

DES News

March 2010 | Alumni and Friends quarterly newsletter | Number 06

Welcome to the March edition of DES News

The academic year has started very well for the Department. For the first time, the Department is full in Part II - 35 new Engineering Science and 25 new Biomedical Engineering students. Amongst this group are 14 accelerated pathway students - 7 into each specialisation. Even more pleasing is the fact that one of the new EngSci students was a member of the winning "NZs Next Top Engineering Scientist" competition (see last years' newsletters for further information on this). Another member of the winning team has been accepted into Engineering Part I, and appears to be very interested in joining the Department next year.

As well as an increase in the number of new undergraduate students, the Department has also had another good intake of new PhD and Masters students, all of whom are now busy on their respective research projects.

The Part IV class have also begun their final year projects, which will consume a lot of their time and attention over the coming months. For most students, the project is the highlight of the degree, although it is often not until some time after the end of the project that the students will admit to this!

As usual, please feel free to provide feedback and/or suggestions for the next newsletter, using desnewsletter@auckland.ac.nz or the address below.

Professor Andrew Pullan, Head of Department
hod_des@auckland.ac.nz

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Backissues

Available at
www.esc.auckland.ac.nz/alumni

Members of the DES family awarded - Ian McCrae and Andrew Pullan



On Wednesday March 24th, Ian McCrae (Class of '81, photo left) won the 2010 World Class New Zealand Award for Information and Communications Technology. Ian is Founder and Chief Executive of Orion Health. He set up in 1994 with four staff and 'not much of a plan other than to try and pay their staff salaries each month'. Orion Health is now a leading provider of clinical workflow and integration technology for the healthcare sector, with over 300 staff. They supply technology and services to 1000 clients in 20 countries, and in 2009 were number 63 of the top 100 healthcare IT companies in the US.

Last months 'News in Brief' mentioned that Professor Andrew Pullan was one of ten in 2009 to be elected a Fellow of the Royal Society of New Zealand. The photo to the right is from the awards ceremony.



Postgraduate Certificate in Geothermal Energy Technology

We will be running the Postgraduate Certificate in Geothermal Energy Technology (PGCertGeothermTech) in Semester Two this year (19th July to 12th November). The programme consists of three courses and a project aimed at giving engineering and science graduates training in geothermal science and engineering.

For more info see the link:

<http://www.esc.auckland.ac.nz/postgraduate-studies/postgraduate-studies-in-the-department-of/pg-cert-geothermal>



Featured Alumni

Buddhika Rajapakse, Class of 2005

My degree was a BA/BE conjoint (French / Engineering Science). I had always targeted EngSci as a specialisation because of my interest in mathematics and computing, and the degree was compelling in that it showed students how knowledge in those two fields could be combined to approach a wide variety of practical industrial problems.

In contrast, my Arts conjoint was not motivated by any particular career aspirations. I had always been good at French and English so I was keen to continue with the humanities at university. However, these papers were certainly beneficial to my engineering studies. They taught me how to organise and structure my thoughts better (very useful for report writing) and also broke up the daily monotony of class after class on technical subjects.

After graduating, I began working at Derceto - a Beca group software start-up. Our Aquadapt software is a world leader in real-time energy cost minimisation for treated water distribution. Aside from contributing to the development of the latest versions of the software, I have worked on implementing the Aquadapt software at specific clients in California and Australia.

As I began to have more responsibilities in managing projects and people, I became interested in how successful firms operated. What were the best practices for managing people, for utilising resources, for adapting to changing conditions, for building relationships with customers and for competing/collaborating with other firms?

So I returned to University in 2008 to begin part-time study on a Post-graduate Diploma in Business Administration. The course has been of great value to me as I am able to immediately apply what I learn to my day-to-day work. I am also able to exchange ideas with other professionals who are in similar situations to mine. My EngSci studies also helped me throughout the course, especially when it comes to understanding financial and economic models.

Part II field trip again a success



On Thursday 12 March the latest cohort of Biomedical Engineering and Engineering Science students left for the annual three day Part II field trip. We separated to visit two companies each - Biomedical Engineering visited Industrial Research Ltd (IRL) and Orion Health, Engineering Science went to Opus and Beca. The visits gave us an idea of the career options available to us when we graduate, and sparked various interests in us. The staff were very friendly, and gave us informative presentations on potential applications for our areas of study, such as in traffic and water network modelling.

Then on to Rotorua, where upon arrival, 65 restless students and staff disembarked from the buses and settled into our accommodation. Having to prepare our own dinner on both nights was a great team building exercise



The following morning began with an early breakfast before departing for the Contact Energy Geothermal Power Station in Wairakei. We were greeted with a thorough safety briefing and information on the three sections to the visit; a background lecture, a steam field bus tour and a plant tour. Having the chance to observe the real-time transformation of steam energy to electricity was exciting. The visit really opened our eyes to the amount of engineering expertise required to establish such a system. It was extremely informative and greatly enhanced our knowledge and awareness of Geothermal energy.

Our final day in Rotorua saw us excited about the impending white water rafting adventure. The water was indeed white - especially at the trips highlight - a 7m waterfall. We all had our share of adrenaline-fuelled fun and had opportunities to work together in exciting situations, comparable to that of submitting a large project. Most of us were exhausted, and fell asleep on the bus, making it a quiet ride home.



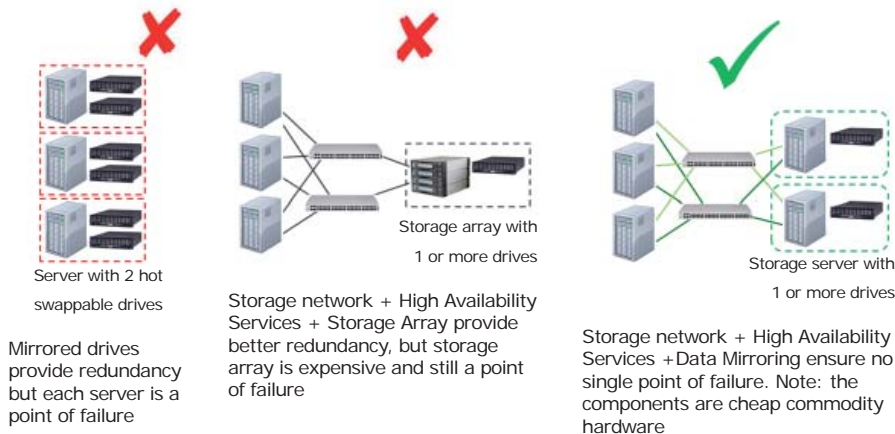
Sam Cheng (Part II EngSci Class Rep)

Research Update

Network Design and Simulation Group

Drs Cameron Walker and Michael O'Sullivan have been actively collaborating on automatic storage systems design since 2001. As consultants for HP Labs they developed software for the automatic reprovisioning of storage networks. Recently they have developed optimisation methods for the automatic design of storage systems and pioneered the use of these methods to build an innovative storage system prototype. This prototype system (a small-scale system built using commodity hardware) compares favourably with current state-of-the-art systems in price/performance.

Data storage systems are evolving from monolithic storage to clustered storage systems. For most organisations the main obstacle to clustered storage system adoption is the design of the network, from the physical layer to the architecture. The software tools developed by Michael and Cameron remove this obstacle.



Michael and Cameron have recently partnered with Uniservices, who are funding a fulltime network engineer to get the current prototype to a production standard. They presented at the Tech Connect Expo and had a display at the Korea-Australia-New Zealand Broadband Summit and attracted interest at both events.

New book from Matthias Ehrgott et al

Multiple Criteria Decision Making for Sustainable Energy and Transportation Systems

Proceedings of the 19th International Conference on Multiple Criteria Decision Making, Auckland, New Zealand, 7th - 12th January 2008

In the 21st century the sustainability of energy and transportation systems is on the top of the political agenda in many countries around the world. Environmental impacts of human economic activity necessitate the consideration of conflicting goals in decision making processes to develop sustainable systems. Any sustainable development has to reconcile conflicting economic and environmental objectives and criteria.

The science of multiple criteria decision making has a lot to offer in addressing this need. Decision making with multiple (conflicting) criteria is the topic of research that is at the heart of the International Society of Multiple Criteria Decision Making. This book is based on selected papers presented at the societies 19th International Conference under the theme "MCDM for Sustainable Energy and Transportation Systems".

New staff

Jon Pearce (left) is a Senior Tutor in our mathematical modelling & computational techniques courses. Jon has a BE in EngSci - class of 2000, and followed through with a doctoral research project on numerical methods in fluid mechanics, in the Department of Mechanical Engineering.



Dr Sadiq Zarrouk (right) has joined us as Senior Lecturer, working in the Postgraduate Certificate in Geothermal Energy Technology programme. Sadiq has a ME in Mechanical Engineering, and a PhD in Engineering Science. He has worked with Professor Mike O'Sullivan in the Geothermal area for some time.



Featured Alumni

James Donald, Class of 2005

I did a BE/BCom, the BCom in economics. I took this up because I had a natural interest in the topic; I felt it would give me a competitive edge in job applications; and I knew it would be useful later in my career. I took papers such as game theory, international business, entrepreneurship and finance - all good complements to engineering. Funnily enough, I found the commerce degree to be light relief from the intense engineering workload.

The economics developed some business sense in me, so management consultancies were an attractive graduate job option. However, in the end, but in the end I realised I wanted to stay close to engineering in the short term, to develop technical skills.

I have been with Shell as a petroleum engineer for four years now, but still derive value in the general principles I learnt in my conjoint. Part of my work requires me to write proposals for technical jobs to be performed. This requires all the economics skills I learnt, such as economic analysis and justification along with inherent risks, and consideration of probability of success and range of outcomes to assist decision making, and make it a rankable project worth spending on (so far I've made proposals up to 60M EUR). In Europe most people have a ME as a minimum, so my conjoint brings equivalent credit. I'm still very pleased I took my second degree to understand the greater impact of the engineering work I perform, I'll recommend it to anyone with similar interests.

For reference, I have been working for Shell since graduation. I started in Oslo, Norway on a mega gas project, which I followed through define, execute, commissioning and start-up phases. I've spent one year each deep in Siberia, Russia and Norway again working on operating fields. In August I shifted to the Netherlands to run two oil fields and a large technically and commercially challenging field abandonment project. I still struggle to describe ESci concisely to foreigners, but I run into some people who are very familiar with the discipline!

Summer Studentship Projects

Each year, undergraduates have the opportunity to apply for Summer Studentships in departments across the university. The studentships carry a stipend of \$4000, and require the student to spend 400 hours on a research project negotiated between them and their supervisor.

This year DES ran 20 Summer Studentships. Following are short descriptions of some of the projects.

Application of a Multi Resolution Time Domain Finite Difference Scheme to Acoustic Wave Propagation

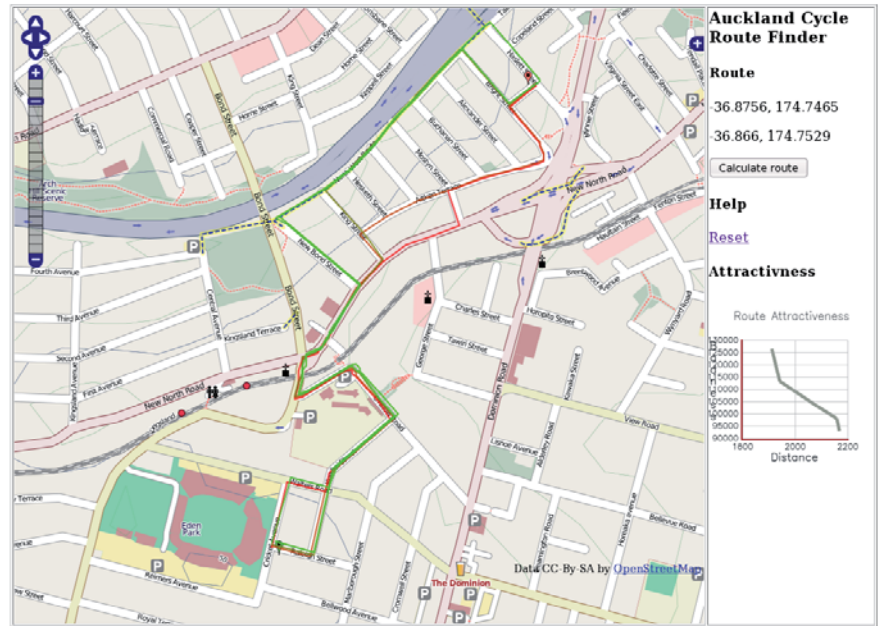
Iain Dunning

Supervisor: John Cater

Abstract: The decreasing cost of desktop processing power has made computational analysis using finite difference time domain (FDTD) methods more widely accessible than ever before. Much work has been done in this area of research since the original proposal by Yee in 1966, with modern schemes offering improved accuracy, decreased processing and memory requirements, and giving more flexibility with regards to the properties and geometric details of a computational domain.

However, the majority of this work has been applied to the solution of Maxwell's electromagnetic equations, and not to the acoustic wave propagation equations which are of a similar form. Of these developments, the multiresolution time domain (MRTD) finite difference scheme proposed by Krumpholz and Katehi (1966) in particular has great potential to reduce the processing and memory requirements for a stable solution. In this article, the MRTD scheme is applied to the equations of linear acoustics for the one-, two-, and three-dimensional cases on a Cartesian grid and the implementation is discussed.

Reflecting boundary conditions are developed based on the image principle, and an absorbing boundary condition is formulated for the MRTD scheme. A decrease in computation time and memory usage is shown to be possible with no loss of solution accuracy, offering a significant improvement over the FDTD methods currently employed for acoustics.



Development of a Web-based Bicycle Routing Tool

Simon Bull and Denis Helm

Supervisors: Dr. Andrea Raith and Assoc. Prof. Matthias Ehrgott

Abstract: There are many web-based routing tools such as google maps and the Wisers website. These tools have in common that they are aimed at cars and will display a single shortest or fastest route, which often contains major roads and motorways. While cyclists cannot use the motorway, there are dedicated cycling facilities that conventional routing tools will not consider. Cyclists are not only concerned about getting to their destination as quickly as possible, they may also want to travel along a safe route with low traffic volumes that is more suitable for cycling.

The aim of this project was the development of a web-based bicycle routing tool for Auckland that highlights a range of different paths of varying length and suitability for cycling. Those routes are presented to the cyclist, who can then make a better route choice decision depending on his/her confidence and experience. Such a website helps promote cycling especially to inexperienced cyclists in showing them more suitable options than conventional route planning tools.

Image 1 above is a screenshot of a prototype of the cycle route finder. Red routes are short and green routes are longer, but more suitable for cycling (or "attractive"). The green routes follow the cycle path along the Northwestern Motorway.

Making optimisation more accessible.

Qi-Shan Lim

Supervisors: Dr Mike O'Sullivan (Jnr) and Dr Cameron Wlaker

Abstract: The project was to link a Python-based mathematical modelling language (PuLP) with one of the latest powerful open source integer programming solvers, Decomposition in Integer Programming (DIP). The work will allow researchers to quickly build models and solve them using DIP. It also simplifies incorporating customised solution methods into DIP, so researchers can easily experiment with innovative new techniques for solving their problems. Furthermore, the simplicity of PuLP means that students can now "get their hands dirty" with the advanced methods offered by DIP.

Footnotes:

Iain Dunning subsequently submitted a journal paper on his project.

Qi-Shan, Mike and Cam's work is now being considered for inclusion within CoinBazaar, part of the open source COIN (Computational INfrastructure for Operations Research) repository that is used by OR practitioners throughout the world.

For future editions

Do you have news to share?

News on current Department members is easy to include, 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