

Faculty of Engineering Newsletter

Message from the Dean

One of the challenges for any Engineering Faculty is to find ways to develop an interest and enthusiasm for engineering in high schools and colleges as this is



where nearly all our future engineers will come from. Many students at schools will be studying physics and maths and science without a clear idea of how engineers use these subjects on a daily basis to solve practical problems. Creative solutions to improve the health and welfare of the community cannot be realised without engineers using these subjects as a basis for their work.

The Engineering Profession and the community generally benefits enormously if the profession can attract its fair share of talented youth. It is well known that Australia does not do this very well in comparison with other developed countries, and so any program which does this successfully is deserving of considerable commendation. Dr Bob Wheway from the Faculty of Engineering at the University of Wollongong has pioneered a High School's competition which has now, after several years, grown to cover all high schools in NSW. Over 350 people came to his prizegiving at the University last week; it is now easily the largest and most comprehensive and successful such program ever organised in Australia.

This competition commenced from a very small beginning in 2000 with a grant of \$250 seed money from Sydney Division of Engineer's Australia. It involved a pilot Year 11 Engineering Studies Competition in the Illawarra Region. The Faculty of Engineering's Senior High Schools Technology Competitions have now gone

Rolling Stock Course Receives Tick of Approval from Industry Experts

Dr Richard Dwight recently led a review on UOW's rolling stock engineering postgraduate degrees.

The review panel consisted of recognised leaders in the rail industry and included companies from all over Australia involved in the design, manufacture and operations sectors.

Panel members included representatives from Interfleet, RailCorp, Downer EDI Rail, Worley Parsons, Bombardier, Bradken, Queensland Rail, ARG, as well as Rail Innovation Australia.

The Rolling Stock Engineering Program was developed as a co-operative project between the University of Wollongong, Rail Innovation Australia and the rail industry to address a shortage of rolling stock engineers.

These programs have been led by Dr Dwight and offered by UOW since 2007 with its first cohort of Masters Students graduating in December.

These courses are one of a number of key initiatives undertaken in the Faculty of Engineering. The faculty said the courses contributed to its strong industry collaborations and commitment to answering Australia's current infrastructure needs and were a key aspect of the University's new SMART (Simulation, Modelling and Analysis for Research and Teaching) Infrastructure Facility now under construction at the University.

The panel fulfils a key role in the quality system of the Rolling Stock course by providing valuable industry-specific input and advice.

Course components reviewed included course objectives, subject outlines, assessments, subject content, student surveys, course delivery and marketing initiatives.

The panel agreed that the course addressed core competencies required by Rolling Stock professionals with all participants roundly endorsing the course.

The Faculty of Engineering said that outcomes from the meeting would ensure continuous improvement and ongoing relevance to the rail industry.

from strength to strength. Subjects now covered on a regular basis are Engineering Studies, Design & Technology and Industrial Technology in both Year 11 and Year 12. Now in 2009 there is no fewer than a total of 6 competitions per year. The 'Engineering Studies' Competitions cover 280 High Schools, the 'Design & Technology' Competitions 430 High Schools, and the 'Industrial Technology' Competitions 440 High Schools. P.T.O

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This covers practically every engineering related subject offered at every High School in NSW. Several scores of prizes are awarded every year to students and to their schools, with over \$40,000 worth of prizes awarded at our 2009 ceremony in November. Dr Wheway has been very successful in engaging Industry support for these programs, since Industry is also very concerned at the future supply of engineering talent. Over 40 separate companies covering a wide range of industries contribute to these prizes and such support is a very clear demonstration of the need that Industry has for engineering graduates. Others have also noted this success, and Dr Wheway has been approached by educational authorities in both the Australian Capital Territory (ACT) and the Northern Territory to implement similar programs. The first ACT pilot program has already run in the second half of this year and there will be another prize giving ceremony in the ACT on December 7th. From all points of view-from teachers and education authorities, from students at school and university, and in assisting Industry in supplying much needed engineering graduates, this program is remarkably successful. Dr Bob Wheway has pioneered a remarkable phenomenon which has made a substantial difference to the understanding of engineering in high schools all over New South Wales.

Triple Progress

Prof. Arndt's new 'Triples' table tennis team game has continued to make progress in 2009, more recently on three fronts:

1. A very successful Triples Demonstration with some of Australia's best junior players was held during the 2009 World Masters Games in October at Hurstville. Plans are afoot to repeat this at the ITTF World TT Team Championships in Moscow in 2010.



2. The 'World's First Triples Competition' was held with 8 teams at Beaton Park in Wollongong during November - and reported on WIN TV -, with top ITTA players from 10 to 70+ years of age fighting it out for the (similarly world's first) Triples Trophies.

3. As part of an ongoing MMM thesis project aimed at replacing the manual Triples score- and display- flip charts with an electronic version, Brendan O'Connell's 2009 thesis on "Electronic Monitoring and Display for Table Tennis Triples" has paved the way for a university-based industrial unit - hopefully in 2010....

Tremendous Industry Support for the Faculty's Senior High Schools Technology Competitions

A Combined Presentation Evening on Wednesday 25th November was the culmination of this year's 6 NSW Senior High Schools Technology Competitions. A packed Lecture Theatre, 67.107, witnessed the presentation of Major Awards and Finalists Awards to competing High Schools and their students.

These Awards were funded by 41 sponsors whose logos appear in this article. The total sponsorship provided by these 41 sponsors totaled over \$40000.

The 6 NSW Competitions are Year 11 and Year 12 Competitions in 3 Senior Technology subjects, Engineering Studies, Design & Technology and Industrial Technology.

A follow-up article detailing the winning students and their High Schools will appear in the first Faculty Newsletter for 2010. In the meantime, the Award Winners for the inaugural Year 11 and Year 12 ACT Design & Technology Competitions will be announced and presented at a Presentation Evening in Canberra on Monday, 7th December. These 2 ACT Competitions have been funded by a Vice- Chancellor's Challenge Grant of \$20000. This third Vice-Chancellor's Challenge Grant brings to \$50000 the funding he has provided in recent years for the Faculty's Competitions.



New Book—Geotechnical and Slope Analysis

A new book entitled "Geotechnical Slope Analysis" was written by Robin Chowdhury with contributions by Phil Flentje and Gautum Bhattacharya. It was published by CRC press (Balkema), Taylor & Francis Group. The book considers modern international practice for understanding and analysis of slope stability and landslides. Research studies and developments right until 2009 are included in the comprehensive reviews included in several chapters. In fact about 100 out of 652 research references are from the last 10 years 1999-2009. Both rainfall-triggered and earthquake-triggered slope failures are discussed. Particular attention is also given to urban slope stability problems. The book emphasises an interdisciplinary approach to slope stability and thus includes important aspects of both regional and site-specific analyses.

The Other Kind of "Clean Coal" Technology Proven a Success

Dr Ting Xiang Ren, a Senior Lecturer from the School of Civil, Mining and Environmental Engineering, has won the 'Health & Safety Award 2009' from BHP Billiton Mitsubishi Alliance. This prestigious award is 'presented to an employee or group of employees/contactors who has excelled in an area of health and safety in the period 1 July 2008 to 30 June 2009' for the Shearer Scrubber Project led by Dr Ren and supported by the Australian Coal Industry's Research Program (ACARP). Dr Ren recently joined the University of Wollongong after six years with the CSIRO.



Dr Ting Xian Ren

The most obvious hazards in a coalmine are the presence of gas and the threat of explosion, plus floods in wet mines and structural collapse in particularly unstable ones. But other killers - less obvious and less cataclysmic - pose significant risks to mine workers. They are pollutants in the form of coal dust, which if not handled carefully, can result in serious health issues, high concentrations of breathable coal dust which can lead to pneumoconiosis - or 'black lung disease' - and silicosis from mining material with a high quartz content. There are measures that mines can take such as ensuring workers wear masks and introducing engineering controls including ventilation dilution, water infusion, wet-cutting, water sprays, wetting agents and foam, and dust collectors such as dust scrubbers.

Scrubber systems have been tested before but success was limited by a lack of understanding of the dust and airflow patterns around the sites for dust control. With the support of ACARP, Dr Ren and his collaborators from CSIRO and EnviroCon have developed an innovative longwall shearer scrubber system using CFD (computational fluid dynamics) modeling techniques which has been shown capable of capturing and modifying the airflow pattern around the maingate cutting drum and reducing dust roll-up toward the walkway area.

The design of the scrubber system incorporated the desired scrubber capacity, the inlet locations and the airflow discharge direction from the elutriator. Field trials of the scrubber were recently carried out at BHP Billiton Mitsubishi Alliance's mine at Broadmeadow in Queensland's Bowen Basin.

The scrubber is a modular system so as to fit the limited space between the ranging arm and the longwall shearer body. The scrubber includes an intake hood directed into the intake ventilation, a hydraulic-driven fan which sucks the air into an impact filtration system, and a discharge duct which forces the clean air under the shearer body and toward the face. The sides of the intake hood have a series of water sprays to create an agglomeration impact point for the dust/water mixture prior to impact filtration removal. The sprays were also designed to provide positive pressure resistance and create an air curtain to prevent dust from entering the walkway. Clean air is discharged under the shearer ranging arm toward the face. The combined effect of the spray pressure, flow and design contribute to further influence the dust's behavior and improve dust collection.

Dust survey results from recent tests of a dust scrubber at BHP Billiton Mitsubishi Alliance's mine at Broadmeadow in Queensland's Bowen Basin give hope for healthier mine environments. Monitoring results indicated that the dust reduction rate varied from 43 per cent (with average dust concentration falling from 1.35 mg/m³ to 0.77 mg/m³) to 56 per cent (with average dust concentration falling from 1.59 mg/m³ to 0.70 mg/m³). The results were better than expected and indicated a positive advance in mine safety.

According to Dr Ren, the project team has been monitoring the performance of the dust scrubber installed at Broadmeadow and making improvements on the system to fully integrate the scrubber into the longwall shearer automation system. In addition, Dr Ren is leading another ACARP project to develop a new venturi system based on ultra-fine water mist technology to reduce airborne respirable dust generated on medium and thick seam longwalls, particularly those dust particles from the advancement of MG chocks and the intake ventilation passing the BSL on to the longwall face.



Varian Prize

At this years EPSM-ABEC 2009 Conference (8-12 November 2009) held at the Hotel Realm in Canberra, Dean Cutajar from the Centre of Medical Radiation Physics, School of Engineering Physics, in the Faculty of Engineering, was awarded the Varian Medical Systems Prize.

Deans oral presentation was on a new technology for improvement of cancer of eye treatment by new dosimetry for eye plaque brachytherapy. This project is supported by A. Rozenfeld et al. NHMRC Grant.

This prize is awarded to the best oral presentation related to radiotherapy at the EPSM-ABEC 2009 Conference.

Award honour for vital rail track research

The University of Wollongong and RailCorp have been honoured with a major award for their joint urgent research to improve track strength and stability to cater for heavier, faster trains.

At a ceremony attended by Deputy Prime Minister Julia Gillard at the Arts Centre in Melbourne, Professor Buddhima Indraratna received the Business-Higher Education Round Table's (B-HERT) most coveted, "2009 Award for Best Research & Development Collaboration" for outstanding achievement.

This award is in recognition of the significant contributions made by the UOW-RailCorp (NSW) partnership of Professor Indraratna (Professor of Civil Engineering) and David Christie (Senior Geotechnical Consultant, RailCorp, NSW).

Professor Indraratna from UOW's Faculty of Engineering is also its Director of the Centre for Geotechnical and Railway Engineering, and the Wollongong Co-ordinator for the Co-operative Research Centre for Rail Innovation.

He is regarded by his peers as being the leader of a group of researchers who are at the forefront of rail research in the world. Since the mid 1990s after starting rail track research for the first time in an Australian university, almost every PhD student in the rail track area in Australia has been a student of Professor Indraratna.

Professor Indraratna paid special tribute to his past and present PhD students and his dedicated research staff who have worked with him for about 15 years in rail track research that has brought recognition to University of Wollongong as one of the most prominent rail track research centres in the world.

"They too must share in this award as does the UOW administration that has continued to support this research since I first arrived here in 1991," he said.

Professor Indraratna and his co-researchers along with RailCorp have been involved in the design and construction of modern rail tracks using high strength plastic grids and synthetic drain systems and for introducing new ballast standards for rail tracks in Australia to cater for faster and heavier trains.

Transporting increased amounts of freight, coal and ore on rail at higher speeds demand a strong and reliable track structure. Rock of high quality for rail ballast is a diminishing resource and extensive quarrying degrades the environment.

"Achievements have been the redesign of the ballast grading to enhance its strength and stability, the introduction of geogrids to improve performance of recycled ballast and the use of prefabricated subsurface drains to improve the performance of soft soil under the repeated loading from heavy trains," Professor Indraratna said.

Earlier this year the NSW Premier Nathan Rees and Transport Minister David Campbell announced \$10 million in funding from RailCorp to establish the SMART Rail Institute at UOW.

The Rail Institute will play a critical part in the overall development of the University of Wollongong's SMART (Simulation, Modelling and Analysis for Research and Teaching) Infrastructure Facility now under construction at the University.

B-HERT Awards were established in 1998 to recognise outstanding achievements in collaboration between business and higher education in the fields of research and development and education and training. The objective of the program is to highlight at a national level the benefits of such collaboration and enhance links between industry and universities. B-HERT awards are primarily sponsored by the Federal Government's Department of Education, Employment and Workplace Relations.



Student Profile

Chihiro Sakata started her Master's research in Environmental Engineering in 2007 under the supervision of Assoc. Prof. Muttucumar Sivakumar. With industrial collaboration, she has been researching on a full-scale microfiltration (MF) plant for water recycling. This topic is currently very 'hot' because MF is often used for the pretreatment process for reverse osmosis system used in desalination and wastewater treatment in the world due to the current freshwater scarcity.

Her background is not within one discipline. She originally studied Mechanical Engineering in Tokyo Metropolitan University (Japan), but worked as a software engineer for several years.

During working, she had travelled to Uluru, Cairns and other places in Australia and finally

decided to come here to study the Master of Environmental Science at UoW. After completing this degree in 2007, she started her current research. During her research, she worked as an academic tutor for both CME and MMM schools. She also enjoyed great activities including skydiving from 14,000ft above Wollongong's beautiful beaches!!



Jules Byrne Student Presentation Evening

The Jules Byrne Student Presentation Evening organised by NSW Branch of Materials Australia was held on the 25th of November. Four PhD students representing UNSW, UTS, USyd and UOW were competing for the 1st Prize. Congratulations to our PhD student Salar Niknafs from EMI Research Strength who presented an excellent talk and was awarded the 1st Prize. Salar was congratulated by Jules Byrnes himself. Salar has previously completed his Master by Research at UOW under supervision of Prof. Rian Dippenaar and just recently published a book based on his thesis. This is a wonderful accomplishment for a postgraduate student.



Triple Symposia Discusses Latest Research on Novel Materials

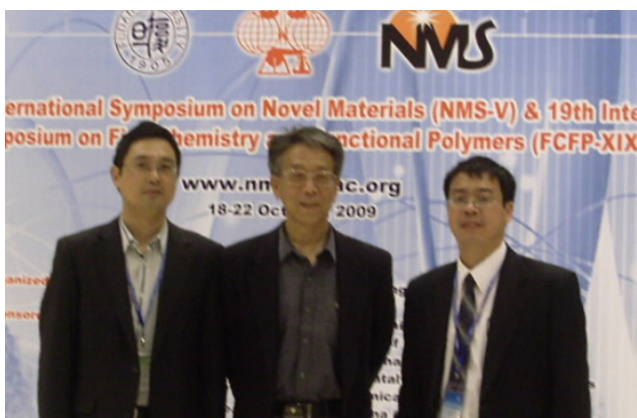
China's Fudan University and the University of Wollongong recently held a joint symposium in Shanghai, China.

It was the 5th International Union of Pure and Applied Chemistry (IUPAC) international symposium on novel materials and their synthesis, together with the 19th international symposium on fine chemistry and functional polymers and the 3rd symposium on power sources for energy storage and their key materials.

Co-chairmen, Professor Yu-Ping Wu from Fudan University and Associate Professor Guoxiu Wang from UOW invited more than 400 participants to attend the international joint symposia. This included 300 international distinguished guests and over 20 representatives of industries from more than 30 different countries.

Among these were UOW's plenary speaker Institute of Superconducting and Electronic Materials (ISEM) Director, Professor Shixue Dou; along with keynote speaker Professor Xiaolin Wang and PhD student Hao Liu, also from ISEM. Associate Professor Guoxiu Wang also gave the opening address and a keynote speech.

The Nobel Prize Laureate in Chemistry 1988, Professor Robert Huber, gave a plenary speech with the title "Proteins and their Structures at the Interface of Physics, Chemistry and Biology".



The triple symposia covered a broad spectrum of materials science, chemistry, biochemistry, and physics.

In particular, the symposia also had a focus on renewable energy storage and conversion. There were presentations on the latest advances on rechargeable batteries, hydrogen storage, fuel cells and solar cells.

Overall, organisers said the symposia proved to be a great success as it served as a high level platform for participants of different backgrounds to communicate and establish a bond of scientific collaboration and innovation.

Fudan University is one of the highly ranked universities in China and through this latest joint international conference UOW has now established a close collaboration.