The University Of Sheffield.

*In*Control.

Newsletter for Automatic Control & Systems Engineering at Sheffield.

Issue 04
Winter 2013

Head's Welcome

Welcome to the 2013 Autumn Issue. We begin the new academic session as we did the last, by expanding our academic staff numbers further. Our new recruits, two new Lecturers and a Reader, have swelled our numbers to 28 and led to the formation of a third research group, Autonomous Systems and Robotics, which complements our other groups: Complex Systems and Signal Processing; Intelligent Systems, Decision and Control.

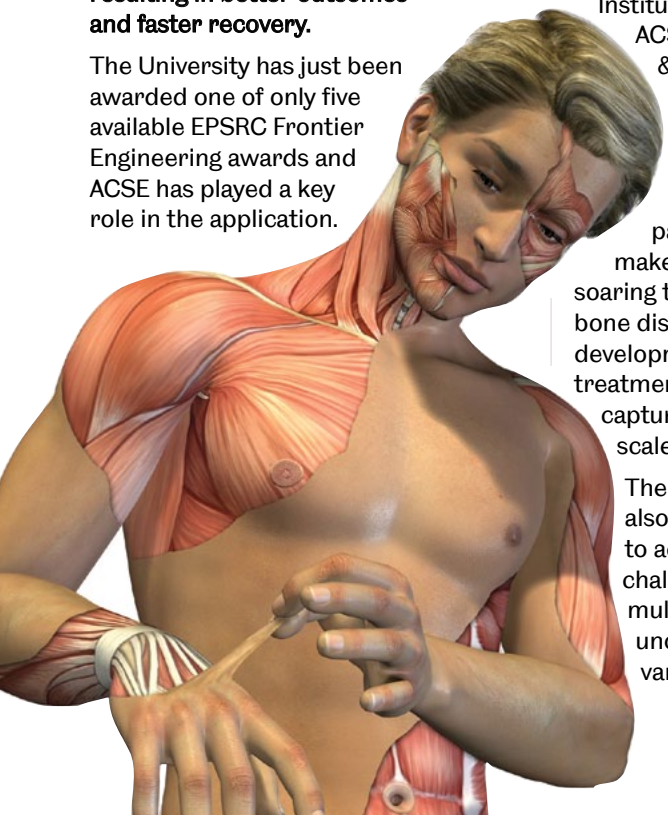
We also had great success in our research grant capture over the last twelve months with nearly £6M. As the preparations for the UK Research Excellence Framework (REF) assessment of Universities comes to a close, our attention has been drawn to making an impact through users of our research.

Professor Visakan Kadirkamanathan
Head of Department

ACSE Staff in Exclusive £6.7m Frontier Engineering Award

A computer model of the human musculoskeletal system will be mapped out by researchers at the University of Sheffield following a £6.7m grant that will lead to personalised treatment for diseases such as osteoporosis, arthritis and back pain, saving money and resulting in better outcomes and faster recovery.

The University has just been awarded one of only five available EPSRC Frontier Engineering awards and ACSE has played a key role in the application.



These awards are new, innovative engineering projects which bring leading engineers and scientists together to address some of the major engineering challenges facing the world.

This award is a collaboration between members of the INSIGNEO Institute in silico medicine from ACSE (Professors Steve Billings & Visakan Kadirkamanathan), Civil Engineering and Human Metabolism.

The engineering-based model of an individual patient's musculoskeletal makeup will be able to reduce soaring treatment costs for chronic bone disorders by predicting disease development and enabling better treatment. It will simultaneously capture processes at a cellular scale right up to the whole body.

The modelling framework will also provide a generic platform to address other engineering challenges that involve multi-scale modelling, unobservable states and variables, and uncertainty.

Alumni View

I recently graduated from the Department of Automatic Control and Systems Engineering, receiving a MEng (Hons) degree in Systems and Control Engineering and I very much enjoyed my time in the Department.

In my final year, I was contacted by Keith Jackson, Chief Technology Officer of Meggitt. I was offered a place on Meggitt's prestigious graduate programme. The programme consists of four placements, with at least one international placement.

I am currently working on a new project: Aircraft Nose Wheel Steering at Meggitt Aircraft Braking Systems. I've already had to delve into control theory and make use of MATLAB and Simulink, proving the importance of the concepts learnt as part of my degree. I'd like to use this time to express my appreciation to all of those at the Department who helped further my academic knowledge and shape my future career.

Tom Newman
Graduated 2013

We love to hear from our alumnis please email: emma.shepherd@sheffield.ac.uk

Also please visit the website to see what opportunities are available to alumni: www.sheffield.ac.uk/acse/alumni

General News

Visitors

ACSE was delighted to host two leading academic visitors during the year. Professor Miroslav Krstic, Associate Vice Chancellor for Research at University of California, San Diego and Professor Mathukumalli Vidyasagar, Professor of Systems Biology Science at the University of Texas in Dallas, both contributed to ACSE's seminar series, full details of which can be found at www.sheffield.ac.uk/acse/research/seminars

Research Grant Awards

Since the last Newsletter in October 2012, the Department has been awarded £5.9m in research funding, including:

EPSRC: Assessing the Underworld - An Integrated Performance Model of City Infrastructures
Dr Anderson and Dr Dodd

EPSRC Capital Funding: Human-Machine Cooperation in Robotics and Autonomous Systems
Dr Gross, Dr Dodd, Prof Coca and Prof Sandor Veres

EPSRC: Capital for Great Technologies - Grid Scale Energy Storage
Prof Zhong

EC: Demonstration of methods and tools for the optimisation of operational reliability of large-scale industrial wind turbines (OPTIMUS)
Prof Zi-Qiang Lang

BBSRC: Understanding neural excitation and inhibition: implications for the interpretation of extracellular field potential recordings
Prof Coca and Prof Billings

Other News

Dr Robin Purshouse received a prestigious Future Research Leaders award from the ESRC, for research into how complex systems methods help explain and predict alcohol consumption patterns in the British population.

Prof Kadirkamanathan received the esteemed PNAS Cozzarelli Prize from the US National Academy of Science for his article, 'Point process modelling of the Afghan War Diary'.

Harry Nicholson Lecture 2013

In May 2013 the Department held its fourth distinguished lecture in honour of its founder, Professor Harry Nicholson. The lecture attracts the most prestigious academics in the field today and was presented to a 110 strong audience of ACSE staff, students and Emeritus staff.

The 2013 lecture, titled 'Control systems and networks from the feedback amplifier to Formula One Racing' was presented by Professor Malcolm C. Smith who is well-known for his invention of the inerter mechanical device currently used in Formula One motor racing and elsewhere.

The lecture traced the close interaction between control theory and networks from the 1920s to the present day. Professor Smith began by reviewing the classical pillars of both subjects: the network synthesis theorems of Foster, Brune and others, the invention of the feedback amplifier and the foundations of classical control. He discussed the aspects of the post-war development of these subjects, including those leading to H-infinity control and the study of active control and passivity, which led to the invention of a new mechanical network element - the inerter.

Proposed Architecture For Next-Generation Smart Grids

ACSE's Professor Qing-Chang Zhong's proposed architecture for the next-generation of smart grids, based on the award-winning synchronverter technology, will allow all power systems to grow organically and to be operated autonomously.

As we increase our reliance on alternative energy, the number of energy suppliers will increase dramatically, which will make it very difficult to regulate all the different suppliers. This could escalate the risk of blackouts, rather than solve it, unless next-generation smart grid technology is widely adopted. If all the power supplied to the grid can be synchronised at the bottom level, as the power is fed into the grid, then all suppliers can work together in a stable, completely autonomous manner.

The secret to this system lies in inverters – the devices that change a DC current to an AC current, that all renewable power generators need in order to be able to feed power into the grid. With the synchronverter technology, these inverters can be controlled to have the internal dynamics and external functions of conventional synchronous generators – the mechanism needed by all generators to convert mechanical power into electrical power.

The team believe they can produce a self-regulating power system by enabling the energy suppliers to synchronise their outputs through the power network itself.

A number of blue-chip companies have already expressed great interest in this architecture.

For more information email: q.zhong@sheffield.ac.uk

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ACSE plays host to prominent International Conferences

ACSE has played host to two prominent international conferences this year; the 7th International Conference on Evolutionary Multi-Criterion Optimization (EMO) and the 10th IFAC Symposium on Advances in Control Education (ACE).

EMO 2013 built on the success of the 2011 meeting in Ouro Preto, Brazil, in bringing together the evolutionary multi-criterion optimization and multiple criteria decision making (MCDM) communities, while also stimulating a new focus on the application of EMO and MCDM research to help solve real problems in government, business and industry.

ACE Symposium 2013

ACE Symposium 2013

The focus on real world applications was particularly successful, helping to bridge the gap between academics and industry. The EMO conferences have been the forum for the first presentation of several breakthroughs, for the raising of new questions, and for the early indication of new trends within the research community of the area.

ACE provides a forum for dissemination of best practice and research within control education. The conference enabled the sharing of new knowledge and alternative approaches in education.

The ACSE Society

The ACSE Society has been improving dramatically every year and we want to continue this trend. We want to make the society cater for all students and have a variety of events and activities.

During intro week, members of the Society met up to chat after a long summer and had a meal and a few games of pool. Another social we have planned is our robot themed fancy costume night in Sheffield, which will give the freshers a great chance to meet other students in the Department and also let students show off their creativity when creating a costume.

We are also carrying on the tradition of registering our very successful football team into the intramural university league.

A fantastic calender has been created this year with events like bowling, hikes to the Peak District, social nights in Sheffield and much more!

Matty Smith,
ACSE Society President

Find us on facebook: www.facebook.com/groups/acsesoc/

If you would like to contribute to the next edition of the ACSE newsletter please email: emma.shepherd@sheffield.ac.uk

For an electronic version of this newsletter go to: www.sheffield.ac.uk/acse/news

Portable teaching kit developed for students

Dr Bryn Jones, Lecturer of State-Space Control Design at the Department of Automatic Control and Systems Engineering has developed a Helicopter Kit that is entirely unique to this Department and available to all final year students to take home and explore.

This kit is an entire system in a box and mimics a twin rotor helicopter, which is equipped with various sensors and actuators, linked to a PC via a data acquisition unit. It is used to teach rapid control prototyping techniques in a 'hands on fashion'. Students put into practice all the theory they have learnt to date on an actual piece of hardware.

Students are required to design a feedback control system that will enable the helicopter to take off,

hover in a stable fashion and steer smoothly to a different location. The confidence and experience they gain can only come from getting a complex real world system like this to work in practice. Prospective employers really value these attributes.

Academic Staff

We would like to welcome three new members of academic staff to ACSE.

Dr Iñaki Esnaola has joined the Department as Lecturer, following a Postdoctoral Research Associate position at Princeton University. His research interests include Information and Communication theory.

Dr Andreas Kolling has joined us from Linköping University as Lecturer and his interests include: Cooperative Robotics, Multi-Robot Systems and Graph Theory.

Dr Lyudmila Mihaylova has joined us from Lancaster University. Her main research interests are Nonlinear Estimation and Control, Tracking Complex Systems and Sensor Data Fusion, Autonomous Systems, Navigation and Statistical Signal Processing.

A Student's Perspective

The University of Sheffield has been an amazing experience. I joined the BEng Mechatronics and Robotics course at ACSE in 2012, and have loved every minute. The University was my top choice, not only because of its renowned engineering department, but because ACSE has the biggest Control Systems department in the whole of Europe.

The Department is absolutely brilliant. They are supportive and motivational, from the friendly receptionists to our Head of Department.

The best part about University life is the opportunity to get involved. Last year I was the International Representative for ACSE, which enabled me to get to know more about the Department and interact with my fellow students on a higher level. I am also Sports Officer for the ACSE Society and with activities ranging from nights out to Go-Karting, there is never a dull moment.

The course is challenging, but conducted in such a way, that the learning is made enjoyable and interesting. The lectures are concise and informative, and the labs show you how to apply what you have learnt to real world scenarios.

Overall, I have no regrets about coming to Sheffield, because of the people, city and educational experience. Now I look to the future, knowing that I have everything I need to succeed.

Yohahn Ribeiro

2nd Year
Mechatronic & Robotics Engineering (BEng)

Student Achievements

The Department is very grateful for SGS-TÜV Saar's new sponsorship of the Functional Safety Prize, given to MEng students for the best group project. Departmental prize winners for the 2012/13 session were:

Yohanhn Ribeiro (Laplace Award)

Craig Hamer (L J C Wooliscroft Prize)

Adam Hartwell (Nyquist Award)

Miyuru Dias, Paul Hughes, Michael Roberts and Shenal Gunawardena (SGS-TÜV Saar - Functional Safety Prize)

Alice Campkin (Bode Award)

Duanyang Hou (Nicholson Prize for Undergraduate Studies)

Michael Toumbas (EDF Project Prize)

Nicholas Howes (Wiener Award)

Thomas Newman and Duanyang Hou (Bechtel Prize)

Full details of ACSE prize winners and awards can be found at: http://www.shef.ac.uk/acse/prizes