



# NETWORKS

Alumni Newsletter of UCD Electrical, Electronic and Communications Engineering

September 2013

We were very pleased at the highly positive reaction of alumni to the inaugural issue of NETWORKS at the start of the last academic year, and I am delighted now to present to you this second issue of our newsletter for graduates in Electrical/Electronic Engineering and related programmes in UCD. In spite of continuing severe financial challenges, this has been a very positive and successful year for the School of Electrical, Electronic & Communications Engineering (the direct descendent of the old EE Department). I hope you can get a feeling of this from the content below, including our continuing expansion and successes in the field of Electrical Energy and our leading involvement in UCD's new joint campus in China, the Beijing Dublin International College. My colleagues and I are very keen to reach out to our alumni, to hear from you and to keep you up to date with our activities, while also encouraging you to support us actively in our mission. Please send us your feedback ([eece@ucd.ie](mailto:eece@ucd.ie)), visit our website ([www.ucd.ie/eece](http://www.ucd.ie/eece)) or just call in to see us in the Engineering building in Belfield at any time, where you will always be very welcome.

Professor Tom Brazil

Head of School of Electrical, Electronic and Communications Engineering

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## In Memoriam – Deirdre Curran



*Deirdre with Tom Brazil, pictured on the occasion of her retirement in 2008*

Staff and alumni of the school were deeply saddened to learn in April of the death of Deirdre Curran. Deirdre joined the Department of Electronic and Electrical Engineering in 1990 to run the departmental office. She did this with great efficiency, at the same time bringing a warm and friendly presence to the heart of the department. Deirdre took a personal interest in staff and students, particularly those who were new to UCD. All who passed through the office enjoyed swapping stories with her, many of them about her great interest in golf and travel, which she enjoyed with her wide circle of friends. She was also a devoted carer to her mother, Molly, who passed away in 2012 at the age of 101. Deirdre retired from UCD in 2008. She is greatly missed.

# BEIJING DUBLIN INTERNATIONAL COLLEGE

The cities of Beijing and Dublin were twinned in 2011 and in the following year the newly formed Beijing Dublin International College (BDIC) admitted its first students. BDIC is a joint venture between UCD and the Beijing University of Technology (BJUT) and is located on BJUT's campus in Beijing. Under a partnership agreement BDIC is offering joint UCD/BJUT degrees across a range of disciplines. "Internet of Things Engineering" was the first BDIC programme to admit students, and this cohort has just completed its first year of study. This four-year bachelor's programme is delivered by staff from the School of Electrical, Electronic and Communications Engineering and the School of Computer Science and Informatics in UCD along with staff from BJUT.

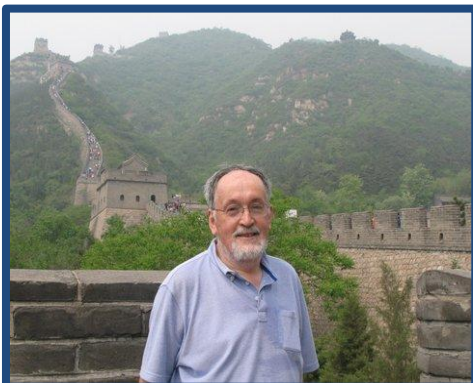
Professor Tony Fagan spent three months in Beijing last Spring to deliver the first offering of a module called "An Introduction to the Internet of Things Engineering." He describes the excitement of the area: "The internet as we know it today is set to evolve into a massive network of networks – one that connects together people and objects all over the world. The objects can be anything from cars and buildings to mobile health monitors and goods on supermarket shelves. The development of this new internet of everything will require a very special new breed of communications engineer – people who are as comfortable designing highly novel radio systems as they are in working on large software projects. This new groundbreaking degree course is designed to educate the next generation of engineers that will radically change the world."



*Tony Fagan with Rem Collier of UCD School of Computer Science and Informatics and members of the BDIC team*

The Internet of Things is already quietly happening but soon everybody will be aware of it. Applications such as the smart electricity grid, mobile health and intelligent transport systems will be utterly dependent on the new internet. Tony elaborates: "We are at the dawn of a new era of communications. The important benefits of the Internet of Things will only become apparent in time, but whatever they are we will be completely and happily surprised."

Tony said "I really loved teaching this course – the students were very enthusiastic. I got them to study how today's internet works so that they would be aware of its strengths and weaknesses. In a group discussion they decided that in its current form it is not yet ready for the Internet of Things and will require radical change. So already they are thinking critically about the future."



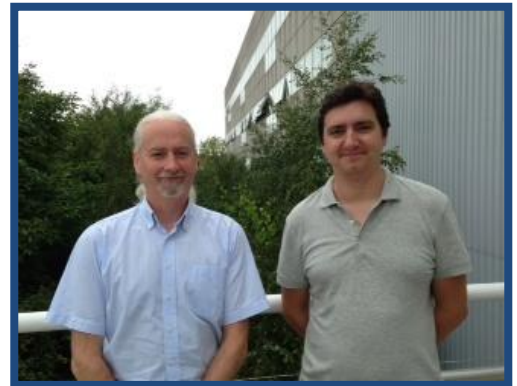
In the laboratory they designed and implemented a system that allows microcontrollers to communicate with each other over large distances. Working in teams they first wrote their own protocols and then implemented them by writing original code. Tony commented: "The students were justifiably proud of what they accomplished in the lab. Writing their own communication standard and then successfully implementing it was indeed a great achievement for first year students."

Finally, how did Professor Fagan find living and working in Beijing? "I absolutely loved it. I grew up in a capital city – Dublin. It was fascinating to see the similarities and differences with another great capital – Beijing. Both cities are very proud of their past and with initiatives like BDIC, together they have a very bright future."

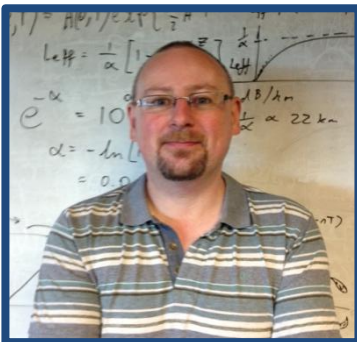
# STAFF NEWS

The School has welcomed four new members of academic staff and three adjunct faculty since the start of 2013.

The first two of these are noted researchers in the area of power systems and power electronics, and are contributing to the ambitious plans of the School in this area, supporting the development of smart grids. A graduate of the University of Genoa, Italy, **Federico Milano** joined UCD from the University of Castilla-La Mancha, Spain. His research interests are power systems modelling, stability analysis and control. Federico has a particular interest in the development of open source software for power system analysis (<http://faraday1.ucd.ie/software.html>) and is Chair of the IEEE PES Task Force on Free & Open Source Software. **Terence O'Donnell** is a graduate of UCD, and has worked with PEI (Power Electronics Ireland) Technologies in the Tyndall National Institute in Cork and Enterprise Ireland. Terence's current research focus is on the use of power electronic converters in power systems and in particular on the integration and interfacing of power electronics to the grid.



*Terence O'Donnell and Federico Milano*



*Barry Cardiff*

**Barry Cardiff** received his BE, MEngSc. and PhD degrees from UCD. He worked with Nokia for 8 years as a DSP engineer, system integration manager, and as a physical layer protocol specialist contributing to 3G specification and Nokia's 3G chip set. He returned to Ireland in 2001 and worked for Silicon & Software Systems (S3) in Dublin until 2013 as a systems architect working on various embedded systems resulting in many mixed signal IC and product designs. His research interests include signal processing for communication systems and digitally-assisted analog circuit techniques. Barry will have particular responsibility for delivering the Internet of Things Engineering programme in Beijing.

**Mahnaz Arvaneh** joined UCD as a lecturer in biomedical engineering in June, covering Madeleine Lowery's duties during her maternity leave. Mahnaz received her BSc degree in electrical engineering from K. N. Toosi University of Technology, Tehran, Iran, and the M.Sc. degree in control engineering from the Ferdowsi University of Mashhad, Iran, in 2005 and 2007, respectively. She then moved to Singapore to pursue her PhD at Nanyang Technological University on brain-computer interface. Her research in UCD focuses on developing machine learning and signal processing algorithms to reliably extract and analyse required information from bio-physiological signals with applications in brain-computer interface, rehabilitation, emotion recognition, sleep and anaesthesia monitoring.



*Mahnaz Arvaneh*

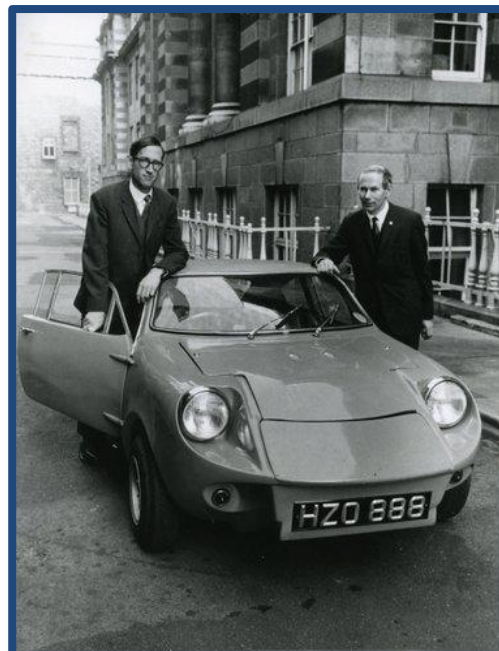
The three adjunct appointments, all UCD engineering graduates, bring a wealth of cutting-edge industrial expertise into our degree programmes. **Liam Madden** has risen to the top of the global electronics industry as Corporate Vice-President of Xilinx Corporation in the heart of Silicon Valley. Liam is preparing an innovative set of distance-learning videos to be introduced in an undergraduate Solid State Electronics module in the coming academic year. In addition, Liam has volunteered to help the School's teaching and research in advanced electronic circuit design, through occasional lectures, prizes for student projects as well as advice on curriculum design. **Conor Hanley**, co-founder of UCD spin-out BiancaMed, acquired in 2012 by ResMed, will deliver a new module on entrepreneurship, which will be highly innovative in its teaching methods. **Noel O'Riordan** of S3 will share his experience of analog and mixed-signal design with our students through lectures and workshops.

## Emeritus Faculty Profile **JIM LACY**

Visitors to the Roebuck area of UCD's Belfield campus may notice that the large clock on the clock tower bears the inscription "Lacy Dublin". Generations of UCD electronic or electrical engineering graduates will deduce from this that the clock is one of many examples of the legacy to UCD of Emeritus Professor James G (Jim) Lacy.

Born in Dublin, Jim was always determined to be an electrical engineer. However, as a victim of polio in 1946 his secondary education was interrupted. An avid reader, his recovery time was not wasted, but reinforced his interest in engineering, his experimental interest greatly aiding his rehabilitation. His residual disability gave him a keen interest in all forms of land and aerial transport, which he retains to this day. He obtained his private pilot's licence in 1980. The polio was to return to haunt him in his sixties in the form of post-polio syndrome.

Jim being a keen experimentalist, his interest in the fundamentals of things mechanical and electrical drew him to study engineering at University College Dublin and motivated much of his subsequent career. Having obtained the BE (Mechanical and Electrical) in 1958 Jim was appointed Demonstrator in Electronics, a subject in the new Electrical Engineering Degree. Seán Scanlan, later to become Professor of Electronic Engineering, was under his tutelage at this time. Following two years as a research engineer with Leo Computers in London, where he designed the solid state logic circuits for the LEO III/1, he was appointed Assistant Lecturer in UCD in 1961, and was promoted to Statutory (Senior) Lecturer in 1976 and to Associate Professor in 1987.



*Jim and John Byrne with the electric car*

Jim made major contributions to the establishment of both courses and laboratories for the new discipline of Electronic Engineering. He developed valuable on-going contacts with industry, both Irish and international, and initiated a wide range of innovative research projects, particularly in the areas of power electronics, digital systems and measurement. These projects attracted considerable external funding, at this time both a necessity and a rarity. One such project, which attracted interest in 1968, was the design and construction of an electric car. This was used as a rolling test bed to evaluate motor control systems developed jointly with Professor John V Byrne. They were jointly awarded the Mullins Medal by the IEI in 1970 for a paper on this subject.

The BE Degree in Electronic Engineering was established in 1973 and Jim played a major role in developing the many new courses then required. While carrying a large teaching load he continued to expand his research interests and to supervise numerous post graduate students. He has held seminal patents on what are now known as switched reluctance motors (1969), only now receiving international recognition, free piston engine ignition systems and measurement systems. He has published in refereed journals over a wide range of topics. He was responsible for the initiation and supervision of the Department's technical staff and workshops until his retirement in 1997. He has acted as consultant to industry both at home and abroad.



Prior to and during the move from Merrion Street to Belfield, Jim undertook many onerous duties related to the planning and equipping of the new Belfield facilities. The University at large has benefited immensely from Jim's contributions over the years. He was always a source of help and information for staff and students and is remembered for his motto, "The Students Come First". Jim celebrated his 80th birthday last May with his wife Pat, daughters Patricia and Joanne and their families, friends and retired colleagues.

# RF AND MICROWAVE RESEARCH

Wireless technologies have revolutionized the way we live over the past two decades, and this revolution shows no sign of abating. The explosion in data traffic caused by the use of smart phones, tablets, etc., is placing huge demands on wireless networks. In the longer-term we are likely to see an extraordinary revolution much bigger than anything witnessed to date, when 100s of billions of everyday objects, from watches and keys to cars and buildings, are connected to the Internet (the "Internet of Things"). As data rates increase, the scientific challenges in wireless system design mount rapidly. New research breakthroughs will be essential to make this exciting vision a reality.

Wireless applications are enabled by electromagnetic waves in the Radio Frequency (RF) and microwave bands, stretching from 100s of MHz to 100s of GHz. The RF & Microwave Research Group in UCD was established by Prof. Tom Brazil in the early 1980s to study the fundamental scientific challenges involved in realising electronic circuits and systems in these bands. Although the technologies have changed over the years, the basic focus of the Group has remained on addressing the key non-linear modelling and simulation challenges involved in successful design at these frequencies. Through securing major research awards from the European Union and Science Foundation Ireland (SFI), the Group has developed a state-of-the art test and measurement laboratory and is well known internationally as a leading academic research centre in this field.



Today the Group, led jointly by Prof. Brazil and Dr. Anding Zhu, has a particular focus on the RF power amplifier (PA), which is an essential unit of almost all wireless transmitters, from tiny sensors to high-power base stations. The PA strengthens the signal to combat losses in transmission by converting DC electric power to added RF output power. It is widely recognised that this key element in the wireless link is critical and difficult to implement, and it consumes a high proportion of the total transceiver energy. It is also a complex nonlinear unit which introduces distortion that severely limits data capacity. The aim of the research carried out in UCD is to address some of the most difficult challenges in future power amplifier development, in particular how to change current paradigms to deal with the unsustainable growth trends in energy consumption as well as minimizing the generation of distortion and maintaining high quality of services for the explosive growth of data traffic in future wireless systems. Current research themes include physical and equivalent-circuit modelling of MOSFET/MESFET transistors, nonlinear circuit analysis, Volterra-series-based behavioural modelling, broadband power amplifier design linearisation using digital predistortion, and advanced transmitter architectures. Research on time-domain/frequency-domain discrete convolution techniques as well as non-linear CMOS device modelling is also carried out.



*INMMIC 2012 Steering Committee*

In September 2012 the Group hosted the International Workshop on Integrated Nonlinear Microwave and Millimetre-wave Circuits (INMMIC), drawing almost 100 researchers from around the world to UCD. Anding Zhu was chair and Tom Brazil co-chair. Keynote speeches were given by Michael Steer (North Carolina State University), Mike Keaveney (Analog Devices), John Wood (Maxim Integrated Products), Dominique Schreurs (KU Leuven) and Nuno Borges Carvalho (Universidade de Aveiro). The technical programme ranged over a wide range of areas, including high frequency nonlinear device and system modelling/characterisation, nonlinear circuit analysis and simulation, power amplifier design and linearization, and millimeter wave applications.

Dave Burke, Senior Engineering Director for Android at Google, studied Electronic Engineering at UCD from 1993 to 1997. For Dave it was an easy choice: "I had a deep fascination with electronic and mechanical things from a young age, whether it was disassembling clocks at the age of 3 or designing and building robots in primary school". It was during his final year project that Dave got the opportunity to start working closely with UCD Emeritus Professor of Electrical Engineering Annraoi de Paor. Dave went on to complete his M.Eng.Sc. and Ph.D. under the supervision of Professor de Paor: "We like to joke that Harry didn't just give me the 3rd degree, he also gave me the 1st and 2nd degree!". In fact, Professor de Paor also supervised the M.Eng.Sc. studies of Dave's father Raymond. "I guess that technically makes Harry my academic grandfather!"

Dave's Ph.D. specialized in dynamical system modelling of electrical activity of the brain. "I've always felt some of the most exciting areas of research and innovation are at the intersection of disciplines – in this case, the intersection of electricity, neuroscience and applied maths". During his Ph.D. studies, Dave got interested in mobile telecoms. In early 2000, he bought the first WAP smartphone – a Nokia 7110 with a monochrome display. He immediately set about creating a maps application for the device, going as far as licensing vector data from Ordnance Survey. He developed a service called "StreetWise", one of the world's first mobile maps applications, resulting in coverage in the Irish Times and elsewhere. "I was hooked! Smartphones were at the intersection of telecoms, computing and the Internet – I could see endless exciting possibilities for multidisciplinary innovation".

In late 2000, Dave and some other UCD graduates co-founded a startup called Voxpilot, with Dave serving as CTO. Voxpilot was one of the pioneers in bringing Internet and speech technologies to the Interactive Voice Response (IVR) industry. The company later sold to a large French enterprise called Devoteam.

In 2007, Dave joined Google, charged with building a new mobile engineering team in London: "In 2007, mobile Internet was still nascent. While the majority of Google was focused on desktop, Larry and Sergey wanted a mobile team in Google essentially as a strategic investment – to get an early start and build out Google's search and apps experience on mobile." By 2010, Dave rose to Engineering Site Director for Google UK. In 2011, Dave was given the opportunity to move to California to work in Google's headquarters in Mountain View.

Today, Dave oversees a team of over 160 engineers developing the Android operating system, which runs on over 80% of the world's smartphones. Dave is also responsible for the Nexus line of phone and tablet devices. "We're at a really pivotal moment in computing: smartphones and tablets are exploding in growth. Tablet shipments overtook desktop PCs and notebooks in the final quarter of 2012. Global mobile traffic is now at 15 percent of Internet traffic, and in 2013 mobile traffic surpassed desktop PCs in China for the first time".

Dave believes his UCD education has played a key role in his success: "In Google, I'm lucky to be surrounded by some of the smartest computer scientists in the world. I love the fact that my undergrad and postgrad training is in Electronic Engineering, however. It's enabled me to really understand the fundamentals of what I do. And it's amazing how often these fundamentals come in useful on a daily basis, whether it's employing a PLL to adjust the phase of a display's refresh with the touchscreen scans to improve responsiveness, or applying a Kalman filter to fuse accelerometers and gyros together for better indoor location tracking".

As for what's next in mobile, Dave muses, "I used to think the holy grail was to control our devices directly from our brains, maybe even one day tapping into my Ph.D. research. I've now realized that what we really want is for our phones to become more intelligent assistants, to think for themselves, and to assist us in our daily lives – ultimately to give us back more time to do what we do best: living!"



*Dave in front of the larger-than-life Android desserts. Google names its releases after desserts in alphabetical order. The latest release is 'KitKat', building on its predecessors 'Jelly Bean' and 'Ice Cream Sandwich.'*

# STUDENT NEWS

## Award for Elec Soc

UCD's Electronic and Electrical Engineering Society (Elec Soc) has won the UCD Small Society of the Year Award for 2013. Congratulations to the Elec Soc Committee members and in particular to the retiring auditor, Raymond Carley, on the many achievements of Elec Soc during this year, notably including the establishment of an IEEE Student Branch within the School. The award was accepted at the ceremony by the current Elec Soc auditor, Peadar Keegan.

More information on this thriving society, including an up-to-date schedule of activities, can be found at the official Elec Soc homepage [www.ucd.ie/electsoc](http://www.ucd.ie/electsoc).

## Class of 2013

The number of students in E&E Engineering has been increasing every year for some time now. This year is the first year that graduates are required to have a Master's degree in order to become a chartered engineer with Engineers Ireland; therefore a number of students branched off from the 4 year BE to do the 3+2 year Master's degree instead. The approx. 40 of us remaining in the BE had a very busy year, with our final year projects taking up the majority of our time in the second semester. The 15 or so students in the 5 year ME spent the second semester and this summer on placement, before they return to UCD in September to complete their Master's.

Besides classes and project work, we also had the important task of deciding what career paths to pursue. Thankfully there is still a strong demand for E&E engineers, both at home and abroad. Some of us have decided to continue our studies at a Masters or PhD level outside UCD, with two heading to the US (myself included) and one going to Tyndall in Cork. Many others have opted to find work at home in Ireland. Three are going to the UK, one to Jaguar Land Rover and the other two to London to work in business/consulting. Finally, others again have decided to take time out to travel or have decided to pursue other non-engineering paths.



With so many people heading off to different parts of the world, we thankfully were still able to organise a final year dinner in May a few days after exams, which almost all students and a good amount of lecturers were able to attend. On behalf of the class of 2013, I would like to thank our lecturers, project supervisors, the college and staff for all their help during the past four years, helping to ensure our success and ultimately our graduation this year.

*Raymond Carley*

### STUDENT AWARDS

Airtricity Gold Medal in Electrical Engineering

S3 Gold Medal in Electronic Engineering

Cylon Award for Excellence in the Project

Conor O'Malley

Raymond Carley

Killian McKenna (Electrical Engineering)

Adrian Walsh (Electronic Engineering)

# ENERGY NEEDS IRELAND

The Energy Needs Ireland (ENI) summer education and research programme headed by Prof Mark O'Malley ran once again in Summer 2013. ENI 2013 consisted of 21 undergraduate students ranging in discipline from electronic and electrical engineering to commerce. These students worked tirelessly over the summer months to analyse the topic of Ireland's smart energy future.

The work of the group focuses on the need for consumer participation in the energy industry in order to implement a smarter energy network. However, they have specified this further by looking at how consumers are involved in and affected by aspects of the energy industry such as the implementation of a smart grid, demand side management and energy exportation.

ENI's findings are outlined in their white paper which was launched very successfully at the Clyde Court Hotel on 3 September with the support and presence of many members of both industry and academia who had assisted the group throughout their three-month research term. A digital copy of the ENI white paper 'Participating in Ireland's Smart Energy Future' can be found on their website ([eni.ucd.ie](http://eni.ucd.ie)). The group has included not only their assessments, but also their recommendations and innovative solutions regarding the consumer and their education, data and smart communities, economic considerations and energy export.

ENI have also presented their findings to members of the public, industry and academia, at both the Engineering Graduates Picnic in UCD and also their own Smart Energy Exhibition held in the National Digital Research Centre and attended by over 200 people.

In addition to their final white paper ENI 2013 also carried out their own studies. A consumer research survey of over 400 residential consumers nationwide gauged public knowledge and opinions on smart grid concepts. The group also carried out a cost benefit analysis on a full and immediate smart grid implementation in Ireland. The reports for each of these are also available on their website along with further information on ENI as a whole, this year's group, its members and the topics considered.

The students were very positive about the learning experience:

"The opportunity has taught me so much; we met and learned from so many people." - Étaín Ryan

"This experience has not only helped me to develop my ability to work as part of a successful team, but also the dynamics needed to make a team successful." - Jonathan Gorman

"It is a very special experience being a part of a team like ENI, as we have the unique opportunity to come together and try to solve some interesting problems facing the energy sector. I have never before worked with such a clever and dedicated bunch of people." - Meadhbh Ní Chléirigh



*Minister Fergus O'Dowd and Mark O'Malley with the Energy Needs Ireland students (Alexandra Scullion not pictured)*

# SCHOOL NEWS

## Irish Research Council Appointment



*President Michael D. Higgins hosted the Irish Research Council, recipients of the Council's Lindau Awards and guests in May 2013*

Professor Orla Feely was appointed Chair of the Irish Research Council in 2012 by Seán Sherlock, TD, Minister for Research and Innovation.

The Irish Research Council was established in March 2012 following the merger of the Irish Research Council for the Humanities and Social Sciences and the Irish Research Council for Science, Engineering and Technology. It funds excellent research across all disciplines, with a particular focus on early-stage researchers.

Professor Tom Brazil congratulated Orla, saying "This is a highly prestigious appointment, which connects the School in a direct way to the highest levels of research policy-making in the State."

## Awards and Honours

Tom Brazil and Anding Zhu were successful in the highly competitive Science Foundation Ireland Principal Investigator scheme in 2013. This is the third such award for Tom, and the eighth received within the School.

Tom Brazil was elected to the Senate of the National University of Ireland in December 2012, and was appointed Chair of the Education Committee of the IEEE Microwave Theory & Techniques Society in June 2013.

Andrew Keane and PhD students Lisa Rutledge and Aonghus Shortt received research awards from Intel under the Early Career Faculty Honor Program and the Doctoral Student Honor Programme. The awards were presented at Intel's European Research and Innovation Conference in Barcelona in October 2012.

Elena Blokhina, a Research Manager in the Circuits and Systems Group, was elected by a worldwide ballot to the Board of Governors of the IEEE Circuits and Systems Society. Elena was also elevated to Senior Membership of the IEEE in 2013.

Orla Feely received the Fellowship of the Irish Academy of Engineering in February 2013.

Anding Zhu was promoted to Senior Lecturer.

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# UCD SCHOOL OF ELECTRICAL, ELECTRONIC AND COMMUNICATIONS ENGINEERING

## ACADEMIC STAFF



Dr Mahnaz Arvaneh  
*Biomedical Engineering*



Prof. Tom Brazil  
*RF and Microwave*



Dr Barry Cardiff  
*Communications and  
Signal Processing*



Dr Paul Curran  
*Circuits and Systems*



Prof. Tony Fagan  
*Communications and  
Signal Processing*



Prof. Orla Feely  
*Circuits and Systems*



Dr Mark Flanagan  
*Communications and  
Signal Processing*



Dr Damian Flynn  
*Electrical Energy*



Dr Andrew Keane  
*Electrical Energy*



Dr Madeleine Lowery  
*Biomedical Engineering*



Prof. Federico Milano  
*Electrical Energy*



Brian Mulkeen  
*Circuits and Systems*



Dr Terence O'Donnell  
*Electrical Energy*



Jerry O'Dwyer  
*Electrical Energy*



Prof. Mark O'Malley  
*Electrical Energy*



Prof. John Sheridan  
*Optical Engineering*



Rick Watson  
*Electrical Energy*



Dr Anding Zhu  
*RF and Microwave*

## TECHNICAL STAFF



Liam Carroll



Luke Dalton



Frank Hoye



Declan Lehane



Steve McEvoy



Pat McNally

## ADMINISTRATIVE STAFF



Martine Kisielewicz



Oran O'Rua



Agnieszka Wisniewska