



## DEPARTMENT OF MATHEMATICS NEWSLETTER

Issue 4 January 2002

### Welcome

Welcome to the Department of Mathematics annual newsletter. In fact, this will be the last “Department” Newsletter to be issued, as structural changes within the Faculty of Science and Engineering are resulting in Departments being replaced by Divisions, identified by appropriate subject areas: so we will become the Mathematics Division. It is not anticipated that this will make any difference as far as prospective Mathematics students are concerned.

This issue mainly covers the year 2001, which will be remembered by many people for all the wrong reasons. However, the Department ended 2001 on a high, with success in the UK Research Assessment Exercise. More detail is given below.

I hope that you will find this of interest, along with all the other news contained here about the Department and some of its staff and students. If you would like more information about the Department, for example about courses etc, please visit our web pages at

<http://www.maths.dundee.ac.uk/>

**Alistair Watson (Editor)**



### Research gets International Rating

The Department’s submission to the 2001 UK Research Assessment Exercise resulted in Applied Mathematics gaining a coveted 5-rating. The work of 10 staff members was submitted for review, and the research was deemed to be of a quality that equated to attainable levels of international excellence in up to half of the research activity and to attainable levels of national excellence in virtually all of the remainder. This time non-UK based experts were also involved in the evaluation process.

This judgement is a tremendous endorsement of the work of staff in recent years.

A review of our fourth year Honours programme to link it more closely to the our research activity is nearing completion, so this can only be good news for Mathematics students in the Department.

The University as a whole now has 95% of researchers working in areas of international and national excellence. According to the Times Higher Educational Supplement analysis, the University of Dundee leapfrogged 11 places up the UK RAE league table to 33 – an improvement beaten only by Manchester – and firmly placing Dundee in Scotland’s top four universities. Principal Sir Alan Langlands says: “The University is performing better than ever in its history. These awards have been most rigorously conducted with international panels examining each area. Dundee’s contribution to knowledge in subjects such as medicine, dentistry, mathematics, civil engineering, history, law and life sciences is now internationally competitive”.

### **Chair for Paul Smith**

Professor Paul Smith’s contributions to research in theoretical and computational electromagnetics, and to non-linear dynamics in electronic systems were recently recognised by the University with the award of a personal chair. Paul is head of the electromagnetic theory research group in the Department, whose other members are Dr Elena Vinogradova (who is a Postdoctoral Research Fellow), Dr Stuart Booker (who currently holds a Royal Society of Edinburgh Personal Research Fellowship), and Professor Sergei Vinogradov, who is currently visiting from Kharkov in the Ukraine.

Paul has worked closely with industry on areas which include antenna design, transient electromagnetic studies, and ultra-wideband synthetic aperture radar. His group recently made headlines in the national press for their work on developing a detector which pinpoints “invisible” land-

mines. In collaboration with workers at the Defence Ministry’s Defence Evaluation and Research Agency (DERA), Paul and his group designed a radar which could help solve one of the world’s biggest humanitarian problems: the threat posed by 70 million uncleared landmines. Such mines, being made of plastic, are difficult to detect, and kill or maim 26,000 people every year.



Paul, pictured above, and below with the other members of his group, has been a member of the Department since 1981.



### **Elite Access**

The University of Dundee was recently named in the UK's top five universities to successfully combine wide access with low drop out rates and excellence in teaching and research.

The "Access Elite" table published in the Times Higher Education Supplement of 18 January 2002 places the University of Dundee fifth in the UK. This latest accolade came just weeks after the University's outstanding performance in the national Research Assessment Exercise.

Vice Principal Professor David Swinfen says: "To widen access without compromising the highest standards of excellence in the academic fields is a difficult trick to pull off but the commitment of the University over a considerable number of years to a pioneering access programme in tandem with improving and developing the best teaching and research is clearly paying off. In March this year Director of the University's Wider Access Study Centre Dr John Blicharski will travel to the House of Commons with a student who originally entered university via the wider access programme as an example of Dundee's effective access policies. The event is being organised by Universities UK to demonstrate to politicians and the public the success of wider access programmes in operation."

The Department of Mathematics is an active participant in the University's various access courses, and many access students go on to take Mathematics courses. There have been many success stories – for example, recently a student who came to us via the Access Summer School graduated with a 2(i) Honours degree in Mathematics, and went on to do a postgraduate course at the University of Manchester before qualifying as a teacher of Mathematics.

### **Carnegie Vacation Scholarship**

Local lad Niall Dodds, a fourth year student in the Department doing Honours in

Mathematics, was kept busy last summer doing more maths! Niall, from Forfar, was awarded a prestigious Carnegie Vacation Scholarship which financed a 6 week Summer project here in the Department. Niall's interests are in the more pure parts of Mathematics and it was in this area that he focused. His project concerned the impressive sounding "self-adjoint operators and Hilbert space". He worked under the supervision of Dr Fordyce Davidson, taking full advantage of the Department's excellent library and computer facilities.



Niall (above) says: "The project dealt with a fundamental structure from mathematics - Hilbert Space - and special mappings which can be defined on this space called self-adjoint operators. The applications of Hilbert space and related operator theory is widespread, particularly through a rigorous study of differential equations which arise as models of both physical and biological systems. The project concentrated on attaining a firm understanding of the theory and underlying concepts of Hilbert space and self-adjoint operators. The emphasis at all stages was to find clear and concise examples and counter-examples of often technical results, as such examples hold the key to a true understanding of this otherwise abstract subject."

Next year Niall hopes to continue his studies in mathematics, by doing a Ph.D. on bifurcation in reaction diffusion equations, again under the direction of Fordyce Davidson.

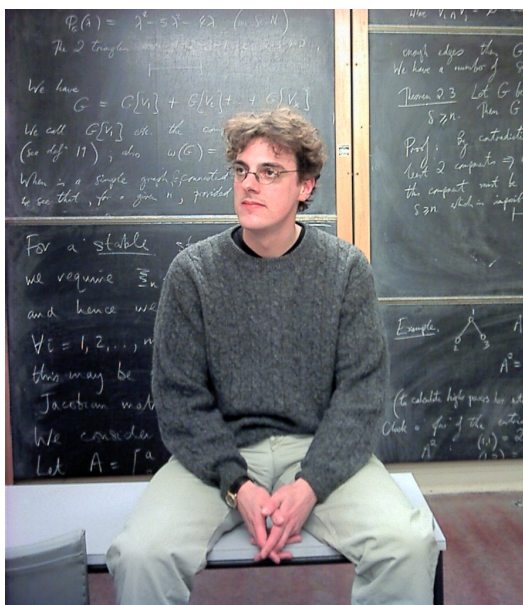
### ERASMUS Student

As usual the Department is host to many overseas students. In particular, Michael Brendel from Hamburg is spending a year in the Department, under the European ERASMUS scheme. He says: "Being interested in advanced methods for solving real world problems, I started studying Wirtschaftsmathematik (Mathematics and Economics) at the University of Hamburg in 1997. This course of studies is providing a sound and thorough qualification in mathematics as well as in economics and business & administration. After the basic study, I have mainly concentrated on the business aspects of logistics and something I would call applied probability theory, that is to say actuarial mathematics and risk theory, applied stochastic processes and mathematical statistics. In this domain I am going to start writing my diploma thesis at my home university later in the year. After graduating hopefully by the end of the year, I intend doing a PhD.

"In logistics one encounters frequently different types of optimisation problems, so one motivation for visiting the University of Dundee via the ERASMUS scheme was to learn more about optimisation and the theory behind it and applied mathematics in general. Dundee proved to be a good place for broadening my mathematical knowledge, and I especially benefited from working on my honours project. The Department of Mathematics provides a pleasant and fruitful environment for studying and most striking for me is the possibility of using the departmental library and IT facilities 24 hours a day. Moreover, the University of Dundee gave a very cordial and warm reception to the overseas students and offered a lot of activities and support. In no time at all Dundee has become a place where I like to be. I am truly enjoying my stay here in Dundee.

"However, further reasons for taking part in an exchange scheme were the desire of improving my language skills and also learning about the Scottish culture. Since my arrival I have travelled throughout Scotland and have taken the opportunity to discover its dramatic and beautiful sceneries and its various historic places. Even Haggis turned out to be edible! All in all, it has been a great experience so far, and therefore I can strongly recommend every student to participate in an exchange scheme and discover new people and places."

Michael is pictured (left) in contemplative mood.



### Academic Partnership in Mathematics

A new initiative has been set up this year to bring Schools in the Dundee area and the University closer together. The Academic Partnership, as it is called, has seen many departments within the University playing host to school pupils to let them get a taste of University life. The Mathematics Department jumped at the chance to be in-

volved in this partnership with Dr David Thomas at the forefront of the organisation.

In October 2001, Head of Department Professor Roger Fletcher welcomed a group of senior pupils who are studying Advanced Higher Grade Mathematics at a number of Dundee schools. The pupils spent the afternoon in the University, first attending a lecture given by Dr Fordyce Davidson on “Maxima and minima”: it was shown that this mathematical topic could be applied to examples such as the stockmarket value of companies and the trajectories of missiles. There was even an experiment conducted where a missile (looking remarkably like a “Snickers” bar) had to clear a given obstacle, a chair on a desk. The target, a Grove Academy pupil, was allowed to keep the missile! The pupils then participated in a workshop supported by senior undergraduates and other members of staff.



The event was recorded for posterity by The Courier and the photograph reproduced (with permission) shows Fordyce with a group of the pupils who attended.

Throughout the following weeks, pupils attended further lectures and workshops given by other members of staff, covering a range of topics from the Advanced Higher Grade syllabus.

### **High-powered Number Crunching**

The 19th Dundee Biennial Conference on Numerical Analysis was held at the West Park Conference Centre from 26 – 29 June, 2001. Organised by Dr David Griffiths and Professor Alistair Watson, the conference brought together 200 delegates from 37 countries.

Focussing on recent research in Numerical Analysis, presentations covered everything from the numerical analysis of pattern formation in biology to computational issues in oil and gas extraction.

The after dinner speaker at the Conference Dinner was Professor J M Sanz-Serna, an MSc graduate from the Mathematics Department here in Dundee who is currently Principal of the University of Valladolid in Spain.

### **Musical students**

It is well known that mathematics and music often go together, and this is borne out by some of our students.

Neil Smeaton, who is a second year student, doing a degree in Mathematics with Statistics, holds the University of Dundee Organ Scholarship. He says: “I began music lessons at the age of seven when I was taught the keyboard. I was given the opportunity to progress onto the church organ when the church with whom I’m currently employed as organist and choirmaster, St John’s Episcopal Church Forfar, contacted my school with the intent of finding a pupil who would be interested in receiving organ tuition with a view to take over the post of organist following a six month period as assistant. I was put forward and accepted and then took up the full position in March 1998.

“The University of Dundee organ scholarship entails playing at the University Carol Service amongst others plus accompanying the University Choir at rehearsals and performances.

“Another task as the organ scholar was to perform an organ recital in the university chaplaincy as part of the university’s lunchtime concerts. My half hour programme included pieces by Bach, Pachelbel, Whitlock and Guillmant. This was in fact my second recital. The first I performed in St. John’s, Forfar for the church’s organ fund in 1999.”

Moving from instrumental to vocal talent, Neil’s fellow second year student Dan Harper, who is taking a degree in Mathematics, is currently President of the University Operatic Society (OpSoc) which is rehearsing for its next production, “Oklahoma”.

Dan played the part of Sonny in last year’s show, “Grease”, and the picture below shows him in that role and obviously up to no good.



Just as obviously up to no good are the young ladies pictured in this scene from OpSoc’s previous production, which you may

not be surprised to know was “The best little whorehouse in Texas”.



### New Member of Math Biology Group

Dr Iulian Stoleriu joined the Department in January, 2002. He says: “I graduated in 1996 from the Faculty of Mathematics, “Al. I. Cuza” University of Iași, Romania. One year later I received a MSc in Partial Differential Equations from the same university, spending a three month probation period at Paris VI University, France.

“Before starting a PhD program I gained some research experience in Applied Mathematics by attending international summer schools in Finland, Italy and Romania. The studies I have done as undergraduate student were mainly theoretical, and these summer schools helped me in establishing contacts with scientists from various domains (Engineering, Physics, Biology), and in applying the theory in practice.

“In 1996 I was appointed to the position of Teaching Assistant in the Faculty of Mathematics, “Al. I. Cuza” University of Iași. This is a permanent position and I was allowed several years to be *on leave* for doctoral and postdoctoral studies.”

Iulian spent three years (from October 1998 to September 2001) at Strathclyde University in Glasgow, where he did a PhD degree in the Department of Mathematics.

His work was concerned mainly with dynamical systems and their applications to modelling various phenomena which arise in Materials Science, such as ferromagnetism and phase separation in binary alloys.”

Iulian goes on: “This January I joined the Mathematical Biology group at University of Dundee, on a Research Assistantship. I will be working here on a EPSRC-funded project on the mathematical modelling and analysis of biochemical reactions, together with Dr Fordyce Davidson from the Department of Mathematics and Dr J. Liu from the Scottish Crop Research Institute. I am proud to be member of such a renowned group, and I hope that my stay in Dundee will be very pleasant and fruitful one!”

Iulian is pictured below with his wife Elena.



## Invitations

As usual, members of the Department received many invitations to speak at specialist Conferences, both in this country and overseas. However, invitations to speak before wider audiences are also obtained. In particular, for the second successive year members of the Department were invited to address the Edinburgh Mathematical Society, which has a programme of 8 talks spread throughout each year at different Universities throughout Scotland. In 2000, Dr David Griffiths spoke at the University of Strathclyde, and last year Professor Mark Chaplain gave a talk at Heriot-Watt University.

Mark is also due to give one of the University of Dundee’s Saturday Evening Public Lectures (other speakers in the current series included Sir Robert Wilson KCMG, Chairman of Rio Tinto Zinc, and The Right Honourable Lord Cullen). One of the leading lights in applying mathematics to medical problems, Mark will explain how he mathematically models tumour growth, and will pose the question “Can calculus cure cancer?”

We eagerly await the answer to this question.

## Sex, flies and videotape

PhD student Peter Schofield has been awarded a prestigious post doctoral fellowship by the Wellcome Trust.

Peter will work with researchers in the University of Dundee who are investigating bacteria that can eliminate males in entire populations of insects. They are mathematically modelling the activity of the bacterium Wolbachia which can switch off male development. In particular, Peter will study the dynamics of parasitic wasps and the male destroying bacteria that the wasps can spread in the insects they attack.

Wolbachia can arrest male production in the early development of an insect with the result that the whole population be-

comes female! The bacterium has the potential to spread across insect species. Peter says: “Research has so far indicated it is limited to invertebrates, a bacterium that evolved to affect vertebrates and humans in the same way might have dramatic consequences for the human race.”

Peter is pictured below and right with carefully selected staff from the Wellcome Trust Building (photo credits: Fotopress, Dundee).



Peter’s project is the latest development in mathematical modelling to make discoveries about biological phenomena. He is aiming to use his results to reach a better understanding of how these parasites behave. He has been preparing the mathematical models and will soon insert the data from his field research to calculate the threat of the male destroying bacterium.

Peter will fill fields outside Dundee at the Scottish Crop Research Institute with caterpillars to observe and record on videotape the dynamics of predation by natural populations of parasitic wasps. He will also take his project to the University of Alberta, Canada where he will study parasitic flies and the caterpillars they attack in acres of forests and assess the results on an even larger scale.

Peter’s personal training fellowship in mathematical biology is one of the most

prestigious scientific scholarships in the UK. Awarded by the Wellcome Trust, only a few are given every year to young scientists with great potential. Peter will be carrying out his research in the School of Life Sciences and here in the Mathematics Department at the University of Dundee, as well as at the Scottish Crop Research Institute, which is located in Invergowrie, just outside Dundee. Peter is also a member of the SIMBIOS Centre – a joint venture between the Universities of Dundee and of Abertay Dundee.

Wolbachia was first identified in mosquitoes in the Netherlands during the 1950s. Peter explains: “It has many possible implications including the biological control of insect pests and the promotion of selected genes through a population. Similar to the sought after results by genetic engineers - Wolbachia is proof that natural selection has already begun genetic engineering of its own.”



Peter took his undergraduate degree in Mathematics and Computing at the Open University before coming to Dundee as a postgraduate student.