

OCIAM NEWSLETTER

October 2005

A new term, a new editor. Andrew Fowler takes over from Hilary Ockendon as editor of the OCIAM newsletter. Encouraged by his senior colleagues, he has promised to spice up the newsletter with the occasional tart comment.

FUTURE EVENTS

Deadline for submission of posters and papers March 27, 2006.

The Alan Tayler Lecture

sponsored by
The Smith Institute

Prof John Bush

Massachusetts Institute of Technology

Walking on water: biolocomotion at the interface

21st November 2005, St Catherine's College, Oxford. The lecture will be held in the Bernard Sunley Building at 5pm, tea from 4:15pm

55th European Study Group with Industry

30 Jan – 3 Feb 2006

Eindhoven, The Netherlands

<http://www.win.tue.nl/swi2006/>

56th European Study Group with Industry

3-7 April 2006

Bath University

<http://www.smithinst.ac.uk/StudyGroups/event-list>

BAMC (British Applied Mathematics Colloquium)

24-27th April 2006

Keele University

<http://www.keele.ac.uk/depts/ma/bamc06/>

ECMI 2006

10-14 July 2006

Madrid, Spain

www.uc3m.es/ecmi06

Deadline for submission of minisymposia : Feb 27, 2006.

Deadline for earlybird registration : March 13, 2006.

NEW PEOPLE AND SPACE

Michael Monoyios is a new lecturer in Mathematical Finance. He comes to us from Brunel, and is currently housed in the heights of the third floor, before his imminent fall to the second floor, where the finance group will be gathered.

The continuing annexation of Dartington House by the Mathematical Institute will shortly be further progressed, after the retirement of Refugee Studies, and the conversion of most of the first floor. It will be occupied by groups from Algebra and Biology, and we hope will provide some respite from the increasing crowding within OCIAM.

VISITING RESEARCH FELLOWS

Gunter Meyer is visiting OCIAM this term as Nomura Visiting Fellow. His home institution is Georgia Tech.

VISITING PROFESSOR

We are pleased to announce that Dr Peter Grindrod has been appointed as a visiting Professor in Industrial Mathematics for three years from July 2005.

Peter is currently Chief Mathematician for the company Lawson Software. He has had a long connection with applied mathematics at Oxford and has brought problems to a number of Study Group

meetings. He is President-elect of the Institute of Mathematics and its Applications.

Hilary Ockendon
Chairman, NETIAM Management Committee.

VISITORS

Colin Please, he of the smiley web page, is visiting OCIAM this term from Southampton University.

NEWS

Unleashing Mathematics

A meeting of leading mathematicians from all over Europe was held in Oxford in July to consider the best way of coordinating and promoting interdisciplinary mathematics in Europe. As a result we are now launching a project entitled "Unleashing Mathematics" and full details can be found on www.netiam.net/Unleashing.

The plan is to assemble a team of committed researchers and policy makers who will construct an **Action Plan for Mathematics in Industry and Society**. The main aims will be to:

- Increase awareness of the uses of mathematics throughout society
- Activate new areas of application for mathematics
- Broaden the basis for interdisciplinary mathematics within the mathematics community
- Optimize media publicity for mathematics
- Identify best practice for collaborative work involving mathematics

The team will begin work in early 2006 and we would like to hear from anyone interested in contributing to this project – see the website for details.

This initiative is a direct result of the NETIAM project that was described in previous newsletters and whose results are posted on the website www.netiam.net/NETIAM

The Wacker Prize

The Hansjorg Wacker Memorial Prize 2006 will be awarded at the ECMI 2006 Conference which will take place at Madrid, Spain, from July 10-14, 2006. All ECMI Institutional Members are invited to submit eligible papers for this prize. Entries should be in the form of a mathematical thesis at the masters' level written at the institution on an industrial subject after March 2004. The winner will be invited to attend the ECMI 2006 meeting (all expenses paid) in Madrid, to present his/her project there and to receive the prize of 1500 euro.

Submission of Entries

Four copies of the thesis should be sent to the address below to arrive by December 31, 2005. The entry should be accompanied by a letter from a member of the academic staff at the institution which summarises the mathematical and industrial relevance of the work. It should also state if the thesis is part of the assessment for a degree or other qualification.

Entries should be sent to
Professor Dr Andreas Neubauer
Institut für Industriemathematik
Johannes Kepler Universität Linz
A-4040 Linz
Austria

Note that the student must come from an institution that is an ECMI member. Details of how to join are on www.ecmi-indmath.org

An Award for John Allen

Beatrice Annaratone and John Allen have won an IEE Innovation Award in Electrical Technology; the title of the submission was "A Novel RF Plasma Reactor".

The award is presented to the University of Oxford.

The Great Debate

8pm, June 20th and the common room was crowded for the inaugural OCIAM debate.

Chaired by gun-wielding John Ockendon, the innocuous title "This house believes that mathematical finance falls naturally within the realm

of applied mathematics” somewhat belied the debate’s fractious beginnings within OCIAM.

Having used this very newsletter to cast the aspersion that “mathematical finance, like philosophy, may well be of dubious intellectual merit”, Andrew Fowler was forced to defend his “uninformed and unhelpful inter-sub-subject sniping” by speaking against the motion. Joined by the metaphysical Chris Farmer, the duo put forward a light-hearted, spirited and clearly doomed defence of the view that mathematical finance lacks the rigour and basis to be a true part of applied mathematics.

Speaking in support of the motion, William Shaw and Ben Hambly provided an overview of the history and content of mathematical finance, explaining the contribution of PDEs and probability theory to the stability of financial markets and economies.

Led by John, the open debate saw wide-spread and wide-ranging participation, encompassing witchcraft, greed, mathematical biology, the Black-Scholes equation, marriage and Aristotle. Everyone, including John, Chris and Andrew spoke in support of financial maths, William was shot and the motion carried.

28 in favour, 4 against, 1 abstention

The full minutes, as frank and unbiased as this brief summary, can be found at:
www.maths.ox.ac.uk/~haworthh/Debate.pdf.

Helen Haworth

Environment Matters

The third floor Mathematics and the Environment group has had a busy summer. Firstly, we (Geoff Evatt, Rachel Zammett, Andrew Fowler) visited the Geophysical Fluid Dynamics Summer School in Woods Hole MA, where Geoff and Rachel gave talks on their research. The highlights of this part of the trip were Geoff nearly poking out Joe Keller's eye and Lou Howard's wonderful stories about Carrier and Krook (of Carrier, Krook and Pearson fame.)

We then went to a ‘Modeling shorelines and associated processes’ (sic) working group at MIT. This was fascinating, as it covered a whole range of topics, including sediment transport, turbidity currents and, fortunately, jump conditions, about which some of us knew something. We also learned

that it is impossible for an Earth scientist to give a five minute talk.

Then it was off to the White Mountains in New Hampshire for the inauguration of the OCIAM tent. Despite the warnings to ‘Prepare for bear’, Andrew was the only person who saw one (allegedly). We also saw Mt Washington, the windiest place on record, got caught in a thunderstorm and swam across a mountain lake.

After this, it was off to Italy for the Karthaus 2005 summer school on ‘Glaciers and Climate Change’. This has been a regular outing for Andrew, who has been to every session since it began, and it is not hard to see why; it is located in a beautiful Alpine village, (where the students double the population), and everyone stays in a lovely hotel with a three course lunch and a four course dinner every day. It's just as well that there are lots of hiking trails nearby!

The work was fairly intensive but lots of fun; highlights were learning about ice cores and the unexplained pink ice at the base of the Greenland ice sheet, seeing Tony Payne's numerical simulations of Antarctica and, of course, continuum mechanics!

Rachel Zammett

The Oxford Excursion to the ECMI Modelling Week 2005

The week got off to an unexpectedly amusing start before we had even left Oxford. We watched helplessly as Eric Yu casually strolled around Gloucester Green seemingly unaware that the Airline coach had just pulled away from the station. Of course frantic phone calls ensued, instructions were dispatched and ultimately, having travelled by bus, train and automobile, Eric reached us at Gatwick airport. Check-in was closed however and negotiations seemed futile until Eric was saved by the occurrence of a reportedly rare event --- the delayed departure of an EasyJet aircraft.

Once in Barcelona, the opportunity for stimulating mathematical analysis befell us sooner than we had imagined. During the mostly dull journey from the airport to the Universidad Autonoma de Barcelona there was one point where the driver took us from a standing start, merged across six lanes of traffic flowing at 70mph, travelling a total distance of less than 100 metres. The results of subsequent calculations concluded that we must have accelerated

to a maximum speed of 120mph and in so doing experienced a horizontal force three times that of gravity and narrowly escaped death by a margin of no more than 3.14 inches.

The participants at the modelling week had arrived from universities all over Europe. Apart from the UK the countries represented included Austria, Finland, Germany, Italy, Norway, Serbia and Montenegro, Spain and Sweden, not to mention a muchacho from Mexico as well as a rogue Australian. Introductions took care of themselves once the two Finnish gentlemen declared a "beer day" and marched everyone down to the student bar for a shot of 'Wodka' and one or two Aristotles of the local amber fluid.

The next day was dominated by the problem presentations which ranged across the following topics:

1. Industrial ironing processes.
2. Algae populations in lakes.
3. Missing values in gene expression data.
4. Temperature transfer between fluids.
5. Optimal lighting of a stadium.
6. Oil extraction from wells.
7. Left-right ambiguity in sonar arrays.
8. Calcium flow in heart cells.

In the afternoon the 40-strong group of students were divided into 8 equally sized smaller groups, each one assigned to a different problem. The groups met with their instructors and it was immediately down to business. Action plans were sketched, google queries entered and reference material sourced... and this was on a Friday afternoon.

Over the weekend everyone worked hard and many breakthroughs were made. The most uniformly important one probably being the mapping of the optimal path from the hotel to the university's mathematics department. Curiously however, the path did not traverse any saddle points but rather took a spurious bend around an appealing outdoor swimming pool continuously in use by a conspicuously under-dressed subset of the local student population.

During the following week we were fortunate enough to be taken on excursions to several well-known Catalonian landmarks. These included the Gaudi apartment building on Paseo de Gracia, the Salvador Dali museum in Figueres, the small coastal town of

Sitges and the ruins of ancient Roman and Greek Emporios also near Figueres. After the initial states of transience during these trips we invariably reached equilibrium somewhere along Las Ramblas, the undisputed cerveza-tapas efficient frontier of downtown Barcelona.

However, it wasn't all paella and sangria. We had our work cut out for us as the end of week deadline approached. The group presentations took place on the Saturday morning and suffice it to say that for some groups Friday night was less than the usual mix of good cheer and conviviality.

The events of the week were brought to a climax in the evening with the throwing of the conference party. Apart from the delicious food, certainly a far cry from deep-fried hake and soggy chips, the highlight was the sequence of fun presentations given by students of different nationalities. Along with much traditional singing and dancing we were also entertained by a Finnish piggy-back race for Vodka, a German quiz starring a full stein of lager and a Spanish Tarot reading that was uncannily accurate when predicting the most improbable events.

On Sunday afternoon, with Eric under close supervision and our bags filled with the customary bottles of duty free liquor, we headed back to Sunny Olde England just in time to see rain washing out the Fifth Test and delivering the Ashes back to the Mother Country.

Max Skipper

54th Study Group with Industry

The 54th Study Group with Industry was hosted by the University of Southern Denmark on 15th-19th August in Odense. Most of the participants were students from the University of Copenhagen and the University of Southern Denmark itself, but there was also a delegation from Eindhoven University of Technology and from OCIAM, which was represented by a small but enthusiastic crowd of two people.

The organisers managed to persuade five companies to bring problems to the study group. These problems dealt with modeling temperature sensors containing a porous material (Danfoss), the influence of temperature gradients on ultrasonic flow measurements (Siemens Flow instruments), counting

small circular objects in noisy images (Unisensor), the calibration excavator sensors (Mikrofynd), and the bearing capacity of roads (Greenwood Engineering). All in all, a very varied collection of problems that covered a broad spectrum of mathematics.

To optimize the output, the participants were provided with stimuli in the form of vast amounts of biscuits, coffee, and beer, not to mention the unlimited supply of wine during the excellent dinners. And not without result. The atmosphere during the week was very good and despite the complexity of the problems, a lot of progress was made on all of them.

Heike Gramberg

2005 Cricket Match Report

This year's annual cricket match between OCIAM and ComLab took place on Friday 8th July 2005 at the very sunny and pleasant Corpus Christi grounds. The date was such that both groups were able to put together some formidable teams, i.e. no-one had forsaken the game for conferences or holidays. After a slight delay to proceedings, following the loss of one A. Fowler in a traffic jam in Abingdon Road (he just by chance happened to have the cricket gear with him!), Comlab went into bat first.

After a break where we managed to work our way through some 160 sausages, around 80 famous Fowler burgers, copious amounts of Pimms, 15kg of strawberries and other fare, OCIAM went out to bat under the watchful eye of Captain Geoff Evatt. Alas, the Comlab team's score under Captain David Gavaghan proved hard to match, and they returned to the Pavilion to collect the Willow Bat. Ben Hambly (OCIAM) was named man of the match.

A wealth of thanks goes to D. E. Shaw Group (www.deshaw.com) who sponsored this year's event and also provided us with free T-shirts. A special thanks also goes to Dr. James Lawry from D. E. Shaw Group who helped with co-ordinating sponsorship.

Corpus Christi grounds proved a suitable choice this year. Not only were people able to watch and/or play cricket, but the tennis courts saw the emergence of some pretty good talent.

Thanks to everyone who took part and we look forward to doing it again next year!

Marcus Tindall

BOOKS

Theory of Tokamak Transport
By L.C. Woods

This book is to be published by WILEY-VCH on 26/11/05. It is the first book to present a theory agreeing with observations for the transport of energy and mass from tokamaks. The commentary below is adapted and abbreviated from the preface.

The world-wide demand for energy is growing exponentially. Estimates of the world reserves of fossil fuels keep changing, but it is likely that they will be depleted within a century. Reactors based on the fusion of light elements may provide an almost unlimited supply of energy in the future.

Fission reactors are likely to provide the short-term replacement for oil and gas; the development of renewable energy sources like wind and wave power is progressing, but much too slowly. It seems unlikely that the latter will be sufficient in the long run and the supply of uranium 235 is even more limited than fossil fuels, not to mention the problems of storing radioactive waste and of proliferating bomb-making capacity. Fast-breeder reactors, consuming the much more common uranium 238, could provide a long-term solution, but these reactors are potentially more vulnerable to accidents and would produce large amounts of plutonium that could be used in nuclear weapon production.

The fusion of light nuclei such as deuterium and tritium offers an alternative energy supply without the disadvantages of the fossil and fission sources. While a fusion reactor would generate some radioactive waste, this is believed to be largely short-lived and manageable. However, the serious problem with fusion is the enormous temperature required to overcome the repulsive force between colliding charged particles. The nuclei have to clash together with the speeds achieved at temperatures about 12 times hotter than the centre of the Sun, which also

operates on fusion, but at densities some 10^{12} times greater than reactor values. At these enormous temperatures, confining the gas long enough for appreciable fusion reactions to occur is a major problem. Strong magnetic fields provide the only possible constraint over the motions of such energetic particles, and the most successful device employing this principle is known as a tokamak. The Joint European Torus (JET) at Culham Laboratory, Oxfordshire, UK, has reached more than half of the required temperature, but the triple product of the ion number density, the energy confinement time and the temperature still falls well short of the value required for ignition.

Presently, there are more than 44 experimental tokamaks in laboratories around the globe, so the theory of these machines is of continuing interest and seems likely to remain so for some decades. Apart from their likely relevance to the looming energy crisis, tokamaks are useful pieces of apparatus for a variety of experiments involving high energy phenomena, radiation and the behaviour of plasmas. One obvious gap in the tokamak literature concerns the economics of fusion reactors, not merely their cost in relation to competitive energy sources, but more importantly the energy investment required in their construction and the time over which a reactor would need to operate to recover this investment. When the basic physics and technology are better understood, this gap will need to be filled.

RECENT D.PHIL THESES

Those recently doctored in OCIAM include Chris Poole, who has successfully passed his oral defence. His thesis title was 'Penetration of a shaped charge', and he was supervised by Jon Chapman. He is soon off to work for Detica.

Nim Arinaminpathy also passed his thesis defence. His thesis is titled 'On the effect of isolated dust grains in a plasma', and was supervised by John Allen and John Ockendon. He has gone to Los Alamos for two months, after which he will take up a postdoc in Zoology, working on bird flu.

Siu-Lung Law also passed his D.Phil exam. His thesis was titled "Financial Optimization Problems" and his supervisors were Jeff Dewynne and Sam Howison.

Carlo Smith's successful thesis concerned Negative Squeeze Film Flows (the kind of hydrodynamics that causes piston slap and arthritis). He was supervised by Sam Howison and John Ockendon.

Michael Mitton passed his Dphil exam. His thesis was titled "Models of illiquid markets" supervised by Sam Howison.