內計算及分析出點焊的品質。

金屬部件的微焊接質量及密封技術為手機等電子產品及醫療用品類高增值產品的關鍵。這系統的檢測速度快，而且有助提升產品質量，更可與現有的鐳射點焊設備相容，提高其表現水準。

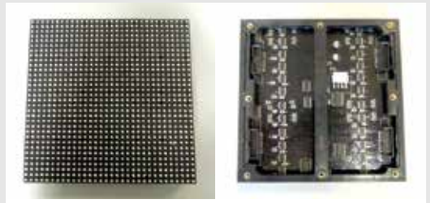
Gold Medal
金獎

An Energy-Saving, Wide-Colour Gamut LED Display System
一種兼備節能和高顯色功能的LED戶外顯示屏系統

Principal Investigators: Dr K.H. Loo, Dr Y.M. Lai and Prof. Michael C.K. Tse, Department of Electronic and Information Engineering
發明者：電子及資訊工程學系盧家航博士、黎沃銘博士及謝智剛教授



Dr K. H. Loo (right) and team member
盧家航博士 (右) 及研究人員



Front view　　Back view

Single LED module consisting of 32x32 LED pixels
每套LED模組包含32x32 LED圖元

PolyU researchers have invented a system to cut down the consumption of energy in and enhance the image quality of outdoor LED display panels. The system uses a low-cost method for implementing multi-level Pulse-Width-Modulated (PWM) driving technology on wide-area outdoor LED display panels. The technology allows the two-dimensional dimming of each LED pixel and results in a colour gamut that is much wider than those of existing display systems.

Because of the physical characteristics of LEDs, the technology also offers the additional advantage of higher energy efficiency than conventionally-driven systems. Moreover, implementation of the technology requires only a very small increase in the hardware cost, making it commercially viable.

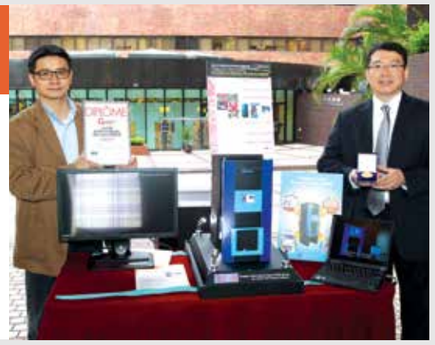
理大研究人員研發出嶄新方法，可以減低LED戶外顯示屏系統的耗電量，同時提升其圖像質素。該發明採用低成本的方法，將已獲認可的多電平脈寬調制電流 (Pulse-Width-Modulated, PWM) 驅動技術應用在戶外LED顯示屏系統中。透過多電平PWM的使用，本發明可在LED驅動上實現二維調光功能，並使LED顯示屏的顯色度大幅提升。

此外，這項技術是針對LED的物理特性而研發，經採用後能明顯改善LED的光效。然而，這項技術只會令硬體成本稍微增加，就能實現以上種種優點。

Gold Medal
金獎

Imaging Colour Measurement System based on Multispectral Imaging Technology
基於多光譜成像技術的顏色測量系統

Principal Investigator: Prof. John Xin, Institute of Textiles and Clothing
發明者：紡織及製衣學系忻浩忠教授



Prof. John Xin (right) and team member
忻浩忠教授 (右) 及研究人員

This Imaging Colour Measurement (ICM) system is the world's first instrument capable of measuring spectral reflectance over the visible spectrum in the range of 400 to 700 nanometres, with a very high accuracy of up to 0.0024 in terms of root-mean-square spectral error. The system has completely overcome the limitation of measuring multi-colour samples with spectrophotometers which is currently the only type of accurate spectral colour measurement device available in the market. It measures the colours of multi-colour samples ranging from printing fabrics, yarn-dyed fabrics, laces, yarns and threads, to coloured plastics, cosmetics and automotive parts. The system's ability to measure colour can be extended to any multi-coloured, irregularly shaped, extremely small three-dimensional objects.

The project was jointly undertaken by PolyU's Institute of Textiles and Clothing and the Hong Kong Research Institute of Textiles and Apparel (HKRITA).

這套成像顏色測量系統是全球首個用於測量在可見光譜400-700納米範圍內光譜反射率的測量儀器。按均方根光譜誤差，其精確度高達0.0024，為紡織和服裝行業提供了一套完善的顏色解決方案。分光光度計是現時市面唯一可準確測量光譜顏色的儀器，而成像顏色測量系統能夠完全解決分光光度計測量顏色的局限。該系統可量度多色樣品，例如印花布料、紗染布料、花邊、紗線、線、有色塑膠、化妝品及汽車配件等的顏色。此外，該系統的顏色測量能力可進一步應用到多色、不規則及極小的三維物件上。

這項目由理大紡織及製衣學系與香港紡織及成衣研發中心合作進行。

Imaging Colour Measurement System
成像顏色測量系統

Bronze Medal
銅獎

Smart Garment with Traditional Chinese Herbal Medicine Microcapsules for Treating Atopic Dermatitis
治療過敏性皮炎的中草藥微膠囊智能服裝

Principal Investigators: Dr Patrick C.K. Hui and Dr Frency Ng, Institute of Textiles and Clothing
發明者：紡織及製衣學系許賜亮博士及吳秀芬博士

Drs Patrick C.K. Hui (right) and Frency Ng
許賜亮博士 (右) 及吳秀芬博士

It is commonly known that Traditional Chinese Herbal Medicine (TCHM) can be directly applied to the skin for the clinical treatment of atopic dermatitis by Chinese bone-setters and TCM practitioners. However, this method may make patients uncomfortable and the release of TCHM cannot be controlled for effective treatment.

PolyU thus developed a new method of preparing Chitosan/Sodium Alginate microcapsules encapsulated with TCHM that can be control-released over time for effective clinical treatment without toxicity. The researchers used two variables – temperature and humidity – to control the release of the TCHM from the microcapsule to the skin for clinical treatment. The microcapsules are grafted onto special textile materials that can be developed into smart garments for the more convenient and effective treatment of patients with atopic dermatitis.

一直以來，跌打醫師及中醫師治療過敏性皮炎的方法是直接將中草藥施加於患者皮膚上，但這種方法不但會令患者感到不適，而且無法控制中草藥的釋放，因而影響治療成效。

有見及此，理大研發了一種用來治療過敏性皮炎的丹皮微膠囊，它既無毒性，又能控制藥性的釋放。研究人員成功使用兩個變量－溫度和濕度，以控制中草藥從微膠囊釋放到人體皮膚作臨床治療用途。應用此中草藥膠囊於特選的布料上製造智能服裝，能夠為過敏性皮炎患者提供一個舒適、高效的治療方案。