Civionics is a discipline concerned with the interface of the use of electronic devices for the monitoring of civil engineering infrastructure. The term was first coined in Canada by the Centre for Innovative Sensing for Innovative Structures. Like the disciplines of Avionics and Bionics it is an interdisciplinary field founded in solving problems of an applied nature for industry. Avionics and Bionics have seen huge advances for the Aircraft and Biomedical industries respectively. It is expected that the field of Civionics will play a vital role for government instrumentalities and companies involved in infrastructure development.

The School of Engineering at UWS is home to one of Australia’s best laboratories for independent testing and monitoring for the construction and manufacturing industries. Its expertise is especially relevant to civil, structural and signal processing engineering businesses and regulatory bodies.

UWS continues to strengthen and deepen its research presence and demonstrate competitiveness in the Australian innovation system. The strategic goal of the University (as stated in the UWS Research Plan 2004-2008) is to “achieve outstanding performance in research and scholarship that is distinguished by its interdisciplinary focus and relevance to industry, government and the community.”

This brochure serves as an entree into the activities of the newly established node for Civionics at UWS. It highlights current node projects, projects funded by the Australian Research Council and industry and provides summaries of our staff expertise. I hope this document serves to galvanise interaction between UWS and your organisation and welcome you to contact us if you are interested in future interaction with our node.

Yours sincerely

Professor Brian Uy
research overview

“The University of Western Sydney (UWS) has progressively built a research-rich environment and a research profile of national and international standing. Our research programs reflect our distinctive strengths and orientation to practical knowledge, as is reflected in our maxim “bringing knowledge to life”. UWS is a source of creativity and new knowledge that is relevant, robust and contributes to individual and community development.”

**Civionics Research Node**

The School of Engineering has recently formed (in March 2008) a Research Node in Civionics – a discipline focussing on the application of electronics to civil structures for structural health monitoring purposes.

The School is in a unique position in that it will be able to conduct cross-disciplinary research across three broad disciplinary programs:

1. Engineering;
2. Construction; and
3. Industrial Design.

The three areas into which the Research Node will initially focus its research efforts on are:

1. Health Monitoring of Infrastructure;
2. Intelligent Infrastructure Design; and
3. Intelligent Maintenance and Repair of Infrastructure.

**Looking ahead**

The Research Node aims to substantially increase the School’s research performance in the field of Civionics by producing high quality and high impact research outputs whilst offering students the opportunity to be involved in a high quality research training program.

It is envisaged that the Research Node will develop into a UWS Research Group/Centre with strong support from the School, College and University and will rapidly grow into a high level research concentration in the nominated areas with national and international reputation and impact.

As the role of Civionics in civil/structural engineering becomes more valuable – with its ability to provide engineers with feedback necessary to aid in optimising design techniques and understanding infrastructure performance, behaviour and state of condition – further research into the field will become increasingly important.
The University of Western Sydney, through the School of Engineering, provides an extensive range of independent testing, monitoring and consulting services and is well equipped with state-of-the-art facilities for conducting research in various engineering fields including civil/structural engineering, electrical, mechatronics and signal processing. The Construction Technology Research Group has a particular emphasis on construction and manufacturing industries and work with partners to develop practical and efficient solutions to various problems.

Our People
The School has a strong multi-disciplinary structure and focus. Academic staff and students carry out work in civil/structural engineering, electrical, mechatronic and signal processing fields and have a high level of research expertise in these areas.

Contract Research Services
The School of Engineering works in partnership with industry-based clients in developing new products and processes to improve efficiency and costs.

Testing Services
The Construction Technology Research Laboratory is a NATA accredited testing facility, complying with Australian and ISO standards. These services include both static and dynamic testing for components and assemblies at the research laboratory or site.

Facilities located on-site at the Kingswood campus include:
- Geomechanics Lab
- Environmental Engineering Lab
- Linux Lab for high speed computing and simulation
- Engineering Digital Lab
- Telecommunications Lab
- Precision Robotics and Assembly Lab
- Rapid Prototype Facilities

Structural Monitoring Services
The School is experienced in the monitoring of movements, strains and vibrations of various structures including bridges, multi-storey buildings and other isolated structures. Extensive facilities to assess and determine modal frequencies of structures are available.

Consulting Services
The School provides expert assessments of products, procedures or design criteria in the fields of construction (civil/structural) works. New product support in the form of structural assessment and the development performance criteria of a number of products is also available. By utilising the experience of various disciplines within the School of Engineering, assessments beyond the structural requirements are possible with experts in materials, electronics and industrial design.
The Testing Laboratory at the Kingswood campus of the University is a state-of-the-art facility. On-site we have five load frames with a capacity up to 5000kN (500 tonnes). These frames are complemented by a 16 by 8 metre multi-configurable strong floor with numerous actuators ranging from 150kN to 2000kN. The range and multi-purpose nature of the facility enables the testing of many configurations. These tests may be full-scale, or on components of assemblies to ascertain the behaviour of the sub-structure or components.

**Previous Projects**

- Compressive tests on upright specimens 3.5 metres with loads up to 3000kN.
- Full-scale composite steel and concrete beams.
- Multi-span multiple loading point bending tests, with both equal and unequal span loading.
- 3 metre walls subjected to combined raking, vertical and out of plane loading.
- Full-scale wall to floor connections to determine the shear moment interaction of connectors.
- Full-scale prestress and post-tensioned slab bending tests.
- Tests on samples to determine material properties (including steel, alloys, concrete, timber, polystyrene and other plastics).
- Bending and tensile tests on concrete slabs with the monitoring of crack width with varying stress levels.
- Various formwork and propping components with vertical or combined vertical lateral loading.
- Determination of sectional properties of timber members prior to placement in bridge structures.
Determination of strains based on visual information

Investigators: Jeffrey Zou, Brian Uy, Yang Xiang and Lawrence Pap

This project aims to (a) develop advanced image processing algorithms for the accurate detection of multiple targets in noisy images at the sub-pixel level; and (b) measure shear and multi-strains to gain new insights into the behaviour of beams and columns under various deformations.

Strains are usually caused by the deformation of structural members under loading or other actions (Figure 1). Traditional techniques for strain measurements using displacement devices, such as wire strain gauges and inductive transducers, are normally appropriate for point-wise measurements, however, it would be cumbersome and time consuming to use them for multiple-point measurements. Other techniques to evaluate strains at multiple points in the past have included fibre optic sensors such as Bragg Gratings, however these are relatively costly and also do not lend themselves to surface strain measurement, being more pertinent as embedded sensors.

Recently, photogrammetric techniques have been introduced to measure the deformation of structural members [Maas2006]. A major advantage of these techniques is that they are capable of measuring the coordinates of an almost arbitrary number of three-dimensional points within the camera's field of view, and hence they can be used to measure multiple-point strains efficiently. These techniques have been applied to various tasks in civil engineering [Lee2008][Koke2008][Grytten2007].

One challenge in using photo-grammetric techniques for strain measurements is the precision that can be achieved. The primary causes for the inaccuracy in photogrammetric measurements include the detection of targets and the noise in images [Grytten2007].

Another challenge is the accurate determination of transverse shear strains and multi-strains in beams and columns. Although a number of theories have been developed to describe strains in beams and columns, their verification is often difficult because of the complex measurements involved.

The anticipated outcomes of this project include advanced image processing algorithms that deal with the challenge of imprecise detection of targets in noisy images for strain measurements (Figure 2). The outcomes also include new insights into the behaviour of beams and columns under various deformations. They will contribute to the knowledge base of a multi-disciplinary area, covering structural engineering, photogrammetry and image processing.

References


Passive wireless sensors for structural health monitoring

Investigators: Ranjith Liyana-Pathirana, Brian Uy and Yang Xiang

The availability of low-power and passive unpowered sensors will make structural health monitoring successful in future smart buildings. Also the sensors will need to be interrogated (in the case of passive sensors) and monitored over secure networks.

This project will investigate novel wireless sensors for measuring strains in structural components. While traditional metal foil strain gauges provide high resolution, wireless sensors to date exhibit low-resolution and are susceptible to severe interference from surrounding structures.

This is especially problematic in steel structures and reinforced concrete buildings. Passive wireless sensors that can be interrogated through the use of radio frequencies in the unlicensed Industrial Scientific and Medical (ISM) bands will be investigated theoretically and experimentally. The sensors are embedded within a concrete structure and interrogated by sending a radio signal of suitable amplitude and phase characteristic.

We investigate the use of pulsed modulation as a means of obtaining a high-resolution output from the resonant cavity of the sensor. Once the resonant frequency has been established to an adequate accuracy, it will be possible to compute the strain by referring to the unstrained (no load) resonant frequency of the cavity resonator. In the experiment cylindrical cavity resonators of various geometrical sizes will be enclosed in concrete with an integrated patch antenna operating at ISM band. A loading frame will be used to apply load to the sample giving rise to strain. Measurement of strain and resonant frequency will be made for a range of static loads.

This project is supported by the UWS College of Health and Science, Research Futures Fund Grant ($15,000, 2008)
The system will contain built-in intelligence to initiate calls (can be video (MMS), voice call or text (SMS)) as a result of predefined adverse events, for example, strain gauge or displacement sensor exceeding the normal operating range or a particular surveillance camera detecting an unauthorized entry to the SHM area.

The operator will be able to manipulate the camera over the 3G wireless network for a more detailed view or to focus on an offending structural component. In the normal operating mode the device will gather data for periodic transmission to a central monitoring station.

This project consists of the following tasks:
- System Controller Design;
- Data Acquisition and Interface Design;
- Image/Video Detection;
- Image/Video Capturing Software; and
- PCB Design.

The system controller consists of a microcontroller to control the various signal processing operations, monitoring functions and video camera remote control operations. The interface will enable the connection of, among others, optical fibre sensors and metal foil strain gauges to the system. Sensor data outputs of individual sensors will be sent via a simple SMS whereas images will be sent by initiating a video call to the 3G network.

An MMS, voice or SMS message could be initiated in response to an alarm situation or for routine inspection of the structure. A stepper motor control unit will enable the camera to be operated remotely. Image/Video detection unit along with the video capturing software will enable intruder detection and transmittal of more detailed views (if needed) of the structure to the operator. All of the above subsystems will be combined into compact PCBs within the prototype unit.

The outcome of this pilot project would be a proto-type system operated over existing 3G wireless networks for monitoring embedded sensors in a structure combined with a remotely controlled video camera. Passive wireless sensors will be investigated in such a way that they can be implemented practically at the design and construction stages of a building.
Discovery Projects
The Discovery Projects scheme provides funding for research projects undertaken by individual researchers or research teams. Discovery Projects aim to:
- support excellent fundamental research by individuals and teams;
- enhance the scale and focus of research in the National Research Priorities;
- assist researchers to undertake their research in conditions most conducive to achieving best results;
- expand Australia’s knowledge base and research capability;
- foster the international competitiveness of Australian research; and
- encourage research training in high-quality research environments.

Linkage Projects
The Linkage Projects scheme involves a collaborating organisation from outside the higher education sector who makes a significant contribution that is equal to, or greater than, the ARC funding, in cash and/or in kind, to the project. Linkage Projects aim to:
- encourage and develop long-term strategic research alliances between higher education institutions and industry in order to apply advanced knowledge to problems, or to provide opportunities to obtain national economic or social benefits;
- support collaborative research on issues of benefit to regional and rural communities;
- foster opportunities for postdoctoral researchers to pursue internationally competitive research in collaboration with industry;
- provide industry-oriented research training to prepare high-calibre postgraduate research students; and
- produce a national pool of world-class researchers to meet the needs of Australian industry.

“The Australian Research Council (ARC) provides financial assistance towards facilities and equipment that researchers need to be internationally competitive under the NCGP. The program is designed to build Australia’s research capability, expand and enhance research networks and collaborations, and develop centres of research excellence. It also provides incentives for Australia’s most talented researchers to work in partnership with leading researchers throughout the national innovation system and internationally, and to form alliances with Australian industry.”

National Competitive Grants Program (NCGP)
Reference: ARC website (arc.gov.au)
Understanding and controlling high frequency vibration response is of crucial importance in aircraft, satellites and other space vehicles. When a thin-walled structure is subjected to a high frequency, the response can lead to forced vibration or heat. Excessive vibration and unacceptable noise can create great fluctuations of mechanical loads and stresses and result in fatigue of structural components, friction, wear, and damage of electronic and other delicate components.

“These problems need to be controlled at the design stage and this can be done with analysis methods that are able to predict the structural response” said Professor Xiang. “Current computational methods lack the numerical stability to do this, so our aim is to create an algorithm that combines accuracy with flexibility overcoming the shortcomings of present methods” said Professor Xiang.

The research will assist engineers to understand the responses of thin-walled structures of varying shapes and sizes when subjected to a range of complex loading conditions.

Project Title: Development of a local spectral method for the computations of thin-walled structures
Funding: $240,000
Contact Details: y.xiang@uws.edu.au
May the force be with you
December 2007

Professor Brian Uy from the School of Engineering is exploring the behaviour and design of composite steel-concrete beams in large scale construction projects through a three year ARC Discovery Grant.

“Composite steel-concrete beams are the most widely used method of construction for steel framed structures such as bridges, stadia and buildings. They are considered to provide elegant form and design with minimum weight and are also re-usable and therefore environmentally sustainable” says Professor Uy. “While much is known about the structural and load bearing properties of the beams when subjected to forces that may bend them, less is known of their behaviour and strength when subjected to different forces such as twisting, shearing or torsion. Knowing this would greatly expand the possibilities for design and construction of large structures. This project aims to develop a unified theory of the behaviour of steel-concrete building materials to integrate what we know about bending stresses with new knowledge of other types of stresses and strains that may also be encountered in building engineering and design.”

On beams made of a combination of steel and concrete, Professor Uy will conduct a series of experiments designed to test how the beams react when subjected to different forces – individually and in combinations of two or more different directional forces at the same time. Beams will be tested to the point of failure and analysed to determine the patterns of stress that led to their structural failure.

This project addresses a national research priority, Frontier Technologies for Building and Transforming Australian Industries, through the development of advanced materials and the structural systems which they will create. Improved understanding of the complex behaviour of steel-concrete building structures and the ability to analyse them more accurately will lead to increased economy of design and increased confidence in design and incorporation of these materials into structures and into Australian Standards. Economic benefits to Australia will also flow from this research, by placing the engineering and structural design professions at the forefront of developments in their field and thus improving Australia’s international competitiveness.

Project Title: Unified theory for the behaviour and design of composite steel-concrete beams subjected to generalised loading and support conditions
Funding: $300,413
Contact Details: b.uy@uws.edu.au
High performance steel in building
February 2008

Professor Brian Uy from the School of Engineering is collaborating with Dr Alex Remennikov from the University of Wollongong and Professor Jat Yuen (Richard) Liew from the National University of Singapore to explore the benefits of high-performance steels (HPS) for protection against extreme loads and events in bridges and other engineered structures, through a three year ARC Discovery project.

“HPS are steels which exhibit improved strength, corrosion resistance and energy absorption” says Professor Uy. “These enhanced properties compared to conventional steels may give HPS protective properties against extreme loads that may occur in events such as explosions, earthquakes, fire, hurricanes and accidental impacts. Such events are severe events for buildings, bridges and other infrastructures, and need innovative structural engineering solutions. The subject of this project is to explore the possibility of reducing the vulnerability of buildings and infrastructure systems to such events through cost-effective protective systems using high-performance steels.”

The research team will compare high-performance steel beams and columns with the same structures made from stainless steel, and will also compare the performance of HPS columns and plates filled with concrete with conventional composite structures. The columns and beams will be tested on state-of-the-art simulation machinery in order to analyse the relative performance of the different materials against sharp impacts and shocks, explosive blasts, and continuous load pressures. This will allow analysis and modelling of characteristics of particular interest to the real life world of engineering, including energy absorbing capacity.

The results of this project will provide comprehensive engineering and design parameters for high-performance steel to enable effective use of these innovative materials. The benefit from increased safety of critical infrastructure will provide greater security against physical and financial losses should an extreme event take place.

Project Title: Utilising the benefits of high performance steels (HPS) and infill materials for critical infrastructure protection (CIP) against extreme loads.
Funding: $371,000
Contact Details: b.uy@uws.edu.au
Ground improvement works are commonly required to overcome poor underlying soils in conjunction with infrastructure and housing development. An extensively employed and popular improvement technique is to impart mechanical compaction to the ground in an effort to achieve adequate strength and favourable load-deformation behaviour (stiffness) for the construction of civil infrastructure, including buildings and roads.

Compaction rapidly decreases soil porosity and in the absence of sufficient moisture to replace the entire air content in the voids, the compacted soil becomes essentially unsaturated. Upon compaction, the matric suction generated within the soil is a function of the current moisture content and the grain size distribution of the soil. In order to assess whether a sufficient level of compaction is achieved to meet future design requirements, the means to confirm the quality of compaction and to acquire an innate knowledge of the relationships among matric suction, moisture content and unsaturated shear strength will be imperative.

In this project, a characterisation method is proposed that is non-classical for verifying the standard of compaction. This involves a low cost and efficient non-destructive passive ambient noise based method, which will be calibrated against a set of both in-situ and laboratory test data. The proposal will be based on a pilot study of two compacted fill sites (A and B) at Penrith Lakes in Western Sydney and centred on two main phases of research. The first concerns the ambient noise based method including refinement of current techniques; ambient noise measurements at Penrith Lakes; and interpretation, validation and calibration of the measured data to characterize the compacted layer and the underlying soil profile.

The second phase of research work will involve a series of field measurements; undisturbed field sample retrieval; and a series of laboratory tests on these retrieved samples including process simulation and pressure membrane testing. This will enable the fundamental soil properties to be calibrated with the ambient noise test data, hence establish empirical relationships representing the quality of soil compaction that is currently not available for practicing engineers.

**Expected Outcomes**

- A well described, more efficient and economical site characterization method based on ambient noise techniques with particular reference to Vs profile, which will in turn be calibrated to useful soil properties reflecting the quality of field compaction.
- Better interpretation of engineering properties of compacted fill through basic understanding of the nature of compaction effort (i.e. static rolling, dynamic and/or impact), which are directly relevant to future construction at the Penrith Lakes.
- Design charts, analytical and visualization tools to assist the end users in making control and for optimising decisions in the compaction of the sandy clay fills.
- In-depth know-how package for practicing engineer on the optimum use of ambient noise techniques including other potential applications (eg for assessment of edge stability of the lakes) not just specific only to Penrith Lakes.
- Rigorous training of PhD students in an area of study that is essential for challenging infrastructure construction efforts currently launched in Australia.

**Funding Arrangements**

This project is an interdisciplinary collaboration of University of Western Sydney and University of Wollongong engineering staff spanning the fields of experimental and theoretical geomechanics, geophysics and signal processing.

**Project Title:** Geotechnical characterisation of compacted ground based on passive ambient noise techniques

**Funding:** $211,000

**Contact Details:** c.leo@uws.edu.au
Brian Uy is Head of School and Professor at UWS. Prior to this, he was Professor of Structural Engineering and Head of the School of Civil, Mining and Environmental Engineering at the University of Wollongong from 2004-2006. He has also held academic positions at The University of New South Wales, Sydney; Imperial College of Science Technology and Medicine, London; National University of Singapore; Ove Arup & Partners (now ARUP); Wholohan Grill & Partners (now Worley) and Wargon Chapman & Partners (now Hyder).

Brian is currently the Engineers Australia, College of Structural Engineers representative of the Standards Australia Committee 8032 and a member of 802. In 2008 Brian was elected Vice-Chair of the Australia Division of the Institution of Structural Engineers, United Kingdom and continues this role in 2009.

Research Expertise

Brian has been involved in research in steel-concrete composite structures for more than 15 years and he has published over 350 articles. Much of this research has been underpinned by competitive grant funding from the ARC and industry totalling over $6 million. Brian serves on the editorial boards of seven international journals for structural engineering and is a significant contributor to international codes of practice in steel and composite construction. He currently serves on the American Institute of Steel Construction (AISC) Task Committee 5 on Composite Construction and the International Association of Bridge and Structural Engineers, Working Commission 2 on steel, timber and composite structures. Brian also served as a member on the American Society of Civil Engineers (ASCE) - Structural Engineering Institute, Technical Committee and Composite Construction. Brian is a chartered engineer in Australia, the UK and USA and regularly provides higher level consulting advice for certification and forensic purposes.

Top 10 Publications


Grants

- UniReAd theory for the behaviour and design of composite steel-concrete beams subjected to generalised loading and support conditions, (Uy), ARC Discovery Grant. 2008-10, $300,413.
- Utilising the benefits of high performance steels (HPS) and infill materials for critical infrastructure protection (CIP) against extreme loads. (Uy and Remennikov), ARC Discovery Grant. 2008-10, $371,000.
- Time dependent response and deformations of composite beams with innovative deep trapezoidal decks. (Bradford, Uy, Ranzi and Filonov), ARC Linkage Projects (Round 1), 2008-10, $256,188 (ARC) + $252,900 (BlueScope Lysaght).
- Innovative retrofitting techniques for the protection of anchorage zones in cable stayed bridges subjected to blast loads. (Mendis, Samali and Uy), ARC Linkage Projects (Round 2), 2008-11, $210,000 (ARC) + $178,638 (RTA).
- Development of innovative beam-column connections within robust composite steel-concrete structural frames. (Goldsworthy, Gad, Uy and Fernando), ARC Linkage Projects (Round 2), 2006-09, $450,000 (ARC) + $465,000 (Ajax, OneSteel, Smorgon).
Yang Xiang

Professor / Associate Head of School

Yang Xiang joined UWS as a Lecturer in 1996 and has since contributed to the course development and coordination of the Civil Engineering program. He was appointed to the position of Associate Head of School (Engineering) in July 2007 and was promoted to Professor in 2008.

Yang is a member of Engineers Australia (IEAust) and a member of American Society for Civil Engineers (ASCE). He is also a member of the Stability Committee, Engineering Mechanics Division, ASCE since 2004. Yang has served on the Editorial Board of International Journal of Structural Stability and Dynamics since 2003.

Research Expertise

Yang has extensive research expertise in the areas of stability and vibration analyses of structures and development of computational methods for the analyses of solid and structural mechanics problems. His research on the buckling and vibration behaviour of thick plates has made a significant impact in this area with results being widely cited. He obtained exact solutions for buckling and vibration of plates and shells which provide important benchmark values for engineers and researchers in this field. He developed several effective computational methods for the analysis of thin-walled structures. His current research interests include: nonlocal beam theory for the analysis of micro/nano rods; photogrammetry technique for stress and deformation measurement; DSC algorithm for the analysis of thin-walled structures; and analysis of plates and shells with surface cracks.

Top 10 Publications


Grants

- Development of a novel numerical method for the computations of thin-walled structures, (Xiang), ARC Discovery grant, 2006-2008, $240,000.
Chin Leo
Associate Professor

Chin Leo was a Post Doctoral Fellow at the University of Sydney from 1994-1995. He was a visiting academic to Ecole Nationale des Travaux Publics de l’Etat, France, in 2004 and 2006. He has also held engineering positions at the Public Works Department in Singapore. Chin is currently a member of Engineers Australia.

Research Expertise

Chin’s major research interests fall broadly in the areas of computational geomechanics and environmental geomechanics with particular regard to soft soils, groundwater flow and contamination problems in soils and soil remediation. He is also interested in coupled problems in porous media. Chin is a civil engineer with professional engineering experience in infrastructure and geotechnical engineering including the maintenance, design and construction of roads, road tunnels and slopes. He has previously undertaken both preliminary and detailed design for road widening, new expressways and expressway interchanges – the scope of which include soil investigation, studies of cuts and fills, slope stability analysis and proposals for dealing with problematic soft soils.

Top 10 Publications


Grants

- Behaviour of EPS geofoam on soft soils, (Leo and Booker), ARC Large Grant, 1997-99, $140,000
- An investigation into the behaviour of creeping soft soils (Leo) UWS internal research grant, 2002-03, $18,000
- Development of constitutive models for EPS compressible inclusion used in earth retaining structures (Leo), UWS internal research grant, 2004-05, $18,000
- Remediation of dioxin-contaminated soils by high power ultrasound (Leo, Collings, Sosa-Pintos and Gwan) Environment Trust seed grant, 2008-09, $15,700
- Geotechnical characterisation of compacted ground based on passive ambient noise techniques (Leo abd Zou) ARC Linkage Grant, 2009-11, $21,000
Research Expertise

Fidelis’ research interests are in fatigue and fracture mechanics with specialisation in fatigue of welded steel connections. He has published over 60 articles in journals and conference proceedings. Fidelis has worked on research projects that are applicable to the mining, road transport and agricultural industries. Fidelis is a referee of the Journal of Constructional Steel Research (JCSR) and the Thin-Walled Structures journal (TWS). He also occasionally reviews papers for the Journal of Structural Engineering – ASCE (USA), Journal of Bridge Engineering – ASCE (USA) and the Materials and Structures journal.

Top 10 publications

Dr Ataur Rahman
Senior Lecturer

Ataur Rahman has specialisation in Water and Environmental Engineering. He has over 25 year’s experiences in industry, academia and research. He worked in Sinclair Knight Merz, CRC for Catchment Hydrology (Monash University) and Physical Infrastructure Centre in Queensland University of Technology before joining to University of Western Sydney.

Research Expertise

Ataur’s research interests include hydrologic modelling, catchment simulation, urban water cycle modelling (water sensitive urban design and rain water harvesting) and water quality management. He has published over 80 refereed technical papers. He received G. N. Alexander Medal from Engineers Australia in 2002 for his research on hydrologic modelling.

Top 10 Publications


Grants

- Project 5 Regional Flood Methods for Australia, Engineers Australia, 2008, $103,000.
- Australian Rainfall & Runoff - Regional methods for design flow estimation in ungauged catchments in New South Wales, Engineers Australia, 2007, $28,000.
- Australian Rainfall & Runoff - Victorian Regional Flood Frequency - Sensitivity Analysis, Department of Sustainability and Environment Victoria and Engineers Australia, 2007, $9,000.
- Research and development of the 96 hours and 120 hours design rainfall temporal patterns for the Gold Coast region in Queensland, Sinclair Knight Merz, 2006, $8,000.
- Application of the Monte Carlo Simulation Technique to the Coomera River Catchment for design flood estimation, Gold Coast City Council, 2005, $7,000.
- Enhanced Joint Probability approach to flood estimation in the Gold Coast City Council area, Gold Coast City Council, 2004, $15,000.
Research Expertise

Xinqun has been involved in research in structural dynamics, especially in structural health monitoring and condition assessment, vehicle-bridge/road/track interaction analysis and smart sensor technology for more than 10 years. He has published over 90 articles, and also participated in 19 research project grants. Xinqun’s significant contribution is condition assessment of civil infrastructure in operational environment. Currently, he works on integrated health monitoring for civil infrastructures in operational environment. Xinqun also provides high level consultancy services in this area.

Top 10 Publications

Dr Zhong Tao
Postdoctoral Fellow
Dr. Zhong Tao was appointed as a full-time postdoctoral research fellow at the University of Western Sydney (UWS) in August 2007. He holds a Bachelor of Engineering from the Zhengzhou Grain College (1993), a Master degree from Harbin University of Civil Engineering and Architecture (1998), and a PhD from Harbin Institute of Technology (2001). He has also held a position of Professor and Associate Professor of Structural Engineering at Fuzhou University, China.

Research Expertise
Zhong Tao has focused on the research of steel-concrete composite structures since 1996. He has been successful in attracting 16 major research grants in China and Australia since 2003. He has been involved in the production of over 100 publications at national and international level, and was awarded five patents by the Chinese National Bureau of Knowledge Property Right in recent years. In order to successfully transfer research results into technology applications, Dr. Tao has played an important role in drafting five Chinese design codes, and had significant consulting experience in the structural design of steel-concrete hybrid multi-story buildings.

Top 10 Publications

Grants
- Australian-Chinese research collaboration on concrete-filled stainless steel tubular columns under extreme loads (Tao, Uy, Han), International Research Initiatives Scheme of University of Western Sydney, 2008-09.
- Behaviour of concrete-filled stainless steel tubular columns incorporating global slenderness effect (Tao and Uy), Research Grant Scheme of University of Western Sydney, 2008.
- Seismic behaviour and application of new types of steel-concrete hybrid structures (Tao and Han), Fok Ying Tong Education Foundation, 2008-10.
- Cyclic behaviour of RC shear walls framed with concrete-filled steel tubes (Tao and Liao), National Natural Science Foundation of China, 2007-09.
- Key issues on concrete-filled stiffened thin-walled steel tubes (Tao, and Wang), Fujian Science and Technology Large Grant, 2006-08.
Dr Ranjith Liyana-Pathirana
Senior Lecturer

Ranjith has been an Associate Lecturer at University of Western Australia, Department of Electrical and Electronic Engineering from 1993-1995, and Research Fellow with the Cooperative Research Centre for Broadband Telecommunications and Networking, Perth from 1996-1998. In 1998, Ranjith joined UWS as a Lecturer and was promoted to Senior Lecturer in 2002. He is a member of the IEEE and Australian Computer Society (ACS). He is a licensed Amateur Radio Operator VK6BHV.

Research Expertise
Ranjith’s areas of research expertise are Coding and Information Theory, Radio Communications & Broadcasting, and Biomedical Engineering. He has primarily contributed to Coding and Information Theory in Communication Technologies by developing novel algorithms, modulation techniques, and performance evaluation via computer simulation. In the recent past, he has contributed to the development of efficient simulation techniques for trellis modulation codes. In the area of Radio Communication, he has expertise in video transmission through error-prone mobile channels with particular investigation in unequal error protection codes for mobile video transmission. In Biomedical Engineering, Ranjith’s expertise is in cryosurgical process control systems which involves the development of a prototype kit for efficient delivery of liquid Nitrogen for cryosurgery. Ranjith has contributed to research training by graduating a number of MEng/PhD students and numerous Honours students. He has published more than 75 articles in International Conferences and IEEE/IET Journals.

Top 10 Publications

Grants
Jeffrey’s research interests include digital image processing, pattern recognition, signal processing and their applications to structural health monitoring and geotechnical characterisation. He has been involved in research in strain measurement based on visual information, ambient noise analysis for soil structure determination, video surveillance, computer vision for driver assistance, DNA microarray image processing, ultrasound imaging, computer-aided cartooning, digital image compression and shape representation. His research results have been published in high-impact international journals and presented in premier international conferences.

Top 10 Publications

Top 5 Grants
1. Geotechnical characterisation of compacted ground based on passive ambient noise (Lea, Indraratna, Zou, Rujikiatkamjorn, Golaszewski, McWilliam, Wang and Bergado), ARC Linkage Projects (Round 1), 2009-11, $210,000.
Dr Qi Cheng
Lecturer

Qi Cheng obtained the Bachelor, Master, and Ph.D. from the Anhui University (1982), University of Science and Technology of China (1985) and the University of Melbourne (1995) respectively, all in electrical engineering. Since 1995, Qi has been a research fellow and lecturer, at the University of Melbourne, the Northern Territory University and the University of Western Sydney. Qi is a member of the Institute of Electrical and Electronic Engineers and the Australian Association for Engineering Education. He was session chairs for IEEE Tencon in 2003 and 2006.

Research Expertise
Qi Cheng is an expert on radar signal processing. Among many of his contributions, he developed fast algorithms for array calibration and the determination of the number of targets. He co-edited a book (published in 2004 by Marcel Dekker) and was included in Marquis “Who’s Who in the World”, 2005 and Marquis “Who’s Who in Science and Technology”, 2005-06. In the last couple of years, Qi has focused on signal processing in OFDM systems. He has proposed methods for frequency and timing synchronization and channel identification. He is currently interested in waveform design in MIMO signal processing and the application of signal processing techniques to magnetic resonance imaging enhancement.

Top 10 Publications
4. High-resolution and Robust Signal Processing (pp.1-62), Marcel Dekker, New York.
Kenny Kwok
Professor

Professor Kwok was a member of Engineering Panel of Research Grant Council of Hong Kong (1999-2005). From 1998 to 2008, he was Professor of Civil Engineering and Director of CLP Power Wind/Wave Tunnel Facility at the Hong Kong University of Science and Technology, and held positions as Professor of Wind Engineering, Associate Dean of Engineering, Director of Wind Engineering Services, and Director of Graduate School of Engineering at the University of Sydney (1977-2002). He is currently Asia-Pacific Regional Co-ordinator and member of Executive Board of the International Association for Wind Engineering.

Research Expertise
Professor Kwok’s main research interests and technical expertise are wind engineering and structural dynamics, particularly wind effects on buildings and structures, wind tunnel tests, environmental fluid mechanics, vibration control and occupant comfort assessment. He has published over 350 articles in book chapters, invited and keynote papers, journal and conference papers. He has been awarded more than $4.5 million in research grants and undertaken wind engineering consultancy projects in Australia, Hong Kong and other countries worth over $4 million. He is editorial board member of three international journals in wind engineering and structural engineering. He is currently a member of BD006-02 on wind loading code AS/NZS 1170.2, a member of Technical Committee for the Code of Practice on Wind Effects in Hong Kong, and a Scientific Advisor to the Hong Kong Observatory.

Top 10 Publications

Grants
- Motion Simulator MKIII, (Kwok, Tung), HKUST Research Equipment Funding, 2007-2009, HKD1,530,000
- Numerical Wind Load Prediction and Aerodynamic Shape Optimization of Tall Buildings, (Chan, Kwok and Kot), RGC CERG, 2006-2009, HKD609,000
- Innovative Design Technologies for Tall Buildings in a Typhoon Prone Urban Environment, (Kwok, Chan, Chang, Ding, Hitchcock, Katafygiotis and Lam), RGC CAG, 2005-2008, HKD3,345,000
Dr Gu Fang

Senior Lecturer

Gu Fang’s teaching and research are mainly in the areas of robotics, control systems and artificial intelligence. He has worked at universities in Australia and China and has published numerous papers in books, international journals and conferences. Gu has served as referee for various international journals and conferences. He is a member of Engineers Australia and IEEE.

Research Expertise

Gu Fang’s main research interests include mobile robot exploration and control including neural network and fuzzy logic control, force control for industrial robots and robot applications in healthcare and construction, computer vision in robotic applications and particle swarm optimisation in robotics. His papers have been nominated for a number of best paper awards with one of his papers awarded the best paper in an international conference. He is a Visiting Scholar at the ARC Centre of Excellence for Autonomous Systems at the University of Technology, Sydney.

Top 10 Publications

1. Fang, G and Dissanayake, MWMG (July 1993) “A Neural Network Based Algorithm for Robot Trajectory Planning”, Proceedings of International Conference of Robots for Competitive Industries, Brisbane, Old, Australia, pp 521-530. (Best Student Paper Award)

Grants

- Autonomous Systems for Road Bridge Maintenance - Stage I (Fang and Dr Dikai Liu from UTS), jointly funded by Roads and Traffic Authority (NSW) and University of Technology, Sydney, 2006-07, $200,000.
- 24 Bit Optical Post Processor (Fang), AusIndustry R&D Start Graduate Placement Grant, 2002-04, $90,000.
- Adaptable Low-Cost, Low-Volume Automation (Fang, Professor Bryan Roberts and Dr John Gal), Hawker de Havilland Pty Ltd, 1998-2002, ($110,000)
- Vector Display System funded by AusIndustry (Fang and Professor Bryan Roberts), R&D Start Graduate Placement Grant, 1998-2000, $100,000.
- Robot Precision Control Using Neural Networks (Fang), ARC Small Grant, 1999-2000, $25,345.
Research Expertise

Jonathon’s research interests span: new and emerging materials and technologies; design’s role in addressing social and environmental concerns; sustainable design; transport design – particularly public transport; augmenting people’s capabilities through perceptive design; designing for people with disabilities; and, alternative interfaces.

Top 10 Publications

Research Expertise

Alan has been involved in dynamics research for over thirty years, and has produced more than 300 publications. His research has included investigations into the dynamic behaviour of structures, in the field, on five continents, including induced vibration tests on over forty structures. This work has included measurements of the response of Dams, Tall buildings, Bridges and offshore structures. His work on Dams was recognised with the award of the Telford Gold Medal. His work on Damping has been incorporated into codes of practice in North and South America, Europe, Asia and Australia. His work has been featured on TV programmes in the UK, China and Australia. Additionally, his work on dynamics formed a fundamental theme that resulted in the award of a Higher Doctorate by University College London.

Top 10 Publications


Grants

- Japan Society for Promotion of Science Fellowship
- Fires in tunnels
- Damping in full-scale structures
- The wind climate of Hong Kong
- Mechanisms for the cracking of concrete in full-scale structures
getting involved

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