

# DES News

## Department of Engineering Science

December 2011 | Alumni and Friends quarterly newsletter | Number 13

### Dear Alumni and Friends

It has been a busy few months in the Department since the last issue of the newsletter. Matthias Ehr Gott is taking a pre-Christmas holiday (in the sun!) so it is my pleasure to update everyone.

The Department would like to congratulate Martyn Nash and Iain Anderson on their promotions. Martyn has been promoted to Professor, and Iain has achieved promotion to Associate Professor, both effective February 1st, 2012.

New Zealand's Next Top Engineering Scientist has continued to be a very successful competition attracting nationwide interest.

Review and accreditation of both the Engineering Science and Biomedical Engineering degrees has been completed by IPENZ.

The Engineering Science department will also be reviewed by the University of Auckland in 2012. As part of that process the Department will be contacting a selection of graduates for information that will feed into the review process.

Everyone misses Prof. Andrew Pullan around the office, but we are pleased that his health is very stable and are thankful for the generosity of everyone who has supported the trust fund established by his colleagues.

Associate Professor Rosalind Archer, Acting Head of Department  
[hod\\_des@auckland.ac.nz](mailto:hod_des@auckland.ac.nz)

### Letter to DES from Andrew Pullan, 20-10-2011

It is with a great deal of sadness that I have decided to retire on medical grounds so that I can focus on my recovery and my family. My retirement will require some adjustments be made by my family, but it is in the best interests of my family that I do this now. I am confident that when I am well the University will have me back in some sort of role so I am thinking of this as just a temporary measure. I have truly loved working in the Department and have high hopes of being back there again. Regards, Andrew

### New Zealand's Next Top Engineering Scientist 2011

117 teams from 65 schools all over New Zealand competed on Saturday 1st October, with students working from 8am through to 5pm. The competition question was "If a severe Tsunami warning was issued, how long would it take to evacuate the 13,000 people who live on Te Atatu Peninsula?"

The Pullan Prize for first place was taken out by a team of three students from Garin College, Nelson. Benedict Morrissey (nephew of Simon Tavener, Class of '81), Matthew Ruffell and Michael Shanahan used an innovative approach of adapting software designed for modeling the evacuation of buildings and then applied it to a larger scale network. The team received \$6000 for their efforts, and Rosalind Archer flew down to Nelson to award the trophy at the Garin Prizegiving.

The runners up were from St Cuthbert's College and Kings College. Highly commended teams came from St Peter's College, Botany Downs College, St Kentigern College, Lincoln High School and ACG Sunderland. Full results, including the top three reports, are available online at [www.des.auckland.ac.nz/competition](http://www.des.auckland.ac.nz/competition).

We would like to thank Orion Health and Fonterra for their continued sponsorship of this event.



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### NZNTES Pullan Prize

In recognition of Andrew Pullan's pivotal role in setting up New Zealand's Next Top Engineering Scientist, the competition's top award has been named the 'Pullan Prize'. DES runs the nationwide competition annually, and it has been highly successful, increasing in entrants each year.

NZNTES aims to highlight to high school students the role and importance of mathematical modelling in solving real-world problems. In doing so, it is also hoped that some of the very able and talented students who participate will consider studying Engineering Science when choosing their degree. This scheme could simply not have happened without the tireless efforts and energy of Andrew Pullan, and it is entirely fitting that the competition bear his mark.



## Featured (almost) Alumni

### Jesse Collis, Class of 2011

During my first year of engineering I was certain I wanted to be a chemical engineer. That was until I discovered just how much my passion for maths could be used in Engineering Science. In my second and third years I buried myself in as much maths as I could find, taking all my electives in pure mathematics papers. Despite the high workload and competitive nature of Engineering Science, I still managed to achieve a work-life balance with the role of Treasurer for the UniQ Auckland group and regular piano practice.

That was until the release of the Part IV Project list, which as the ES graduates of you know, leads to exponential decay of your social life. Luckily, this social life was replaced with a project which really jumped at me, improving success rates of in vitro fertilisation. The project involved predicting swimming patterns of sperm cells within IVF devices in order to capture motile sperm cells. I proposed a new model of sperm cell transportation using a torque balance between the sperm cells head and tail. This was able to predict swimming patterns for varying tail beating geometries and wave numbers. The project has given me a lot of enjoyment over the year, as well as a fair amount of heckling from my bakeoff entry. The highlight of the year, coming as much of a surprise, was being awarded with best ES project poster and best ES project presentation at the Part IV Project dinner.

Now the year is coming to a close, I am faced with many decisions regarding my future. I am looking into both PhD and Graduate positions and am excited for what the future holds.



## Part IV Project 2011

### The Dinner

The annual Department of Engineering Science dinner took place on Friday 7th October in the Waitemata Ballroom of the Langham Hotel. As in previous years, this was an opportunity for staff and students within the Department to celebrate the completion and accomplishments of the Part IV Projects. This year, proceedings were expertly emceed by Part IV student Zan Mazharullah, who effortlessly navigated us from Matthias Ehrgott's welcome as Head of Department, through to the student awards for best project presentations, and finishing with the highly entertaining student awards for staff. The evening concluded with a film montage produced by the Part IV students, to the music of Queen, and featuring numerous (and in many cases, rather brave) staff cameos. As ever, the dinner provided a thoroughly enjoyable culmination, not only to the projects, but also the teaching year as a whole.

### The Awards

Part IV Project Poster and Presentation winners were as follows:

	BME	EngSci
<b>Best Poster:</b>		
Winner	Tzu-Chin Yu	Jesse Collis
Runner Up	Nikini Puhulwelle Gamage	Kwan-Ann Lim
Highly Commended	Chloe Irwin-Whitney	Jeremy Minton
<b>Best Presentation:</b>		
Winner	Sarah Milsom	Jesse Collis
Runner Up	Tzu-Chin Yu	Scott Priestley
Highly Commended	Zan Mazharullah	Faisal Wahid

### The 'Other' Awards

#### Student awards:

Most impressive draft project report: Nick Simmons  
 Most bullied student: Prashanna Khwounjoo  
 Greatest increase in caffeine consumption: Jesse Collis  
 BME Question Master: Xiaoming Wang  
 Most balanced lifestyle: Scott Priestley  
 There are no stupid questions: Renji Sun

#### Staff awards:

Most constructive criticism: Andrew Taberner  
 Most creative assignment questions: Richard Clarke  
 The enigma of instrumentation: Andrew Taberner  
 Solo Parent Award: Mike O'Sullivan Jr.  
 Most reasonable presentation questions: Poul Nielson  
 Best ENGG403 Support Crew: Golbon Zakeri  
 Largest ratio of power-to-job responsibilities: Michael Byrne  
 Set the most assignments that have made people cry: John Cater

## EngSci Graduates of 2011: what they're doing now

Angela Buckland	Manufacturing Graduate	Fonterra
Simon Bull	Research Assistant	ABI
Allen Crimmins	Process Computing Engineer	New Zealand Steel
Scott Dakers	Asset Management Consultant	Opus International
Iain Dunning	PhD	MIT
Chung (Dominic) Fok	Operations Research Analyst	Air New Zealand
Jerry Gao	PhD	ABI
Timothy Harton	Control Systems Engineer	Light Metals Research Centre
Hsin Hui (Wayne) Lin	Master of Engineering Science	University of Queensland
Veselina Pencheva	Optimization Engineer	Derceto
Harriet Priddey	Traffic engineer	Arup, Melbourne
Catherine Roberts	Optimization Engineer	Derceto
Christopher Vogel	PhD	University of Oxford
Yiqi Zhou	Business Optimisation Analyst	Telecom NZ

## Mason's OpenSolver wins international award

The COIN-OR INFORMS Cup is an annual award which recognises open-source contributions to operations research. Andrew Mason (Class of '87) and Iain Dunning (Class of 2010) are the 2011 winners, for the software "OpenSolver".

The need for a good open-source Excel optimiser became apparent to Andrew during a 2010 consultancy project with the Ports of Auckland. Andrew released a beta OpenSolver later that year, and has been steadily improving OpenSolver since. Part IV student Kathleen Gilbert assisted with improving code over last summer, and Iain Dunning has worked with Andrew to add a number of new innovative features before heading off to start his PhD at MIT.

Andrew says the award has done much for the exposure and use of OpenSolver. While it was gaining momentum by itself, downloads rose 50% to over 1450 in November. OpenSolver is described on the [COIN-OR website](#) as an "Open Source linear and integer optimizer for Microsoft Excel. OpenSolver is an Excel VBA add-in that extends Excel's built-in Solver with a more powerful Linear Programming solver." OR blogger Mike Trick says more on the INFORMS 2011 Annual Meeting blog: "This year's award recognizes that lots and lots of people want to use top-notch optimization code, but would like to stay in the world of Excel. The authors of this work"...have done a great job in integrating the optimization codes from COIN-OR into an easy-to-use interface in Excel. It is a fantastic piece of work"...and one that I believe does a tremendous amount of good for the world of operations research." The Computational Infrastructure for Operations Research (COIN-OR) project is an initiative to spur the development of open-source software for the operations research community. The [INFORMS Computing Society](#) is a strategic partner of COIN-OR.

Andrew has just released **SolverStudio**, another Excel add-in that lets users build optimisation models inside Excel using formal modelling languages such as PuLP (developed by Stu Mitchell, class of '97) and AMPL.

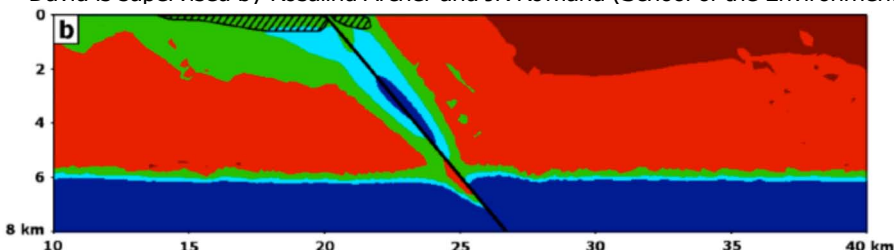
## Cheng (Class of 2007) wins Segedin Scholarship

Jonathan Cheng has been awarded the 2011 Cecil Segedin Postgraduate Scholarship in Engineering Science. Supervised by Piaras Kelly, Jonathan's research concerns modelling aspects of manufacturing processes for composite materials, with applications in a variety of industries ranging from biomedicine to aerospace. In the closing stages of his thesis, his plans now are to consolidate his models and efforts to date, and produce two more publications in international journals.

Established in 2008, the scholarship is funded by the Segedin-Menzies Family Trust, in remembrance of Professor Cecil Segedin. Cecil began teaching Engineering Mathematics at Ardmore in the 1950s and went on to establish our department - then, the Department of Theoretical and Applied Mechanics in 1963. Worth \$5000, the main purpose of the scholarship is to assist and encourage students undertaking postgraduate study in Engineering Science.

## PhD candidate Dempsey wins Geoscience NZ prize

David Dempsey recently won "Best Student Oral Presentation" at the Geoscience NZ conference in Nelson for his paper entitled "The role of frictional plasticity in normal fault evolution". His success earned him \$2,500 to attend the 2012 International Geological Congress in Brisbane. David created a computational model to investigate the evolution of stress and frictional plastic strain in the vicinity of a normal fault over several seismic cycles. His case study is based on the properties of the Taupo Volcanic Zone and explores the impact of the extension of that zone by 12 mm yr<sup>-1</sup> over geological time scales. David's model gives insight into how the orientation of geological faults may have changed over time due to repeated cycles of seismicity. Sample output from his model (below) shows how the stress state of the earth's crust varies on either side of a single fault. David is supervised by Rosalind Archer and JR Rowland (School of the Environment).



### Featured Alumni

#### Angela Buckland, Class of 2010

All through school I had a love for maths, however when applying for university, I decided that I didn't want to study pure maths as there didn't seem to be many job opportunities in that field. I decided on engineering, and found that Engineering Science was right up my alley.

I loved my time in the Department of Engineering Science. Being such a small department, it had the feel of a second family. It was easy to get involved with department barbeques, the sports competitions and I loved organising the bake offs with Tessa I was extremely happy to see that these have still continued after I have left.

After finishing my degree at the end of 2010 I started on the Fonterra Graduate Technical Programme in November. The programme, during which I complete a Masters, has taken me on a whirlwind tour of the country, working in eight different dairy factories from Invercargill to Whangarei. I have made butter, protein beverages, milk powder and all different kinds of cheeses. After a three month stint in Palmerston North, learning the technical side of the dairy industry, I have relocated to Timaru to complete my Masters.

The combination of working and studying has definitely agreed with me, although I am looking forward to getting my teeth stuck into the next challenge Fonterra has to offer me!

**Angela co-founded the DES Bakeoff, along with Tessa Paris (featured in the October issue).**





## New Course

### ENGSCI 701/745

Engineering Science has a new course on its books. Rosalind Archer has created ENGSCI 745, Petroleum Engineering, in response to strong student interest from across the Faculty of Engineering in the oil & gas industry. Rosalind has piloted the course for the past two years and has taught groups of 25 to 30 students each year drawn from across all Engineering departments. The motivation for the course came from a group of students who founded a student chapter of the Society of Petroleum Engineers at Faculty. Many of these students had been exposed to the oil & gas industry via summer internships and wanted to compliment that with academic study in the area. The course provides an introduction to the fundamental science and engineering involved in the exploration and production of oil & gas – moving from introductory geology and geophysics, to reservoir engineering, to drilling and production aspects. “Peak Oil” and the capacity for petroleum industry technology to be applied for underground sequestration of carbon dioxide are discussed.

The course includes a two day field trip to Taranaki in mid-semester break so students can visit plants and well sites. This trip has been generously sponsored by the Petroleum Skills Association, Society of Petroleum Engineers (Taranaki Chapter), AWE Limited, Shell Todd Oil Services, and Todd Energy. Some lectures are given by guest lecturers from industry and from other departments who can complement Rosalind Archer’s core expertise in reservoir engineering. These lecturers usually have a range of fascinating “real world” examples of the challenges of oil & gas development include piracy at sea and extreme weather.

Picture by Godfrey Boehnke – Field trip group

## Geothermal Workshop - Energy for the Future

The Department of Engineering Science hosted the 33rd New Zealand Geothermal Workshop, themed ‘Geothermal - Energy for the Future’. The workshop is New Zealand’s longest running energy conference, running this year from November 21st to 23rd, here at the School of Engineering.

Investment and interest in geothermal energy is running red-hot. In New Zealand the installed generating capacity increased from 472MW in 2007 to 628MW in 2010 and more is in the pipeline or planned. Internationally, the total global geothermal capacity has grown by 20% since 2005 to the current figure of almost 11GWe and more rapid growth is predicted. The International Geothermal Association projects growth to 18500MW by 2015. Thus the forces that are reinvigorating the geothermal energy market are global.

The workshop was attended by more than 190 delegates with more than 60 papers presented from New Zealand, US, Australia, Canada, Indonesia, Iceland, the Phillipines, Chile, Kenya, Japan and Korea. 10 of these were presented by staff and students of the Department of Engineering Science.

## Rebirth of the Geothermal Institute gains impetus

In 2007 Mike O’Sullivan reactivated and reinvented the dormant Postgraduate Diploma in Geothermal Energy Technology as a Certificate - the PGCertGeoTech - with the support of Juliet Newson and Sadiq Zarrouk. It started with a modest enrolment of 8 students from Indonesia, Philippines, USA, Slovenia, and New Zealand. There were 8 students again in 2008 and 24 in 2009. Since then, the course has been filled to its capacity of 25 students per annum.

Industry was supportive from the start, with guest lectures and help on field trips, and financial support from Contact Energy and MB Century who provided scholarships in the first two years, and in 2010, The University of Auckland made \$100 000 available to restart the internationally renowned Geothermal Institute – the body originally responsible for the Diploma/Certificate. Then late last month, two major investments were announced.

First, the New Zealand Ministry of Foreign Affairs and Trade’s Aid Programme has reinvigorated its support for geothermal energy, making 25 new scholarships available each year for international postgraduate students to enrol in postgraduate geothermal courses, including the PGCertGeoTech, MEnergy, ME, MSc, and PhD. Of the 25 scholarships about half will be for Indonesians - building on the close cooperation between the two countries in the field of geothermal energy dating back to when New Zealand and Indonesian engineers developed Indonesia’s first geothermal energy in the 1970s.

Prior to its closure in 2002, more than 850 students from more than 50 countries graduated from the Geothermal Institute with a world recognised qualification in geothermal energy; many have gone on to become leaders in the global geothermal industry. Over 160 were Indonesian engineers.

Amanda Ellis, Deputy Secretary of the NZ Aid Programme says “New Zealand sees access to clean, reliable and affordable energy as essential for sustainable economic development and the New Zealand Aid Programme is pleased to be supporting this innovative partnership with The University of Auckland’s Geothermal Institute.”

The second major investment comes from Mighty River Power, who have committed to investing \$1 million over a five year period in the sponsorship of a newly established Geothermal Chair - to be known as the ‘Mighty River Power Chair in Geothermal Reservoir Engineering’.

Mighty River’s General Manager Development, Mark Trigg says “The University of Auckland is among the top Universities in the world for geothermal engineering research and education – an area of high importance to our business. The re-establishment of the Geothermal Institute will provide vital impetus to the building of New Zealand’s geothermal capacity, both in terms of a greater number of graduates with the skills sought by Mighty River Power, and also in building a greater depth of geothermal knowledge in New Zealand”.

A search panel will be established to appoint the Chair, including a representative from Mighty River Power. Applications expected from all over the world, and it is anticipated the appointment will be made during the first half of 2012.

## Ryan wins RSNZ Pickering Medal

David Ryan was awarded the RSNZ Pickering Medal at the 2011 New Zealand Research Honours Dinner, which was held on Wednesday, 16 November in Wellington. The Pickering Medal recognises excellence and innovation in the practical application of technology, and has attached prize money of \$15,000.

The citation stated that the award was made to David "for his world-renowned research specialisation in mathematical programming and optimisation theory, and in particular scheduling, timetabling and combinatorial optimisation problems." More is said of David on the RS website "Professor David Ryan is New Zealand's leading authority on Operations Research and this country's most influential contributor to the field. He is best known for developing the innovative 'Ryan-Foster constraint branching' technology which is now a fundamental component of optimisation software used worldwide for solving complex logistics problems. This technology revolutionised the optimisation landscape by dramatically increasing the range and size of problems to which optimisation could be applied." ([Full RS article here](#)).



In a continuation of his long term collaboration with Air New Zealand, David has recently worked with them to develop robust solutions that can reduce the impact of disruptions, work which is regarded as ground-breaking and possibly the first airline implementation of this new technology.

## O'Sullivan wins top Geothermal award



Mike O'Sullivan has been recognised "for Outstanding Achievements in the field of Geothermal Reservoir Engineering". He was presented with the Henry J. Ramey, Jr. Geothermal Reservoir Engineering award from the Geothermal Resources Council (GRC) on October 26th, at the GRC 2011 Annual Meeting.

Left: Mike with Roland Horne (Class of '71)

## Success in recent Marsden round

### Taberner: Getting the beat with a cardiac myometer

Andrew Taberner is the primary investigator. Working with him on the project are Associate Professors Poul Nielsen and Denis Loiselle, and Dr Marie Ward. They are looking for a way to measure force, contraction, heat production, oxygen consumption, and intracellular calcium ion concentration all at the same time, and propose to achieve this challenging objective by constructing an innovative miniaturised testing device, a cardiac myometer. With just one instrument, Andrew and his team will be able to simultaneously analyse all five measurements, beat by beat, in heart tissue under both normal and diseased conditions. The new information will increase our understanding of heart muscle behaviour, and thereby improve our ability to treat common heart diseases.

### Sellier and Archer: Self-propelling, coalescing droplets

Mathieu Sellier (Mechanical Engineering, University of Canterbury) and Rosalind Archer (as an Associate Investigator) have been awarded a Marsden grant of \$337,696. Their project will combine mathematical, computational and experimental work. In proof of concept experiments Mathieu has shown that a pre-deposited droplet of distilled water, can be pushed around a hydrophilic corner by a droplet of ethanol. The micromanipulation of discrete droplets on surfaces to emulate a "lab-on-a-chip" may enable biotechnology equipment to be downsized by orders of magnitude. Experiments done at Canterbury will be completed by computational model work done in Rosalind Archer's group. Novel models built in Engineering Science to study a related problem have shown that coupling gas and liquid dynamics in such systems is important.

### Contributors

Thanks to Rosalind Archer, Angela Buckland, Peter Bier, Richard Clarke, Jesse Collis, Zan Mazharullah and Sadiq Zarrouk

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## News in brief...

### Vinod's new daughter

Mira Areta Ammathi was born to Vinod Suresh (Senior Lecturer) and Shalini Shenthar on Saturday 10th December at 0530 weighing 2.46 kgs.



### Sam Gordon, Class of 2006

Sam is in London, in the early stages of starting up a new business focused around new university graduates, and helping them through their first year of work. To take a look, check out [www.firstyearin.wordpress.com/fyi-a-starting-point/](http://www.firstyearin.wordpress.com/fyi-a-starting-point/)

We will be featuring Sam in the first issue of 2012.

### PhD heads to Princeton

PhD candidate Javad Khazaei (supervisor: Golbon Zakeri) has received an offer for a postdoctoral position at the Operations Research and Financial Engineering Department at the prestigious Princeton University.

## Do you have news to share?

News on current staff and students is easy to obtain, because they're right here. News on wider family members - alumni and former staff - doesn't necessarily reach us. If you have something to share, email it to [desnewsletter@auckland.ac.nz](mailto:desnewsletter@auckland.ac.nz)

## From the previous edition

### BME Class of 2010 destinations

Michelle Deacon - Teaching English language in China, Travelling

Nick Stringer - Software Development, Openfeel, Singapore

## Upcoming events

### Rotating Flows Workshop

9-11 January, 2012, Mudbrick Winery  
<http://www.maths.adelaide.edu.au/jim.denier/RFW/Home.html>

### 11th Int'l Conference on Flow Processing in Composite Materials

<http://www.facultyconferences.auckland.ac.nz/uoafpcm11>