

The School of Mechanical, Aerospace and Civil Engineering

Issue 4 – Winter 2012/13



Spotlight on:

- New Research Themes in the School
- Will climate change in the Arctic increase the landslide-tsunami risk in the UK ?
- Adaptive Production Management - ARUM
- “What’s cooking ?” report on food sustainability

© Matt Hintsa

In this issue

- Page 2 Message from the Head of School
Research News
- Page 3 Tyndall Manchester News
- Page 4 -6 Grants & Awards
- Page 7 Research Themes and Recent appointments
- Page 8 The bigger picture

Contact us

School of Mechanical, Aerospace and Civil Engineering
The University of Manchester
George Begg Building,
Manchester, M13 9PL, UK
Tel: +44(0)1 61 306 4545
Email: researchsupport-eee-mace@manchester.ac.uk
Web: <http://www.mace.manchester.ac.uk/>

Editorial by the Head of School



It is with great pleasure that I introduce my first research newsletter as Head of School. Since joining the School last year I have been hugely impressed by the breadth and quality of our ongoing research and some of the recent highlights and news are featured here.

The School has developed considerably in the last few months with the introduction

of focused research themes and a research and resource group structure. As this restructure beds down, the School has continued to build on its grant success of the last few years. For example, three new grants have just been awarded from the TSB and there have been further awards from the EPSRC, NERC, the European Union and industry.

The Tyndall Centre for Climate Change Research grows from strength to strength with the publication of reports on the impact of shipping, shale gas extraction and food related greenhouse gas emissions. An agreement between the University of Manchester and EdF has been signed to extend the Modelling and Simulation Centre's research on solid and fluid mechanics.

It is also pleasing to announce the appointment of three new young members of staff as the School strengthens its key research areas. Community inside the School is also of importance and if you skip to the end of the newsletter you will see examples of our recently introduced staff-student football competitions and the award of a Bronze Green Impact award.

I am writing this editorial as I sit on a flight to Singapore where we will meet staff from Nanyang Technological University and industry to discuss new collaborative projects in manufacturing and, hopefully, I should be able to report positive developments in the next newsletter.

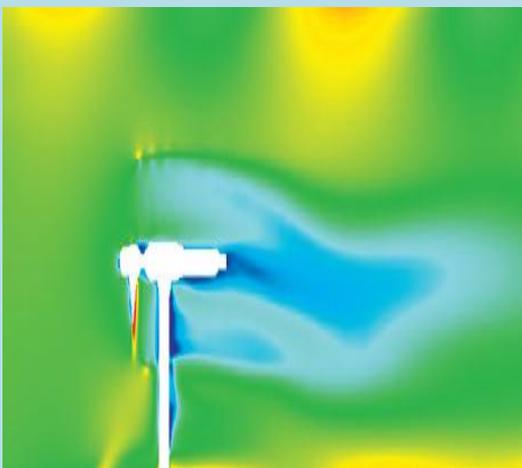
Professor Andrew Gibson

MEng, PhD (Heriot-Watt), DSc (UMIST), FIET, SMIEEE, C.Eng

Research News

EDF, the leading electricity producer in Europe, has signed a global framework agreement with The University of Manchester

The agreement, between EDF R&D, [EDF Energy](#) and the University, was signed in a joint meeting with Paul Spence (EDF Energy Director of Strategy and Corporate Affairs), Professor Colin Bailey (Vice-President and Dean of the Faculty of Engineering and Physical Sciences) and Bernard Salha (Senior Vice President of EDF SA, President of EDF Research and Development) (*seated, left to right in the photo*)



Vertical section of the velocity field from 3D CFD simulation of a 3-bladed tidal stream turbine due to steady flows and waves

Happy together

The University of Manchester and EdF have worked together successfully for over a decade. The main focus of the relationship is in the area of simulation to enhance worldwide developments in energy research for the development of renewables as well as nuclear energy in the UK. More recently the pressing needs of research in energy generation and the infrastructure for computationally intensive activities in bio-medical engineering and manufacturing at micro-nano scales have been addressed.

- Within the context of the following multi-collaborating partner projects, EDF and the School have made significant academic advancements in the area of renewable energy: PerAWaT (2009 – 2013): The primary aim of this project is to develop and validate numerical models to predict the hydrodynamic performance of wave and tidal energy converters (WECs and TECs) operating in arrays.
- ReDAPT (2009 – 2014): The objective is to accelerate the development of tidal stream turbines by design and development of a data acquisition platform built around the Tidal Generation Limited (TGL) 1 MW tidal stream turbine.
- X-MED (EPSRC, 2012-2015): The main focus is on the development of advanced numerical models for predicting extreme loads on tidal stream turbines and wave energy devices.

For further information: peter.stansby@manchester.ac.uk

Tyndall Manchester News



Dr Alice Bows and Dr Carly McLachlan launched their report “What’s cooking?”

Greenhouse gas targets will be missed unless policymakers take account of the potential impacts of climate change on food-related emissions, according to a report from the Sustainable Consumption Institute published in 2012.

Much emphasis is placed on decarbonising the energy system, The full report is available from: <http://www.sci.manchester.ac.uk/news/whatacircs-cooking-acirc-the-ukacircs-potential-food-crisis>

yet the emissions associated with agriculture, particularly the greenhouse gas nitrous oxide, are likely to be much more difficult to cut. Not only that, as climate change impacts become more severe over the coming decades, more fertiliser may need to be added just to achieve the same yields, which will further elevate levels of nitrous

oxide. Because emissions are cumulative, this means that the harder it is to cut nitrous oxide emissions, the greater the efforts needed to curb the carbon dioxide emissions from energy for the same climate impact.

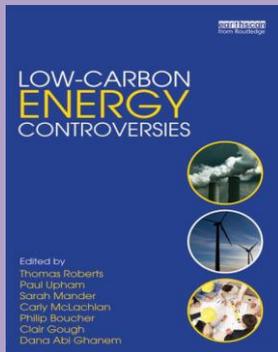
The new report, which has been led by researchers within the School of

Mechanical, Civil and Aerospace Engineering, developed suites of food-system scenarios to explore the triad of challenges relating to mitigation, adaptation and the growing demand for food.

The work involved stakeholders from agriculture, retail and manufacturing as well as consumer focus groups.

US Shale Gas Drives Up Coal Exports

A report by research at Tyndall Manchester has concluded that, whilst the US is burning less coal due to the shale gas production, millions of tonnes of unused coal are being exported to the UK, Europe and Asia. As a result the emissions benefits of switching fuels are overstated. Dr John Broderick, lead author on the report comments: “Research papers and newspaper column inches have focussed on the relative emissions from coal and gas”. Full report: <http://www.tyndall.manchester.ac.uk/public/Broderick Anderson 2012 Impact of Shale Gas on US Energy Emissions.pdf>



Controversial Book Published

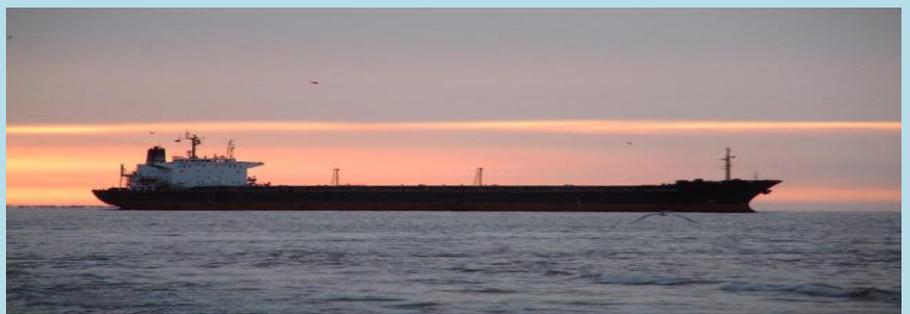
The deployment of low-carbon energy supply technologies worldwide has sparked a debate about how to balance local environmental protection and our need for reliable low carbon energy. Bringing together ten years of research by the Tyndall Centre, this book uses a range of low carbon energy technology case studies to explore the complex nature of disputes between a wide range of stakeholder groups. The book is edited by Sarah Mander, Carly McLachlan, Clair Gough and Dana Abi Ghanem along with Thomas Roberts (University of Kent), Paul Upham (University of Leeds) and Philip Boucher (University of Nottingham)

<http://www.routledge.com/books/details/9780415502627/>

Carbon Management’s special issue on shipping and carbon emissions

Carbon Management has published a mini-focus issue on Shipping and carbon emissions: a focus on mitigational issues is guest co-edited by Alice Bows of the [Sustainable Consumption Institute](http://www.sci.manchester.ac.uk/news/whatacircs-cooking-acirc-the-ukacircs-potential-food-crisis) and Tyndall Centre Manchester and features contributions led Kevin Anderson, Ruth Wood and Sarah Mander.

This is the link: <http://www.future-science.com/doi/pdfplus/10.4155/cmt.12.67>



Ethical attitudes to underground CO₂ storage: Points of convergence and potential faultlines

A new paper was published in the International Journal of Greenhouse Gas Control by Tyndall Manchester researcher Clair Gough. The paper highlights that, while awareness is growing, ethical and justice-based debates hold implications for the development of fair and effective climate policy, the specific ethical implications of Carbon Capture and Storage (CCS) deployment have received limited attention.

The full article is available from:

<http://www.sciencedirect.com/science/article/pii/S1750583612003167>

Grants & Awards

ARUM



Prof Andy Gale and Dr Richard Kirkham are collaborating with several industrial and academic partners in a EU funded research project ARUM (Adaptive Production Management; www.arum-project.eu). This project, with a total budget of € 11.5M, and a Manchester share of around € 0.7M, aims at improving planning and control systems for the manufacturing of complex products in small lot production, such as aircraft and aircraft interiors.

ARUM will do this by decreasing the risks of product immaturity and production disruptions, ICT improvements for manufacturing systems and increasing the integration of engineering into production process. The ARUM team will identify mitigation strategies to respond faster to unexpected events and will provide ICT systems and tools to enable this.

This is the link to the press release:

http://www.eads.com/eads/int/en/news/press.20121105_eads_arum.html

Rolls Royce support

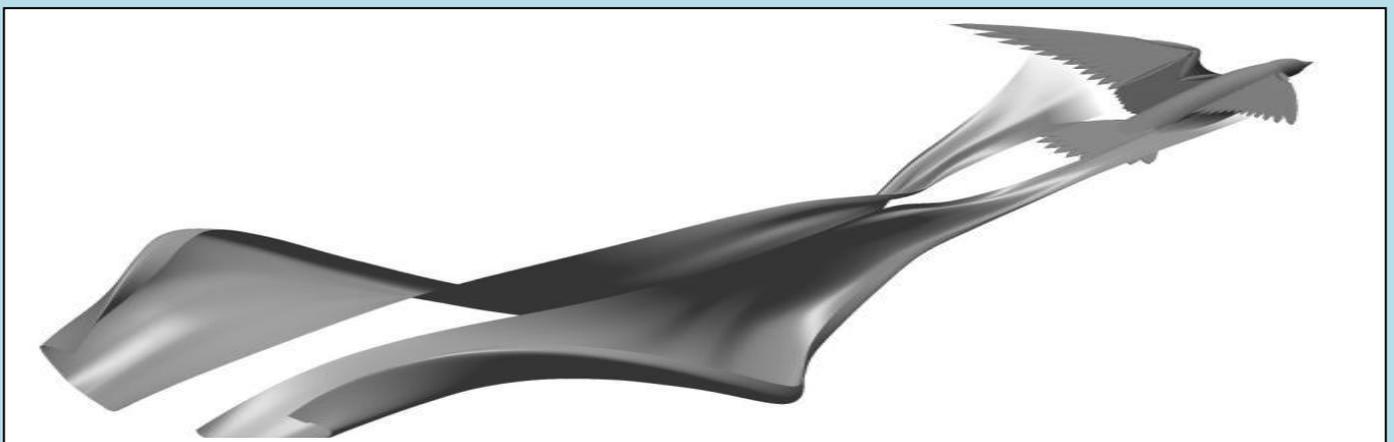
Rolls Royce has agreed to provide funding for technical and administrative support of their University Technology Centre at Manchester which has been successfully led by Prof Tim Abram since 2010. The financial support is providing funding for the appointments of Dr Joel Turner and Ms Reyes Palacios. The UTC is part of a network of centres across the world:

For further information: http://www.rolls-royce.com/about/technology/uni_research_centres/key_academic_partnerships.jsp



BAE Systems - Canning Town

Dr Bill Crowther and his research group are contributing to BAE Systems' Canning Town project through provision of nationally leading expertise in the areas of biomechanics, flapping flight simulation and optimisation, leg based undercarriage systems, UAV flight control, and practical demonstration of UAV technologies. Specific contribution will be made towards engineering assessment of current flapping/perching technology, vehicle aerodynamic/mechanical conceptual design, preliminary design and experimental validation and full system detailed design and demonstration. Please contact Dr Bill Crowther (william.crowther@manchester.ac.uk) for further details.



*Simulation of the wake behind a pigeon flying at minimum power speed (12m/s).
Results and documentation available online at www.flappingwings.co.uk*

Grants & Awards

Will climate change in the Arctic increase the landslide-tsunami risk in the UK ?

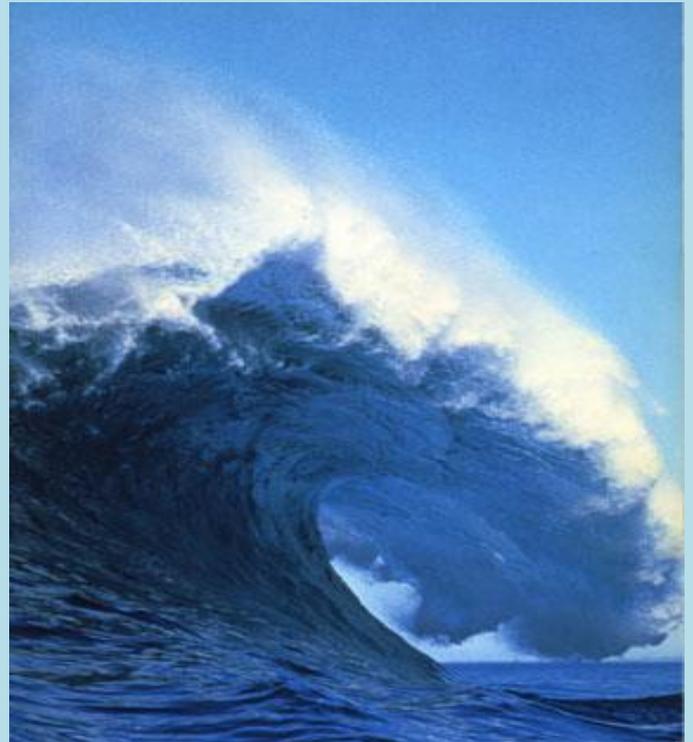
This £2.3M NERC funded project is led by the National Oceanography Centre in Southampton. Prof Peter Stansby, Dr Ben Rogers and Dr Lee Cunningham are co-investigators in Manchester.

Submarine landslides can be far larger than terrestrial landslides and many generate destructive tsunamis.

Given the potential impact of tsunamis generated by Arctic landslides, an assessment is required of the hazard they pose to the UK over the next 100-200 years, their potential cost to society, the degree to which existing sea defences protect the UK, and how tsunami hazards could be incorporated into multi-hazard flood risk management.

This rapid climatic change in the Arctic could increase the risk posed by landslide-tsunamis.

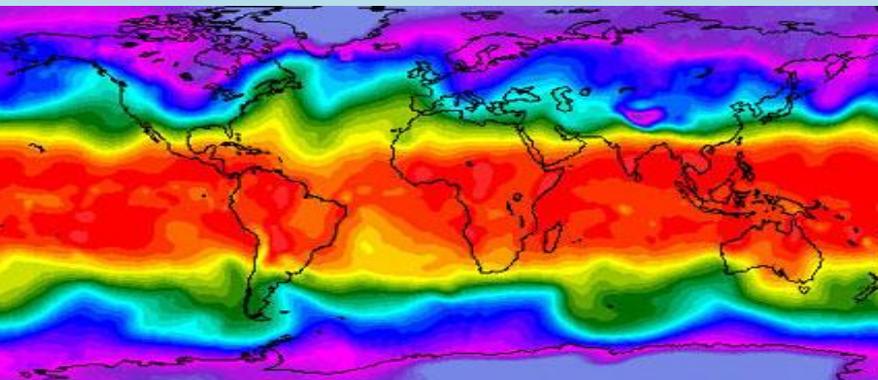
For further information, please contact Prof. Peter Stansby: peter.k.stansby@manchester.ac.uk



SUPERGEN Solar Energy Hub Whole System Impacts and Socio-economics of wide scale PV integration (WISE PV)

The EPSRC have awarded a £ 1.4M project under their Solar Energy Hub umbrella to Dr Joseph Mutale (EEE) with Co-Is Drs Patricia Thornley, Sarah Mander and Paul Gilbert (MACE). The academic team brings together internationally recognised experts in electrical power systems, social sciences, environmental and techno-economic assessment, PV materials and devices from the Universities of Sheffield, Loughborough and Oxford Brookes and Manchester.

The project sets out the scientific, technical and socio-economic grand challenge of wide scale integration of photovoltaic systems (PV) into electric power systems with particular focus on the UK. For further information, please contact Dr Joseph Mutale: J.Mutale@manchester.ac.uk



A NASA image of the Earth's surface temperatures ranging from blue (really cold) to orange/red (warm). The temperatures are related to how much solar energy is received. Copyright © 1998 NASA

Step-WEC: Step change for wave energy conversion through floating multi-body multi-mode systems in swell

Marine energy should make a substantial contribution to the UK renewable energy target of 30% electricity by 2020 and the potential of wave energy is high. However wave energy conversion requires a step change in power output per unit cost to be commercially viable. This £ 0.8 M EPSRC funded project, led by Prof Peter Stansby with co-investigators Dr Tim Stallard, Dr Jun Zang (Bath) and Prof Paul Taylor (Oxford) looks to address the question 'what is the maximum power which can be converted if structure size is no object and if several modes of motion are exploited for power conversion?'

The overall aim is to design, analyse and optimise floating systems for wave energy conversion of approximately 10 MW capacity in swell and mixed swell/wind waves based on two or more dynamically connected bodies with multi-mode response and to assess their interaction, particularly power generation, within an array.

For further information:

<http://gow.epsrc.ac.uk/NGBOViewGrant.aspx?GrantRef=EP/K012487/1>

Grants & Awards

Technology Strategy Board Collaborative Research Grants:

Developing the civil nuclear power supply chain

Three grants awarded to the School of Mechanical, Aerospace and Civil Engineering

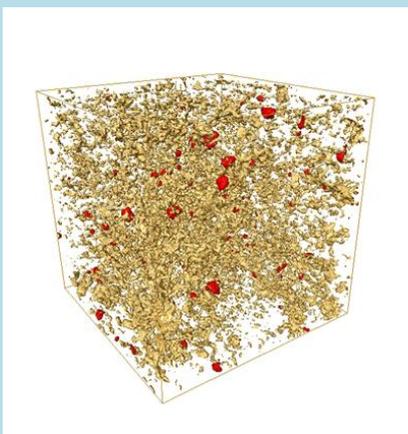
The Influence of Graphite Irradiation Creep on Plant Life Optimisation £ 495,172

PI: Prof Paul Mummery; Co-I: Dr Abbie Jones and Prof Barry Marsden in collaboration with the University of Surrey and EDF Energy NG

Knowledge of the irradiation behaviour of graphite is crucial to prolonging safely the life of Advanced Gas-cooled Reactors (AGR). This project combines first-principles understanding of defect processes inside, outside and between crystallites with state-of-the-art measurement of nuclear graphite, irradiated to high fluence in atmospheres appropriate to AGR conditions.

The principle aim of the project is to make quantitative links between macroscopic behaviour and the defects and topological features at the nano- and micro-scale in support of the development of a micromechanical model for CTE and irradiation creep. Such a model would enable a better understanding of the role of irradiation creep on the stress state of the core of the reactor, leading to more reliable predictions of core integrity and reactor safe operation.

For further information please contact:
paul.mummery@manchester.ac.uk



3D tomographic reconstructions of British Experimental Pile Zero (BEPO) graphite showing pore structures and high attenuation spots indicative of metallic inclusions

Treatment of Irradiated Graphite Waste - 'From Core to Capture' £485,539

PI: Dr Abbie Jones; Co-I: Prof Paul Mummery and Prof Barry Marsden in collaboration with Bradtec, Costain, Studsvik and Hyder

This project is focused on the research and development which is required to underpin a new, innovative approach for the management of the UK's large volume (~100,000 tonnes) of irradiated graphite wastes which represents approximately 30% by volume of the UK Intermediate Level Waste (ILW) and one third of the worldwide inventory. The overarching objective of this research is to define and specify the parameters for an integrated industrial process (retrieval via *in situ* size reduction and vacuum transfer, gasification, liquefaction and carbon capture and storage). This will lead to reduction of costs for storage and burial.

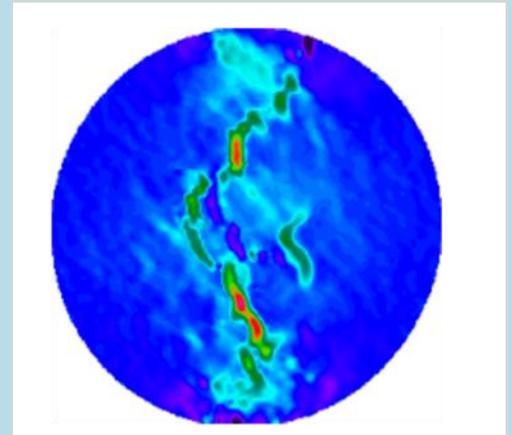
For further information please contact:
abbie.jones@manchester.ac.uk

Fracture of Graphite Fuel Bricks £ 514,298

PI: Prof Paul Mummery;
Co-I: Prof John Yates, Prof Barry Marsden, Dr Abbie Jones and Dr Marc Schmidt in collaboration with EDF Energy NG, EDF R&D UK.

Graphite is used as the moderator in EDF Energy Nuclear Advanced Gas Cooled Reactors. It also plays a structural role and the integrity of graphite components has a high impact on plant lifetime economics. The aim of the project is to gain a good understanding and evaluation of fracture in irradiated graphite components by complementary numerical and experimental approaches. An advanced modelling tool allowing automatic simulation of crack propagation in graphite bricks will be developed and validated by innovative experimental methods. Uncertainties related to the whole core mechanical behaviour will also be assessed. By supporting the decisions regarding AGRs plant life extensions, it will aid the security of low carbon electricity supply in the UK in the next years, at affordable and competitive costs.

For further information please contact:
paul.mummery@manchester.ac.uk



2D strain mapping around cracks by digital image correlation

QUBE: Quasi-Brittle fracture: a 3D experimentally-validated approach

The EPSRC have awarded a £1.4M grant to The Universities of Oxford, Bristol, Delft (NL) and Manchester (£0.5M) which considers quasi-brittle materials: how their microstructure controls the initiation and propagation of cracks that lead to failure and how to benefit from this in engineering design. The Principal Investigator at Manchester is Prof Paul Mummery.

The goal set is to develop a robust general method for assessing the integrity of engineering structures of quasi-brittle materials.

The research brings together both critical experiments and novel models to permit the creation and development of such a method.

The aim is to develop an improved structural integrity assessment methodology to reduce unnecessary conservatism in the safe design of quasi-brittle structures.

This project assembles world-leading expertise in quasi-brittle materials with modelling and experimental characterisation of properties, damage and stresses in quasi-brittle materials from the length scale of the microstructure to that of engineering components.

For further information, please follow the link:
<http://gow.epsrc.ac.uk/NGBOViewGrant.aspx?GrantRef=EP/J019992/1>

Restructure & Appointments

The School has recently set up Research Themes which provide a formal leadership structure, in turn this is providing the backbone for flexible membership. The School's Research and Partner Engagement Themes reflect our strategic and priority areas of international expertise. These themes are of national importance and/or address society/industry grand challenges. We encourage researchers, industry, business, research councils, governments to engage with themes and their leadership to explore research and technology development areas of mutual importance.

Research Themes and Leaders/Deputy Leaders:

Aerospace
Bio Energy
Bio Engineering
Climate Change
Infrastructure (built environment, water, transport, energy)
Innovative Manufacturing
Modelling and Simulation Centre
Nuclear
Offshore Renewable Energy
Project Management
RHX Dating of Fired Clay Ceramics

Professor Kostas Kontis
Dr Patricia Thornley/Dr Paul Gilbert
Dr Partha Mandal/Dr Alistair Revell
Professor Kevin Anderson/Dr Carly McLachlan
Dr Roger Edwards/Dr Alice Bows
Professor Lin Li/Dr Paul Mativenga
Professor John Yates/Dr Ben Rogers
Professor Paul Mummery/Dr John Francis
Professor Peter Stansby/Dr Tim Stallard
Professor Andy Gale/Dr Paul Chan
Dr Moira Wilson

Recent appointments

Dr Carlos Lam moved from Macau in 1998 to neighbouring Hong Kong to study for a BEng in Civil and Environmental Engineering at The Hong Kong Polytechnic University. After completing his studies in 2001, he worked on the construction of the West Rail's Tuen Mun station in Hong Kong. In 2003 he completed an MSc in Soil Mechanics at Imperial College London. He then worked on onshore ground investigation and consultancy projects, and was later involved in projects for the offshore oil and gas industry. In 2007 he started his research on excavation-support fluids funded by an EPSRC studentship at the University of Oxford. Following a year of post-doctoral work at the same institution, where he was seconded to Balfour Beatty Ground Engineering, he came to Manchester in September 2012 to take up the post of Lecturer in Geotechnical Engineering.

carlos.lam@manchester.ac.uk



Dr Christian A Griffiths' overall research interest lies in the field of Micro and Nano technology (MNT). The main focus of his PhD was in Micro Injection Moulding: Tooling and Process Factors. Recently his research has been focused on characterisation of micro scale polymer flow behaviour at the melt/tool interface, using rapid tooling and novel condition monitoring techniques. In the last five years, he published 36 papers in peer-reviewed scientific journals and international conference proceedings. He has gained the necessary experience for undertaking the MNT research and dissemination tasks in EU FP6, FP7, EPSRC, TSB and WEFO programmes. Finally, his research activity is underpinned by 12 years of industrial experience in the automotive industry working for French and German multinational companies. During this time he has gained a strong technical and practical background specifically within the fields of injection moulding tool/machine, robotics and laser cutting. Christian joined the Manufacturing Group as a Lecturer in December 2012.

christian.griffiths@manchester.ac.uk



Dr Ian Stewart was appointed as Lecturer and Programme Manager of the MSc in Management of Projects and is thoroughly enjoying managing a course in such international demand, with the support of an excellent team of colleagues, academic and PSS. Additionally, he lectures in Commercial Management of Projects. This subject first brought him to the school in 2001 through teaching on the bespoke UMIST BT MSc in Commercial Management. A PhD in this area followed, which was a combination of historical research into the descent of the Commercial Manager into project-led organisations such as BT, RR & BAE and the practice of innovation within the commercial role in those firms. From this, he claims the distinction of holding the last UMIST PhD. The history of British industrial management from 1850, particularly social mobility, vertical integration and the resistance of Schools of Engineering to commercial and management education remains a research interest. Following disenchantment with the I.T. industry and the .com boom, Ian has been falling towards academia and along the way has developed extensive interdisciplinary experience, contextualising business and management education for engineering, projectised and high technology contexts. Ian holds visiting lectureships at Ecole d'Ingénieurs en Génie des Systèmes Industriels, La Rochelle, Warwick Manufacturing Group and Manchester Business School.

i.c.stewart@manchester.ac.uk

The bigger picture

Ball skills

It is not always easy to calibrate the balance between mental and physical fitness but efforts are being made to achieve this at the School's 'Staff vs Students' football tournaments. Many teams with imaginative names such as 'Sheikhy Starters' and 'Tight Shirts FC' come to the modern day battlefield that is the football pitch. They get the adrenaline flowing to levels that would make Sir Alex Ferguson, Roberto Mancini and their Reds and Blues turn green with envy.



The winning team "Moiras boys" with their manager Dr Moira Wilson



Prof Andy Gibson, Head of School, had some strategic moves

Green Impact Award



All H-floor staff in the Pariser Building have been awarded the Bronze Green Impact award and the entire building is vying to get the Silver Award in the 12/13 competition. Already in its fourth year at The University of Manchester, the project encourages staff to lead the way towards achieving positive environmental changes and impacts. Teams throughout the University are given a workbook with bronze, silver, and gold criteria to help create a more sustainable workplace.

For further information about Green Impact Awards: <http://www.green-impact.org.uk/>



Andrew Welfle, Rachel Wood-Harper and Professor Dame Nancy Rothwell, VP of the University of Manchester at the Green Impact Awards Ceremony

Continual Professional Development

Maintenance Engineering & Asset Management

The School runs a suite of CPD courses in Maintenance Engineering and Asset Management. These modules can be taken individually or can be combined towards the award of an MSc degree. A number of these modules have been approved by the Institution of Mechanical Engineers for contribution towards Professional Accreditation.

- [Maintenance Strategy](#)
- [Turnaround Management](#)
- [Maintenance Systems](#)
- [Reliability, Maintainability and Risk](#)
- [Maintenance Awareness in Design](#)
- [Maintenance Organisation](#)
- [Condition Based Maintenance](#)
- [Machinery Vibration Monitoring & Analysis](#)
- [Auditing Maintenance Systems](#)

Involving Students in the Learning of Structural Concepts

This seminar is for academics who teach Structural Engineering in UK Higher Education Institutions. It will discuss the ways in which structural concepts are taught at the University of Manchester and will share teaching resources by providing slides for teaching of structural concepts. The seminar is supported by the Higher Education Academy and is free to attend.

Date : Wednesday 12 June 2013, 9:30 – 16:30

Venue : University of Manchester

Contact : Hector Bobadilla

Hector.guerreroBobadilla@manchester.ac.uk

to register for attendance