Joining hands to fight flooding

Researchers of the Department of Civil and Structural Engineering (CSE) have been working closely with the Government's Drainage Services Department (DSD) to prevent of flooding in Sheung Wan and Tsuen Wan districts.

Stormwater Pumping Station in Sheung Wan

Prof. Li Yok-sheung

The research team, comprising Associate Professor Dr Onyx Wai and Professor Li Chi-wai, has been dedicating efforts to refine the design of the Sheung Wan pumping station, due to open in 2009. The system will catch rainwater in the area around Wing Lok Street and send it to an underground tank at the pumping station by the waterfront and pump it to the harbour. According to Prof. Li Yok-sheung, Head of CSE, it can pump six cubic metres of rainwater per second into the harbour, helping to ease the flooding problem in Sheung Wan during prolonged rainstorms.

*Before (left) and after completion of the pumping station**

Sheung Wan Stormwater Interception System*

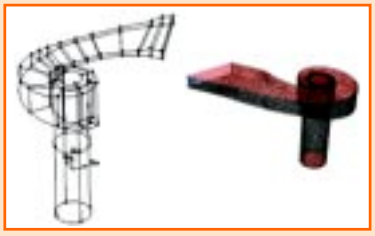
* Source of illustrations: DSD website

A miniature of the engineering structure of the Tsuen Wan drainage project has been built in the University's Hydraulics Laboratory. It took more than six months to construct this 1:20 physical model of the river, intake structure and device for simulating water flow during rainstorm warning. Dr Onyx Wai shows the model to the media in a press briefing.

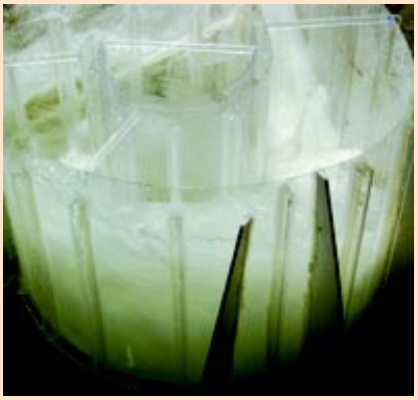
Experiment: Vortex dropshaft

Rainwater Intake Structure in Tsuen Wan

In collaboration with Mott Connell, the University's civil engineers have been developing a rainwater intake structure for DSD which will be built along a meandering natural river on the upstream of Tso Kung Tam in Tsuen Wan. The new structure will catch excess rainwater during heavy downpours with its design of a funnel-like vortex system. Tests showed that it could withstand the most intense rainstorm that may occur once in 200 years. At the same time, the structure will not disturb the natural flow of stream water in normal days so that the ecology in the area can be preserved.



Future research: Combining the computational fluid dynamic technique and physical modeling technique to estimate hydraulic performance.



Experiment: Vortex chamber

Pioneering *world's first* fibre optic sensors for railways

The world's first "Fibre Optic Sensor System" for monitoring railway "health and safety" has recently been installed in the tracks and trains of East Rail, the key railway linking Hong Kong to the Chinese mainland. This marks the fruition of the collaboration between researchers from PolyU's Photonics Research Centre and Kowloon-Canton Railway Corporation (KCRC).

With a funding of $3 million from KCRC, the innovative system was developed by Prof. Tam Hwa-yaw and Prof. Ho Siu-lau of PolyU's Department of Electrical Engineering and KCRC experts. A patent application for their invention is being filed.

Although fibre optics have often been used in telephone systems and telecommunications for decades, their advanced application in railway systems is by far a major technological breakthrough, according to Ir Tony Lee Kar-yun, Acting General Manager, Rolling Stock Design, of KCRC.

Building on a photosensitive fibre with a refractive index modulation, fibre Bragg grating sensors (FBG) measure strain in terms of shifts in FBG wavelength. At PolyU, researchers developed a novel time- and wavelength-division multiplexing technique to interrogate several hundred FBG sensors along a single strand of optical fibre of about 1cm in length — thin like a strand of hair, with radius of only about 0.1mm. By putting this strand of optical fibre under special ultra violet rays, thereby changing its refractive index, the piece of fibre is turned into a fibre Bragg grating sensor.

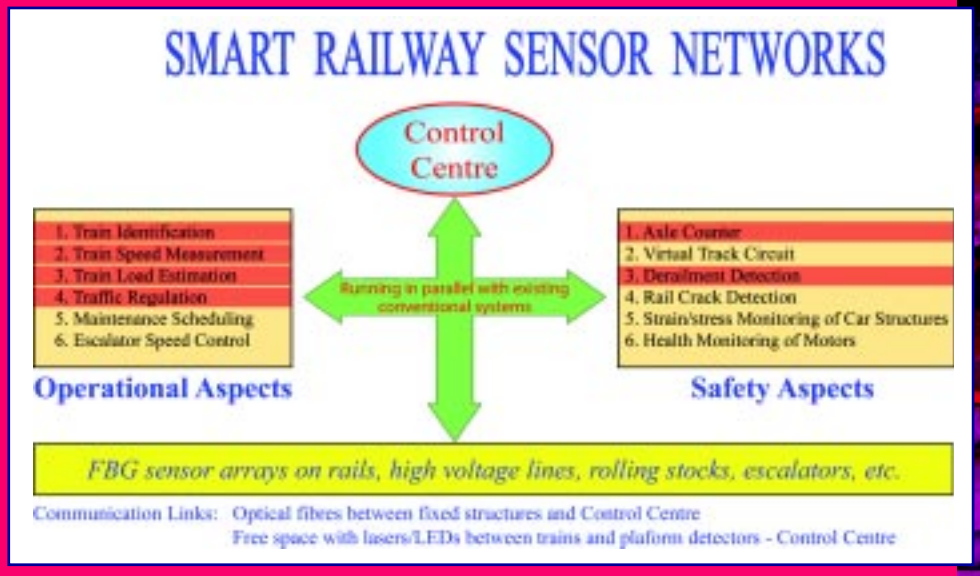
Using the FBG and interrogation technologies, the researchers held that thousands of FBG sensors can be incorporated along railway tracks and coaches as "optical sensory nerves". Data is gathered and analysed on the computer whenever the wheel of a train exerts pressure on these "nerves" along the railway, or whenever components installed with the sensors underneath a coach is subject to external forces, thus immediately reflecting the "health" of the train and the tracks.

Prof. Tam said: "We believe this has good potential to ultimately revolutionize railway systems and turn conventional systems into 'Smart Railways'."

A "Smart Railway" will be installed with a "Smart Railway Sensor Network" using FBG sensors. These sensors can be used to build up important sub-systems such as axle counters, derailment monitors, train load detectors and rail crack detectors. Such a sensor network allows real-time and continuous monitoring of an entire rail network, and facilitates maximization of network capacity, optimization of electricity utilization and effective detection of potential operational hazards.

Prof. Ho remarked: "FBG sensors can provide reliable and vital information to

Prof. Tam: working hard to bring about "Smart Railways".



rail operators. The result should be an enhancement in overall service safety and quality."

FBG sensor systems are found to bring a number of advantages over conventional sensors.

- While electrical sensors in most conventional detection systems installed in railway networks are highly susceptible to electromagnetic immunity (EMI), FBG sensors are more reliable with their immunity to electromagnetic interferences.
- The capability to multiplex a large number of sensors fabricated in a single fibre enables a much more simplified installation process and reduction in costs.
- FBGs are created inside standard optical fibres which exhibits extremely low loss, permitting remote sensing over distances of 50 km or beyond, covering the whole East Rail network.

Other important advantages include the long lifespan of optical fibres of over 30 years, and low mass production cost, requiring only a few dozen dollars to produce an FBG sensor.

Since 2003, the team has worked closely together to develop a novel Fibre Optic Sensor System for monitoring the train conditions and track activities of the East Rail. The first eight sensors were installed in a southbound section of East Rail near Tai Wai Station. Throughout the series of tests and experiments conducted, the sensors proved to be highly effective in generating information for early detection of potential problems, so that immediate preventive or remedial actions could be taken. In 2005, KCRC established a laboratory in Fo Tan especially dedicated to monitoring the data produced by the sensor system.

Ir Lee of KCRC shows a strand of optical fibre.

Following further installation of the sensor system in July near Fo Tan Station, full installation in the trains and along other sections of East Rail is expected to be implemented around the end of this year. By then East Rail should become a truly Smart Railway with a Smart Railway Sensor Network.

Ir Tony Lee added that installation of the sensor network in West Rail and Ma On Shan Rail would also be considered.

The project builds on the success of two award-winning associated studies led by Prof. Tam. The "Advanced Fibre Bragg Grating Railway Monitoring System" earned a Gold Medal in the 32nd International Exhibition of Inventions, New Techniques and Products, held in Geneva in 2004. The "Innovative Opto-Electronics Railway Monitoring System" scored a Bronze Medal in the 5th China International Invention Expo, held in Shanghai in the same year.

Meanwhile, a plan to set up a research laboratory on smart railways on PolyU campus later this year is already underway. Further applications of the sensor system in the Lantau Airport Railway of the Mass Transit Railway Corporation (MTRC) are also being explored.

Four of the research team members (from left) Mr Antonnio Yip, Dr Michael Liu, Prof. Tam, Dr Dick Chung.

Mix and match? Do it the smart way

Researchers from PolyU's Institute of Textiles and Clothing (ITC) have recently developed "An Intelligent Simulator for Cross-selling & Up-selling using Smart Fitting Room & Smart Dressing Mirror". It is expected to help fashion retailers improve their sales and customer services.

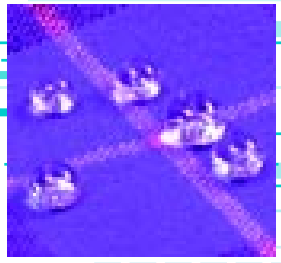
This system uses the Radio Frequency Identification (RFID) technology to detect items for sale. When an item is taken into a fitting room or placed in front of a dressing mirror, the product ID will be immediately detected and transmitted to the system through the antennae and reader.

The mix-and-match database of the system will then deliver recommendations to the customer through a touch-screen LCD monitor or projected screen. Inside the fitting room, if the customer is interested to pick the recommended mix-and-match items, he/she can make their choice by simply clicking on the items shown on screen. Through the intercom system, the salesman in the shop counter will thus be informed of the additional items required by the customer inside the fitting room.

Dr Leung and Dr Wong trying out the new system.

Led by Dr Calvin Wong, Dr Sunney Leung and Dr Tracy Mok, this project involves close collaboration between ITC and industry. The team believe that the intelligent system can help boost fashion retailers' sales performance through systematic cross-selling and up-selling. It allows retailers to identify items which appeal to customers most. It also facilitates teaching and research in areas like fashion retailing, consumer behaviour, promotional strategies and supply chain management.

New centre to enhance cutting-edge R&D in textiles & clothing



As host of the new Hong Kong Research Institute for Textiles and Apparel (HKRITA), established with funding support of the HKSAR Government's Innovation and Technology Commission, PolyU is set to play a key role in spearheading innovation and technology development for Hong Kong's textiles and clothing industry.

Leveraging the expertise of PolyU's Institute of Textiles and Clothing – the top of its kind in the territory, HKRITA is also supported by institutes, companies and associations in the textiles and clothing industry in Hong Kong, mainland China and other countries.

HKRITA was officially opened on 20 April in a joint launching ceremony with four other Research and Development Centres, organized by the Innovation and Technology Commission at the Hong Kong Convention and Exhibition Centre.

The officiating guests included the then Acting Chief Executive Mr Rafael Hui Si-yan, Secretary for Commerce, Industry & Technology Mr Joseph Wong, and the five centres' chairmen. More than 600 industry and technology leaders from Hong Kong, the mainland and overseas also joined in the event.

At the helm of HKRITA is its Chairman Mr Kenneth Fang. The leading industrialist is Chairman of Fang Brothers Knitting Limited, Honorary Chairman of the Hong Kong Textile Council and an Honorary Graduate of PolyU. Mr Haider Barma, who was formerly Hong Kong's Secretary for Transport and later Chairman of the Public Service Commission, joined HKRITA as its Chief Executive Officer in April.

According to Mr Barma, HKRITA is owned and hosted by PolyU but run independently as a limited company, with its own Board of Directors and with funding from the HKSAR Government. "We are Hong Kong's premier research and development centre on textiles and apparel," he said.

The five centres are undertaking industry-oriented research in technologies demanded increasingly in the Pearl River Delta Region. Apart from textiles and clothing, the other centres will focus on automotive parts and accessory systems; information and communications technologies; logistics and supply-chain management enabling technologies; and nanotechnology and advanced materials.

The Innovation and Technology Fund is financing the programme, and has reserved more than $2 billion to run the five centres. Hosted by local universities and technology support organizations, they will provide applied research and technology transfer support to help industries advance Hong Kong's economy.

For more details, see: http://www.hkrita.com and http://www.innotech.gov.hk/en/inno_forces/research.development.centre.html.

香港紡織及成衣研發中心
The Hong Kong Research Institute of Textiles and Apparel

HKRITA's technology focus areas

- New Materials and Textiles and Apparel Products
- Advanced Textiles and Clothing Production Technologies
- Innovative Design and Evaluation Technologies
- Enhanced Industrial Systems and Infrastructure