

OCIAM NEWSLETTER

March 2004

FUTURE EVENTS

OCIAM Special Workshop

22 March

Seminar/Workshop Philip Bond (Brevan Howard)

Critical Systems from Lasers and Earthquakes

<http://www.maths.ox.ac.uk/notices/events/bond-seminar/>

The 49th European Study Group

Mathematics with Industry will be held from 29th March until 2nd April 2004 hosted by OCIAM

Contact Chris Breward

Email beward@maths.ox.ac.uk

Details available on

www.maths.ox.ac.uk/ociam/Study-Groups/ESGI49/

24-28 May 2004

50th European Study Group with Industry

Helsinki University of Technology

Email: Robert.Piche@tut.fi

<http://www.csc.fi/esgi50/yhteystiedot.phtml.en>

16-20 August 2004

51st European Study Group with Industry

DTU, Lyngby, Denmark

<http://www.mat.dtu.dk/ESGI/>

19-22 April 2004

British Applied Mathematics Colloquium

University of East Anglia

Details available on www.mth.uea.ac.uk/bamc

Third Nomura Lecture
Professor Paul Embrechts ETH-Zürich
Tuesday 27 April at 5.00pm
Martin Wood Lecture Theatre,
Clarendon Laboratory

<http://www.maths.ox.ac.uk/notices/events/special/third-nomura-lecture/>

For information: Dr. Sam Howison
howison@maths.ox.ac.uk

21-25 June 2004

20th Annual Workshop on Mathematical Problems in Industry

University of Delaware

<http://www.math.udel.edu/MPI/>

21-25 June 2004

ECMI 2004

Eindhoven, University of Technology

<http://www.ecmi2004.tue.nl/>

GRADUATE SCHOOL

OCIAM ran:

EPSRC/LMS Graduate School in Mathematical Finance

15-19 March 2004.

Mathematical Institute, University of Oxford

Dr David Hobson, Prof Tomas Bjork,

Prof Mete Soner

<http://www.maths.ox.ac.uk/~hambly/inst-meet.html>

NEW PEOPLE

Ruth Preston: Having deserted the MI to join OCIAM I am glad to say that I am very happy to have tunnelled out to 'the other side'. I am here as the OCIAM Administrator and hope very much to take on a positive role. You can find me working with Angela in DH17.

Dr Damien Challet (Nomura Research Fellow) :

Being the successor of Vicky Henderson has proven to be very easy and very difficult, for the same reason: Vicky seems indeed to have left a unanimous positive and lasting impression. This is to say the pleasure to be in the OCIAM, where the atmosphere is the most enjoyable I have encountered in my short academic life. I was trained as a physicist and never quite did any physics afterwards, having no electric charge nor any spin (terrible are my dancing skills), or any other half-integer quantities. To my utter relief, mathematicians' strong sense of humour does not seem quantizable, that is, not discrete. If you wish

to confirm this preliminary hypothesis, my office is DH2

Dr. Devin Kilminster

Has just arrived from Western Australia to work with Lenny Smith

PEOPLE LEAVING

Jeanette Woerner: has been appointed to a junior Professorship at University of Göttingen. She has special responsibility for the Maths Finance and Econometrics programme there and plans to keep in contact with the Mathematical Finance Group in OCIAM.

James Bosson: has completed his D.Phil on ‘Asymptotic Approaches to Oscillatory Eigenvalue Problems’ and now works for a consultancy firm called Advantage Business based in Farnham.

VISITORS

Michael Mackey of McGill University recently spent 6 weeks visiting OCIAM. He is from McGill's Department of Physiology and the Centre for Nonlinear Dynamics in Physiology and Medicine, and while here worked two projects. One was an extension of previous work with Andrew Fowler involving modelling of periodic hematological diseases especially periodic leukaemia. The second involved modelling of gene regulation in particular, the oscillatory behaviour noted in the transcriptional repressor Hes1. Both of these modelling efforts involve the development of models framed as nonlinear differential delay equations, and an accompanying stability analysis and numerical simulation for comparison with experimental and clinical data. Additionally he gave two lectures in the Mathematical Physiology course and enjoyed it very much.

Robert G. Tompkins from the Hochschule für Bankwirtschaft (Business School for Banking and Finance) in Frankfurt is visiting us until the end of June as the Nomura Senior Research Fellow attached to St. Catherine's College. Robert has presented two sections of courses in the part-time MSc in Mathematical Finance and two papers in the Quantitative Finance Seminar series. Robert is interested in empirical analysis of option pricing and hedging with special emphasis on mathematical models to explain these results. During the time here, his research agenda includes investigations into complete market models of stochastic volatility, alternative simulation approaches for financial market data and he hopes to complete a paper titled “Why Smiles Exist”, a theoretical and empirical investigation of biases in option prices away from standard theoretical models.

Professor Ronald Smith from Loughborough University is visiting OCIAM until early May. He writes that he has had the privilege of a few months of being a failure. How much research time should one give to the big problems and to near-certain failure? Too much time and one could posthumously become a celebrated failure such as Charles Babbage (computers) and John Scott Russell (solitary waves). Too little time on big problems and one merely knocks-off a sequence of obvious research papers that the rest of the academic world regarded as too boring to bother writing. A realistic recommendation is half a day a week on big problems. At the 10% rate, Ron has burned up a couple of years ‘big problems’ time at OCIAM. While it would have been glorious to have succeeded, it was a privilege to be permitted to fail.

VISITING PROFESSORSHIP

We are delighted that Professor L. Mahadevan (Maha) has been appointed **Schlumberger Visiting Professor in Mathematics** at Oxford University for the next 3 years. This means he will be able to visit for a few weeks each year and everyone who heard his Alan Taylor lecture last year or saw his involvement with the modelling of shoe comfort will appreciate what a great piece of news this is.

STUDY GROUPS, FARADAY AND OTHER INTERACTIONS

NETIAM

The Smith Institute is coordinating a project in the European Commission's programme in [New and Emerging Science and Technology](#) (NEST) under Framework 6. The project will concentrate on New and Emerging Themes in Industrial and Applied Mathematics (NETIAM), and will fund five meetings over the next 14 months. There will be 4 themed workshops:

- **7-8 June, Florence**
Criminality in the social environment
- **2-3 April, Ventspils, Latvia**
Modelling the business environment
- **29-30 September, Kaiserslautern**
Visualization and simulation of materials
- **2-3 December, Eindhoven**
Complexity at the molecular level

Technology Translators from the Smith Institute will facilitate these multidisciplinary workshops and then a Plenary Workshop in Oxford will consolidate the findings into a form that will enable new research consortia to be taken forward.

The NETIAM project has just got under way. For further information, including the opportunities

available for taking part in the workshops, contact Melvin Brown at the Smith Institute (melvin@smithinst.co.uk), or consult the project website at www.netiam.net.

Interdisciplinarity

It was good to see that this area, around which much OCIAM research is centred, was the focus of a Royal Society meeting on March 1st, 2004. Most of the participants were physical and biological scientists, but Chris Farmer, Irene Moroz, Philip Maini and John Ockendon tried to highlight the underpinning role of applied maths in interdisciplinary ventures. But it was an uphill struggle against many senior core scientists, who are still suspicious of interdisciplinary activity, often because of the unjustified fear that more resources for interdisciplinarity, inevitably means fewer for basic research. Nonetheless, we hope that a positive report will eventually emerge.

On the positive side, the Royal Society has OK'd a Maths in Industry meeting in India, probably in December 2004 or January 2005 and will probably support another in South Africa around the same time (The first South African workshop in Witwatersrand in January this year was a great success, with Tim Myers, Alistair Fitt et al, ensuring strong impact both scientifically and media wise.

Please contact John Ockendon if you are interested in either of these ventures.
ock@maths.ox.ac.uk

NEW WEB SITE

A new OCIAM web site dealing with Applied Dynamical Systems, has already found the attention of Dr Zareen Ahmed, Mathematical & Physical Sciences Divisional Access Officer with a request to produce a visually appealing folder to promote MPS.

This group comprises Irene Moroz, her DPhil students and some others from Engineering as well as visitors. They hold weekly talks on Tuesdays at 11am in OCIAM and are interested in the general interdisciplinary research with, at present, Physics and Engineering. Interests include wavelets, speech and signal processing, atmospheric physics, electronic circuits, dynamo models and unstable periodic orbits.
<http://www.maths.ox.ac.uk/ads/>

CHINA

At the end of October 2003, Hilary and John Ockendon took part in the meeting on *Differential Equations and Asymptotical Theory in Mathematical Physics* in Wuhan University in China. Hilary went on to visit Professor Fuping Bian (a former OCIAM visitor) in Tianjin University and managed to fit in a quick trip to Beijing and the Great Wall. Meanwhile,

John, accompanied by Alistair Fitt, went to a meeting at Bao Steel in Shanghai where they attended a series of dinners with the odd workshop in between. After a relaxing weekend in Hong Kong, John and Alistair went on to the Chinese Study Group in Guangzhou. Rob Hinch, who arrived with a 102° temperature, had some difficulty convincing the border guards he did not have SARS and then spent the week constructing a wonderful model of the spread of SARS. There was also work done on alloys, aquifers etc.

CHAT

Antique furnishings and memorabilia department.

Prompted by the relentless and dire health and safety warnings, the OCIAM third floor has recently upgraded its furnishings and decor. Pride of place is Dr Fowler's new hardwood door, courtesy of Messrs Jewson of the Botley Road, replacing the nondescript cheap shoddy item previously installed. In addition, aided by the experience and advice of the new OCIAM design consultant Bruce Malamud, white board and notice board have been refitted, and new antique oak display cabinets have been purchased from OCIAM's exclusive furniture contractor, the Sobell charity shop in Little Clarendon St. A corridor party to celebrate the new layout was held at the beginning of Hilary Term, and a rather grander opening party is planned in the near future. **Andrew Fowler**

Games of Skill and Chance

You'd think that OCIAM students might want some time out during lunchtime from the intellectual stimulation of writing a DPhil. This is true, but rather than switch off, many of the students have turned their hands to more 'trivial' pursuits. Indeed, when I first arrived in OCIAM, the backgammon league was in full flow, with a full array of individuals' points on the whiteboard. I initially conjectured that these points translated into real money, though later discovered that James Bosson's amazing early losses in that respect had caused the bottom to drop out of the bank, thus precluding any more pecuniary gains for the rest of the students.

Backgammon became less commonplace, with a friendly chess league coming into fruition. Chess should not really be classified under 'chance', though having seen Christophe Girardet and Chris Breward play, I'm not so sure that this is the case. Fortunately for Chris, he can play poker. Having heard the caveat that Chapman will empty your wallet, turning up to the department armed with food and beer for an evening of poker can be a daunting prospect. Luck seemed to favour Chris on the last such evening, until the final hand when Rosemary-'I-haven't-played-before'-Dyson cleared up with four aces over Chris's four jacks.

Last, and by no means least, is bridge. This has become the preferred lunchtime diversion, with keen players of wildly differing abilities amongst the students and faculty. The gauntlet was thrown down in coffee one morning - faculty vs. students duplicate bridge. The students were ably captained by John Fozard, the faculty (and Rob Hinch) not quite managing to elect a captain. The stage was set one Friday evening. With John Ockendon pushing for ever increasing stakes, the faculty took an early lead over the first four hands, despite some miscommunication about Blackwood. Luckily for us students, the beer continued to flow and consequently we managed to claw our way back with some honour! The party then adjourned to the pub to cap the evening off. **Chris Poole**

Chris Breward was recently awarded the Cadet Forces medal for 12 years uniformed service with the Air Training Corps. Those who think that reservists don't take their life in their hands should come and see his 13 year old cadets on their first trip to the firing range.....!

NEW BOOK

Waves and Compressible Flow

Hilary Ockendon and John R. Ockendon
Springer-Verlag, 2004

This new book is a completely revised and updated version of Hilary Ockendon and Alan Tayler's book, 'Inviscid Fluid Flows'. Recommended for serious students of the subject.

OCIAM RESEARCH REPORTS

These are the papers that have been accepted for publication during 2003/4. Copies are available from OCIAM@maths.ox.ac.uk.

- 387 A numerical study of the Schrödinger-Newton equations
R. Harrison, I. Moroz, K.P. Tod
Nonlinearity, **16** 101-122 (2003)
- 388 Dissolution/precipitation mechanisms for diagenesis in sedimentary basins
A.C. Fowler, Xin-she Yang
J. Geophys. Res. Solid Earth **108**, (2003)
- 389 The Malkus-Robbins dynamo with a linear series motor
I. M Moroz
Int. J. of Bifurcat. Chaos **13** 147-161 (2003)
- 390 Incompressible limits of lattice Boltzmann equations using multiple relaxation times
P. J. Dellar
J. Comput. Phys. **190** 351-370 (2003)

- 391 Oblique slamming, planning and skimming
S.D. Howison, J.R. Ockendon, J.M. Oliver
J. Engrg. Math, **42**, 373-388 2002
- 392 Interaction of two modulational instabilities in a semiconductor resonator
G. Kozyreff, S.J. Chapman and M. Tildi.
Phys. Rev. E., Rapid Communication **68** 1-4 (2003)
- 393 Core bulk of wool fibres as a function of their curvature and diameter
G. Kozyreff, G. Wake, H. Ockendon, R.M. Sumner
Phys. Lett. A., **314** 428-433 (2003)
- 394 The propagation of a liquid bolus along a liquid-lined flexible tube
P.D. Howell, S.L. Waters, J.B. Grotberg
J. Fluid. Mech **406** 309-335 (2000)
- 395 A multiphase model describing vascular tumour growth
C.J.W. Breward, H.M. Byrne, C.E. Lewis
Bull. Math. Biol. **65** 609-640 (2003)
- 396 On the earth's magnetic field and the Hall effect
J.E. Allen
Nonlinear Proc. Geoph. **10** 437-440 (2003)
- 397 Singular Hopf bifurcation to strongly pulsating oscillations in lasers containing a saturable absorber
G. Kozyreff and T. Erneux
Euro. J. Applied Mathematics **14** 407-420 (2003)
- 398 Designing experiments for semi-parametric B-spline models
D.C. Woods, S.M. Lewis, J.N. Dewynne
Sankhya Ser. B.
- 399 Field probe for low-pressure capacitively coupled radio-frequency discharge plasmas
A. Dyson, J.E. Allen
Meas. Sci. Technol. **14** 107 (2003)
- 400 On the consistency of the collisionless sheath model
J.E. Allen
Phys. Plasmas. **10** 1528 (2003)
- 401 The fragmentation of wires by pulsed currents: beyond the first fracture
D.P. Wall, J.E. Allen and S. Molokov
J. Phys. D: Appl. Phys.
- 402 Bifurcations and instabilities in rotating two-layer fluids: II the β -plane
A. Lovegrove, I.M. Moroz, P.L. Read
Nonlin. Proc. Geophys. **9** 1-21 (2002)
- 403 Solid stress generated by spheroid growth estimated using a linear poroelasticity model
T. Roose, P.A. Netti, L.L. Munn, Y. Boucher, K. Jain
Microvas. Res. **66** 204-212 (2003)

- 404 Non – Linear Coupling Between Modes in a Low-Dimensional Model of ENSO
M. S. Roulston, J. D. Neelin
Atmos. – Ocean. **41** (3) 217-231 (2003)
- 405 Temporal and spatial patterns of the interannual variability of total ozone in the tropics.
C. D. Camp., M. S. Roulston, Y. L. Yung
J. Geom. Phys. **108** (D20, 4643) 6-17 (2003)
- 406 Free boundary problems in the steel industry.
A. D. Fitt., J. R. Ockendon, C. P. Please.
Chinese J. Eng. Maths
- 407 Persistence of memory in drop breakup: the breakdown of universality.
P. Doshi, I. Cohen, W. Zhang, M. Siegel, P. Howell, O. Basaran, S. Nagel.
Science Magazine. **302** 1185-1188 (2003)
- 408 Optimisation of hydrophone placement: a dynamical systems approach.
D. A. Wood, D. J. Allwright
Euro. J. Applied Mathematics **14** 1-18 (2003)
- 409 Circulation in inviscid gas flows with shocks.
D. J. Allwright, K. Kaouri.
App. Math. Lett.
- 410 On the rheology of till.
A.C. Fowler.
Ann. Glaciol. **37**, 631-632 (2002)
- 411 A Model for Water Uptake by Plant Roots.
T. Roose, A.C. Fowler
J.Theoretical Biology
- 412 A Mathematical Model for Water and Nutrient Uptake by Plant Root System.
T. Roose, A.C. Fowler
J. Theoretical Biology
- 413 Field probe for Low-pressure capacitively coupled radio-frequency discharge plasmas.
A.Dyson, J.E. Allen
Meas. Sci. Technol. **14**, 107-113 (2003)
- 414 On the Earth's magnetic field and the Hall effect
J.E. Allen
Nonlinear Processes in Geophysics **10**, 437-440 (2003)
- 415 Diffusion processes on fractal fields: heat kernel estimates and large deviations
B.M. Hambly, T. Kumagai
Probab. Theory and Related Fields, **127**, 305-352, (2003).
- 416 Law of the iterated logarithm for oscillating random walks conditioned to stay positive
B.M. Hambly, G. Kersting, A.E. Kyprianou.
Stoch. Proc. Applic. **108**, 327-343, (2003).
- 417 Thick and thin points for random recursive fractals
B.M. Hambly, O.D. Jones
Adv. Appl. Probab. **35**, 251-277, (2003)
- 418 Finitely ramified graph directed fractals, spectral asymptotics and the multidimensional renewal theorem
B.M. Hambly, S.O. Nyberg
Proc. Edin. Math. Soc. **46**, 1-34, (2003).
- 419 A note on the Bohm criterion for electronegative gases.
J.E. Allen
Plasma Sources Science and Technology, **13**, 48-49 (2004)
- 420 Monte Carlo methods for the valuation of multiple exercise options
N. Meinshausen, B.M. Hambly
Math. Finance
- 421 Random fractal strings: their zeta functions, complex dimensions and spectral asymptotics
B.M. Hambly, M.L. Lapidus
Trans. Amer. Math. Soc.
- 422 Geological Modeling and Reservoir Simulation
C. L. Farmer
Mathematical Methods and modeling in Hydrocarbon Exploration and Production. Armin Iske and Trygve Randen, Springer – Verlag, Heidelberg (2204)
- 423 The extended Malkus-Robbins dynamo with a nonlinear motor
I. M. Moroz, *Intl J. Bifurcat. Chaos*
- 424 Asymptotic analysis of models of superconductivity, Nonlinear PDE's in Condensed Matter and Reactive Flows
S.J. Chapman, H. Berestycki, Y. Pmeau, Eds., *NATO Science Series C, Mathematical and Physical Sciences*, **569**, 375-398 (2002)
- 425 Selection of Saffman-Taylor fingers by small kinetic under cooling
S.J. Chapman,
J.Eng.Math **46**, 1, 1-32 (2003)
- 426 A hierarchy of models for superconducting thin films
S.J. Chapman, D.R. Heron
SIAM, J.Appl.Math. **63**, 6, 2087-2127 (2003)

- 427 Wave packet pseudomodes of twisted Toeplitz matrices
L.N. Trefethen, S.J. Chapman,
Com. Pure Appl. Math.
- 428 Prediction of epileptic seizures:are nonlinear methods relevant?
P.E. McSharry, L.A. Smith, L.Tarassenko,
Nat. Med. **9**, 241-242 (2003)
- 429 Comparison of predictability of epileptic seizures by a linear and a nonlinear method
P.E. McSharry, L.A. Smith, L. Tarassenko,
IEEE Trans. Biomed. Engineering **50**, 628-633(2003)
- 430 Consistent nonlinear prediction:identifying model error
P.E. McSharry, L.A. Smith,
Physica D.
- 431 Asymptotic angular stability in non-linear systems: rotation numbers and winding numbers
P.E. McSharry, P.R.C. Ruffino,
Dynam Syst. **18**, 191-200 (2003)
- 432 Quenching Lorenzian chaos
R.Hide, P.E. McSharry,
C.C. Finlay, G.D. Peskett
Intl J. Bifurcat. Chaos
- 433 Delay differential equations for mode-locked semiconductor lasers
A.G. Vladimirov, D. Turaev, G. Kozyreff
Optics Letts
- 434 Inertial Levitation
A.D. Fitt,G. Kozyreff,J.R. Ockendon
J. Fluid. Mech