

**THE INSTITUTE OF MATHEMATICS AND ITS
APPLICATIONS**

IMANA NEWSLETTER

**Newsletter of the Numerical Analysis Group of the
Institute of Mathematics and its Applications**

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1 Introduction

HAPPY NEW YEAR

In this issue of the Newsletter, we meet the large and diverse group of researchers involved in the Maxwell Institute for Mathematical Sciences in Edinburgh. We also learn about the current HPC/NA Roadmap activity. All readers are encouraged to go to the associated webpage (<http://www.oerc.ox.ac.uk/research/hpc-na>) to provide comments and feedback and to get actively involved in this activity that could significantly influence the future direction of EPSRC funding for numerical analysis within the UK.

My thanks to those who responded to my pleas for NA news from their institutions. Unfortunately, some NA Groups are not regularly sending in their news: please could I ask once again that you nominate someone to do this (supplying information on visitors, technical reports, seminars, courses etc three times a year really does only take a short while to compile and can be done by an admin. assistant, postdoc or research student). For the Newsletter to be useful to our UK NA community, it needs **your** input. So please make a New Year's resolution to do this. **Thank you!**

The copy date for the next Newsletter will be **Friday 27 March**.

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2 Meet the Numerical Analysis Group ... Maxwell Institute

The Maxwell Institute for Mathematical Sciences is a relatively new enterprise (formed with Scottish Funding Council support) that brings together within a single 'virtual' body, the mathematics research and people at **Edinburgh** and **Heriot-Watt** universities. In terms of numerical analysis, the Maxwell Institute contains, besides the Edinburgh Research Group on Optimization (ERGO), a well-established tradition and internationally-renowned researchers within the computational and applied mathematics groups of the two universities. We remind the reader of these numerical analysts:

Lubomir Banas (Computational Maths, HWU) works on the modelling of coupled nonlinear time-dependent PDEs, where he proved convergence of the methods of characteristics for a class of nonlinear convection diffusion equations and constructed a novel numerical method based on the ELLAM framework. He constructed numerical methods and proved convergence/existence and/or error estimates for numerical methods in micromagnetism which involve coupled Maxwell-Landau-Lifshitz-Gilbert equations and equations of elastodynamics. He has also constructed effective multigrid methods for the solution of discrete algebraic systems arising from the finite element discretization of the Cahn-Hilliard equations.

Lyonell Boulton (Computational Maths, HWU). His field of research is the spectral analysis of linear operators. It covers a broad area of interest including non-self-adjoint operators, pseudospectra of operators and matrix polynomials, quantum interpretation of Hamiltonians arising in the theory of supermembranes, numerical aspects of spectral theory, spectral pollution and numerical localisation of eigenvalues embedded in spectral gaps, and ordinary differential equations.

Evelyn Buckwar (Computational Maths, HWU). Her research is primarily concerned with the investigation of numerical methods for a variety of classes of stochastic differential equations. In particular, she is involved in developing and analysing convergence and stability of one-step and multi-step methods for stochastic ordinary differential equations and stochastic delay differential equations. Current and future research interests also lie in the area of analytical and numerical investigations of networks of stochastic delay differential equations arising in neuroscience and of stochastic models of infectious diseases.

Coralia Cartis (ERGO, UoE). Her research addresses the development, analysis and implementation of algorithms for linear and nonlinear optimization problems. In particular, she has worked on the convergence of practical interior point methods for linear programming, the complexity of linear and

nonlinear optimization, Phase I strategies, and trust-region methods. She is also interested in the interconnections between dynamical systems and continuous optimization.

Dugald Duncan (Computational Maths, HWU) works on the numerical analysis and solution of time dependent differential and related boundary integral equations. Recent work includes the numerical analysis of overlapping grid methods for time dependent PDEs in reservoir simulation, retarded potential integral equations for wave scattering (with related work on Volterra integral equations) and a time domain integro-differential equation for phase change problems.

Chris Eilbeck (Computational Maths, HWU) has used computer algebra to develop the theory of Weierstrass functions associated with trigonal curves of genus 3 and 4, an open problem since Baker's work on the hyperelliptic case in 1907, in a collaboration with researchers in Kiev, Boston, Japan and Imperial. With Mike Russell (Honorary Professor at HWU) he has also published the first experimental evidence for the existence of moving breathers in a crystalline solid, verifying their previous numerical simulations.

Jacek Gondzio (ERGO, UoE) is interested in the theory and implementation of optimization methods for linear, quadratic and nonlinear programming. He is also interested in the use of linear algebra techniques and sparse matrix factorisation methods applied in optimization. His interests include the use of parallel and distributed computing for solving real-life very large optimization problems arising in telecommunications, energy sector and finance.

Andreas Grothey (ERGO, UoE). His research addresses decomposition methods for large-scale nonlinear, nonconvex and constrained optimization problems, interior point methods with emphasis on warmstarting, and pooling problems.

Julian Hall (ERGO, UoE) is interested in the development of algorithmic and computational techniques for solving large scale linear programming (LP) problems using the revised simplex method on both serial and parallel computers. Consequential research interest is the application of these techniques in other areas of computational optimization and linear algebra.

Ben Leimkuhler (Applied Maths, UoE) studies fundamental principles underpinning algorithms for dynamical simulation. His recent work has focused on novel methods for molecular dynamics and sampling, including geometric integrators for physical and chemical applications, multiple time-scale integration methods based on averaging, extended variable and stochastic dynamic formulations, and the application of molecular algorithms in materials simulation and bio-molecular modelling.

Gabriel Lord (Computational Maths, HWU) has broad interests in applied and numerical analysis. He is developing and proving convergence of multiscale methods to efficiently solve both PDEs and stochastic PDEs. He is also developing methods to directly compute physically relevant solutions such as stochastic travelling waves by applying techniques from dynamical systems analysis. He is working in computational neuroscience on a range of scales examining models of part of a single neuron through to field models of neurons in the presence of noise. Another aspect of his work are new numerical methods in advection dominated flows in non-homogeneous media with applications to CO₂ storage.

Simon Malham (Computational Maths, HWU) has been focusing on developing and proving convergence of new stochastic integrators for SDEs and SPDEs, and their financial applications, which also led to new research directions on the effect of stochastic forcing in neural dendrites.

Kenneth McKinnon (ERGO, UoE). His current research interests are in serial and parallel algorithms for solving large scale optimization problems and modelling practical problems. He has found the family of simplest possible examples where the LP simplex method cycles (joint with Julian Hall), and the smoothest known case where the Nelder-Mead simplex method fails to converge to a stationary point. He has researched solving optimization problems globally, and on industrial applications of optimization in oil, chemical and electricity industries.

Nikola Popovic (Applied Maths, UoE). His research interests are in dynamical systems and differential equations, in particular with applications to mathematical biology and neuroscience; specific techniques include (geometric) singular perturbation theory, geometric desingularisation ("blow-up"), asymptotic analysis, and dimension reduction methods.

Maximilian Ruffert (Applied Maths, UoE) works on simulations of gravitational dynamics, such as coalescing neutron stars.

Noel Smyth (Applied Maths, UoE) studies nonlinear waves in general, nonlinear optics, Korteweg-de Vries and related equations, Nonlinear Schrödinger (NLS) and related equations; modulation theory, nonlinear waves in liquid crystals, Sine-Gordon equation and its applications and nonlinear waves in meteorology and oceanography. Recently, his work has included numerical analysis of methods for solving those equations, as well as analytical techniques.

Jared Tanner (Applied Maths, UoE). His research involves designing, analysing and implementing numerical algorithms for signal/data processing applications. Examples of research topics include the analysis of nonlinear complexity regularization techniques and methods for the exponentially accurate manipulation of piecewise smooth data.

The Institute benefits from the teaching and research contributions of several visiting professors, such as Roger Fletcher, FRS (Dundee), Nicholas Gould (RAL) and Nick Radcliffe (Stochastic Solutions). Currently, there are 21 PhD students supervised by the above staff, while Marco Colombo (UoE) and Thorsten Sickenberger (HWU) are postdoctoral researchers associated with the above groups and numerical analysis research. The ERGO group runs an MSc programme on Operations Research, with specializations including OR with Energy, Finance, Risk and Computational Optimization; this year, there are over 50 students enrolled in the course. Numerical analysts at Maxwell Institute are also involved in the Scottish-wide training programme of PhD students in mathematics (SMSTC).

Furthermore, the Maxwell Institute Numerical Analysis is not just a collection of researchers, but a highly interactive, internally and externally collaborative institution. For instance, EPSRC has very recently funded a Science and Innovation grant for “Numerical Algorithms and Intelligent Software”, two of the three hubs of this S and I grant comprise the Maxwell Institute (with the third hub being Strathclyde University). Numerical analysts at Edinburgh, Heriot-Watt and Strathclyde will work together with compiler experts from Edinburgh Informatics and specialists in parallel computing from the Edinburgh Parallel Computing Centre (EPCC) to improve the software development framework for implementation of numerical algorithms on diverse and evolving multiprocessor systems. In this context, advanced numerical algorithms will be developed for state-of-the-art applications, such as high-order adaptive finite elements for solid and fluid mechanics, numerical optimization, multi-scale methods, and new parallel methods for molecular simulation and data analysis. Additional strategic appointments will be made by the universities involved, with the purpose of strengthening the place of numerical analysis at these academic institutions in a sustainable and long-term manner; in the same vein, several PhD and postdoctoral places will be available, yielding critical mass in this area. This initiative includes knowledge exchange partnerships with major computing companies (HP, IBM, SGI) and industrial users of HPC algorithms (Schlumberger, Orange/France Telecom, SAS), often building on previous such contacts and exchanges established in the context of other grants and collaborations (www.maths.ed.ac.uk/ERGO, etc.) Also, connections to national laboratories such as Daresbury and the Rutherford Appleton are being enhanced in this context, with staff and PhD students such as Coralia Cartis, Nicholas Gould, Jonathan Hogg already involved in such collaborations. Ben Leimkuhler (UoE) will direct the newly-established centre. In a broader perspective, a research network will be created with funded connections with Cambridge University, the University of Warwick, the Wales Institute for Mathematical and Computational Science, and beyond, with other UK universities.

Coralia Cartis (Coralia.Cartis@ed.ac.uk)

3 HPC/NA Roadmap

Recognising a crisis in computational science software is affecting the ability of scientists to tackle large-scale and grand challenge applications, a group of numerical analysts and high-performance computing specialists have started work on the development of a high-performance numerical algorithm roadmap. The initial program of work is funded by the EPSRC and the roadmap should help inform the research programmes within EPSRC.

Many applications share a common numerical algorithmic base. Often the algorithms underlying current software are not able to cope efficiently with the increasingly difficult problems that arise in multiscale, multiphysics applications, and the software is not fully exploiting the high performance computing (HPC) hardware. The reasons include many years of inadequate investment in transferring the best algorithms

into high quality software, and a lack of communication between those needing the software and those developing the underlying mathematics and algorithms.

The HPC/NA roadmap will identify areas of research and development to be focused on during the next five years, including specific algorithmic areas required by applications as well as new architectural issues requiring consideration. The initial roadmap is being constructed through a series of workshops bringing together stakeholders and enabling input from the broader community, and is being driven by application needs. By initially considering science applications we are trying to determine:

- The role and limits of a common algorithmic base.
- How this common algorithmic base is currently delivered and how it should be delivered in the future.
- What the current requirements and limitations of the applications are, and how these should be expanded to meet future scientific challenges, both from the end-user perspective and the developers perspective.
- What the perceived and actual “road-block” that limit the scope of the future exploitation of these applications are.
- A better comprehension of the “knowledge gap” between algorithmic developments and scientific deployment
- How significant computing language as well as other “practical” issues weigh in the delivery of algorithmic content

For example, much numerical analysis content is available in the form of libraries, including open-source libraries and proprietary libraries. How well do these libraries fulfil current and future needs? How does their development match the development of applications? What impact will the approaching new architectures have on these libraries?

The first roadmap workshop was held in Oxford in November. More than 40 applications developers from industry and academia together with numerical analysts and computer scientists from around the UK set about identifying the key issues and algorithmic components. A report from the meeting can be found on the website. In early December, a group of numerical analysts met in Manchester to study the outcomes from the applications workshop and to focus on specific algorithmic areas. The final workshop will be at the Royal Society in January where an initial roadmap will be discussed. We encourage any interested party to get involved in the activity. The roadmap will only be useful if it reflects the broad community. Please take a look at the website <http://www.oerc.ox.ac.uk/research/hpc-na> and register your interest. Feel free to comment on the information there already and to provide input about your own area.

Anne Trefethen (anne.trefethen@oerc.ox.ac.uk)

4 Academic prizes: calls for submissions

14th Leslie Fox Prize

The Fourteenth Leslie Fox Prize meeting will take place on 29 June 2009, at the Mathematics Institute, University of Warwick.

Entries for the Fourteenth Leslie Fox Prize competition can now be submitted. Any person who is less than 31 years old on 1 January, 2009 and has not already won a first prize is eligible. Each entry should consist of a paper, describing some of the candidate’s research, that is suitable for a 40 minute lecture at a numerical analysis meeting.

The entries will be considered by an Adjudicating Committee of Andrew Stuart (Warwick, Chairman), Mark Ainsworth (Strathclyde) and Nick Higham (Manchester). Entries should be received, by the Chairman, by **31 January, 2009**, either electronically as a pdf file, or as three hard copies by regular mail. The receipt of all entries will be acknowledged.

Full details of the prize, and the submission procedure, may be found at:
<http://www.warwick.ac.uk/masdr/fox/>

5 Gene Golub Fellowship Fund

It is now a year since Gene died. Many people have expressed the wish that a perpetual memorial be established in his name. Gene spent some 40 years at Stanford and during the whole of that time was a strong advocate for students. iCME, which is the child of the SCCM graduate program that Gene created at Stanford, has established a student fellowship fund. If a minimum of \$500,000 is raised, Stanford will match what is raised. This will then be sufficient to support a perpetual fellowship in Gene's name for at least one student.

If he knew of some worthy cause, Gene never needed to be asked to contribute. When told of a worthy cause, he never needed reminding. It is hoped that his friends will respond as Gene did for so many during his life. To date, in excess of \$300,000 has been promised or received, largely due to three generous gifts. One is a personal gift from Cleve Moler, which has been matched by a gift from The Mathworks. The third is a gift from Svante Littmarck of Comsol.

Anyone wishing to make a contribution to the fund can do so directly by going to the webpage http://icme.stanford.edu/golub_fellowship/ or by sending an email to either Cleve Moler or Walter Murray (walter@stanford.edu) declaring your intent. A link will be added to the webpage that will monitor progress of the fund and list those who have contributed or are planning to do so.

A site has also been created with some Gene memorabilia. One item is a video of Gene's last class at Stanford, and another is an interview that is fascinating to hear. See <http://icme.stanford.edu/history/golub.php>

Thanks for your support.
Cleve Moler and Walter Murray

6 Who's Visiting Whom

Bath

Ludmil Zikatanov (Penn State) will be visiting Bath in May.

Oxford

Dr Martin Lotz (University of Paderborn and City University of Hong Kong), is visiting OUCL from July 2008 to September 2009. He is working with Dr Raphael Hauser on "Geometric Methods and Probabilistic Analysis of Condition Numbers".

Toby Driscoll (University of Delaware) will visit OUCL between 6 - 16 January 2009 and Prof Roy Mathias (University of Birmingham) visits 19 January - 15 March 2009. The host for both visitors is Prof Nick Trefethen.

Rutherford Appleton Laboratory

Dr Fred Wubs (Groningen University) is visiting Dr Jennifer Scott and the Numerical Analysis Group between 1 November 2008 and 31 March 2009. He will be working with the Group on the solution of large sparse symmetric indefinite systems of equations.

Philippe Toint (University of Namur) will visit Nick Gould and the Numerical Analysis Group between mid January and late March 2009.

7 Technical Reports

University of Bath

BICS reports: Available from <http://www.bath.ac.uk/math-sci/bics/preprints/>

- 17/08 Image-model coupling: application to an ionospheric storm.
N.D. Smith, D. Pokhotelov, C.N. Mitchell, C.J. Budd.
- 16/08 Image-model coupling: a simple information theoretic perspective for image sequences.
N.D.Smith, C.N.Mitchell, C.J.Budd.
- 15/08 Small planar travelling waves in two-dimensional networks of coupled oscillators.
Christian Pfrang and Karsten Matthies.
- 14/08 A convergent adaptive method for elliptic eigenvalue problems and numerical experiments.
S. Giani and I.G. Graham.

University of Cambridge

Reports available from http://www.damtp.cam.ac.uk/user/na/NA_papers.html

- NA2008/13 Arieh Iserles and David Levin.
Asymptotic expansion and quadrature of composite highly oscillatory integrals.
- NA2008/12 Marissa Condon, Alfredo Deao, Arieh Iserles, Kornel Maczynski and Tao Xu.
On numerical methods for highly oscillatory problems in circuit simulation.
- NA2008/11 Ben Adcock.
Convergence acceleration of Fourier-like series in one or more dimensions.

Cardiff University

- 08/09 T. Reis and T. N. Phillips.
A numerical investigation of steady viscous flow past a confined cylinder using the lattice Boltzmann method.
- 08/09 A. Lozinski, R. G. Owens and T. N. Phillips.
The Langevin and Fokker-Planck equations in polymer rheology.
- 08/10 S. J. Lind and T. N. Phillips.
Spherical bubble collapse in viscoelastic fluids.

University of Edinburgh

Reports available from <http://www.maths.ed.ac.uk/ERGO/preprints.html>

- ERGO 08-003 P.-J. Chung, H. Du and J. Gondzio.
A probabilistic constraint approach for robust beamforming with imperfect channel information.

University of Liverpool

Reports available from http://www.liv.ac.uk/~cmchenke/na_liverpool.htm

- 09/01 Multigrid method for a modified curvature driven diffusion model for image inpainting.
Carlos Brito-Loeza and Ke Chen.

- 09/02 A robust affine image registration method.
Noppadol Chumchob and Ke Chen.
- 09/03 On two multigrid algorithms for modelling variational multiphase. image segmentation.
Noor Badshah and Ke Chen.

University of Manchester

MIMS EPrints from <http://www.manchester.ac.uk/mims/eprints>

- 2008.116: Nicholas J. Higham (2008).
Cholesky factorization.
- 2008.115: Chun-Hua Guo, Nicholas J. Higham and Françoise Tisseur (2008).
An improved arc algorithm for detecting definite Hermitian pairs.
- 2008.111: Sven Hammarling and Craig Lucas (2008).
Updating the QR factorization and the least squares problem.

University of Oxford

Reports available from <http://web.comlab.ox.ac.uk/oucl/publications/natr/index.html>

- NA-08/21 A second derivative SQP method: Local convergence.
N I M Gould, D P Robinson.
- NA-08/20 Barycentric-Remez algorithms for best polynomial approximation in the chebfun system.
R Pachon and L N Trefethen.
- NA-08/19 Preconditioned GMRES for oscillatory integrals.
S Olver.
- NA-08/18 A second derivative SQP method: Theoretical issues.
N I M Gould, D P Robinson.
- NA-08/17 Local projection finite element stabilization for the generalized Stokes problem.
K Nafa and A J Wathen.
- NA-08/16 Conformal Maps to Multiply-Slit Domains and Applications.
N Hale and T W Tee.
- NA-08/15 Using global interpolation to evaluate the Biot-Savart integral for deformable elliptical
Gaussian vortex elements. R B Platte, L F Rossi and T B Mitchell.
- NA-08/14 Chebyshev semi-iteration in Preconditioning.
A J Wathen and T Rees.
- NA-08/13 Chebfun: A New Kind of Numerical Computing.
R B Platte and L N Trefethen.

Rutherford Appleton Laboratory

Reports available from <http://www.numerical.rl.ac.uk/reports/reports.html>

- RAL-TR-2008-029 A DAG-based parallel Cholesky factorization for multicore systems.
J. D. Hogg

8 Diary of Seminars (January - April 2009)

BATH Numerical Analysis Seminars: Seminars take place on Fridays at 12:15pm in Department of Mathematical Sciences, Building 1 West, Room 1W3.6. The timetable is available at <http://www.maths.bath.ac.uk/~jv120/na-seminars>

BATH BICS series: Seminars take place at 1:15pm in Department of Mathematical Sciences, Building 1 West, Room 1W3.6. A timetable is available at <http://www.bath.ac.uk/math-sci/bics/seminars/>

BATH CNM Seminars: Seminars take place on Tuesdays at 1:15pm in the Department of Mathematical Sciences, Building 1 West, Room 1W3.6. The timetable is available at <http://www.bath.ac.uk/cnm/>

BATH CNM series: Seminars take place on Tuesdays at 1:15pm in the Department of Mathematical Sciences, Building 1 West, Room 1W3.6. The timetable is available at <http://www.bath.ac.uk/cnm/>

BIRMINGHAM : The Optimisation and Numerical Analysis seminar at Birmingham run on Thursdays, between 12-1pm in Arts Lecture Room 6, Edgbaston Campus at the University of Birmingham. The programme can be found at <http://web.mat.bham.ac.uk/loghin/onaseminars.html>

BRUNEL : Two seminar series are held in the Department of Mathematical Sciences, John-Crank Building, Room M128. The Applied Mathematics Research Seminars take place on Mondays at 14:00, and the Seminars on Mathematical Physics and Random Matrices are held on Tuesdays at 16:00. More details are available at <http://www.brunel.ac.uk/about/acad/siscm/maths/events>

CARDIFF : Seminars take place on Mondays at 3pm in School of Mathematics room M/2.06. Contact: Tim Phillips (phillipstn@cardiff.ac.uk).

CAMBRIDGE : There are three relevant seminar series in Cambridge which are held in MR14, Pavilion F, Centre for Mathematical Sciences: Applied and Computational Analysis Seminars (up-to-date details at <http://talks.cam.ac.uk/show/index/9811>), Numerical Analysis Seminars (up-to-date details at <http://www.damtp.cam.ac.uk/user/na/seminars.html>), and ACA Graduate Seminars (up-to-date details at <http://talks.cam.ac.uk/show/index/15177>).

EDINBURGH : The Edinburgh Research Group in Optimization (ERGO) runs seminars on Optimization and Numerical Analysis. Unless stated otherwise, seminars are held at 3.30pm in Room 6206 of the James Clerk Maxwell Building. More details are available from: <http://www.maths.ed.ac.uk/ERGO/Seminars.html>

LIVERPOOL : Seminars are normally held on Wednesdays at 4pm, in the Whittaker Room (211), Mathematical Sciences Building. See <http://www.liv.ac.uk/maths/Applied/Research/Seminars/index.html>

MANCHESTER : Numerical Analysis and Scientific Computing Seminars 2007/08 The seminars are held in the Alan Turing Building, Frank Adams Room 1, at 3pm. For more details and abstracts, see <http://www.mims.manchester.ac.uk/events/seminars/numerical-analysis.php>

OXFORD : Seminars take place on Thursdays at 2pm in the Lecture Theatre of Oxford University Computing Laboratory, Wolfson Building, Parks Road. A timetable and abstracts are available from <http://web.comlab.ox.ac.uk/oucl/news/>

RAL : Seminars are held in the Atlas Centre, Rutherford Appleton Laboratory and start at 2pm. Contact: sue.dollar@stfc.ac.uk

READING : Seminars take place on Fridays promptly at 3pm in room 113 of the Mathematics Department. External audiences are advised to contact Brigitte Calderon on 0118 378 5002 or email

b.calderon@reading.ac.uk to confirm the programme before attending.

JANUARY 2009

- January 15 : OXFORD. Miro Rozloznic (Academy of Sciences of the Czech Republic), On the accuracy of inexact saddle point solvers.
- January 16 : READING. Yaroslav Kurylev (UCL). Mathematics of Invisibility.
- January 16 : CAMBRIDGE. Marie-Therese Wolfram (Applied PDE group, DAMTP). From semiconductors to ion channels and beyond.
- January 19 : BRUNEL. Larissa Fradkin (South Bank University). Diffraction by a two dimensional traction free solid isotropic wedge: comparison of two semi-analytical approaches.
- January 21 : EDINBURGH. Csaba Fabian (Lorand Eotvos University, Budapest). Title to be confirmed.
- January 22 : RUTHERFORD. Fred Wubs (University of Groningen), Preconditioning of linear systems in an ocean flow model.
- January 22 : CAMBRIDGE. Laurent Desvillettes (ENS Cachan) Coupling kinetic and fluid equations: some ideas about the theory and the applications.
- January 23 : READING. Antonio Moro (Loughborough) Dispersive deformations 2+1D dispersionless integrable systems.
- January 23 : CAMBRIDGE. Tatiana Shingel (Numerical Analysis, DAMTP). Title to be confirmed.
- January 27: CARDIFF. Matthias Heil (Manchester). Large-amplitude self-excited oscillations in 3D collapsible tubes – theory and computations.
- January 29 : OXFORD. Martin Lotz (Oxford University and City University of Hong Kong). Title to be confirmed.
- January 30 : READING. Johannes Zimmer (Bath). Moving interfaces in solids: from conservative lattice models to macroscopic dissipation.
- January 30 : CAMBRIDGE. Guillaume Dujardin (Applied PDEs, DAMTP). Title to be confirmed.

FEBRUARY 2009

- February 2: BRUNEL. William Parnell (Manchester). Effective Properties of Inhomogeneous Media with Applications to Cortical Bone and Pre-stressed Nonlinear Composites.
- February 3: CARDIFF. P. Nithiarasu (Swansea). Computational blood flow.
- February 5 : OXFORD. Robert Nuernberg (Imperial College London). Parametric approximation of geometric evolution equations and their coupling to bulk equations.
- February 6: READING. Alex Lukyanov (Reading). Relaxed states and self-organisation in non-equilibrium complex systems.
- February 10 : EDINBURGH. Karsten Neuhoff (Cambridge). Title to be confirmed.
- February 11 : LIVERPOOL. Y Capdeboscq (Oxford). Inverse problems and imaging PDEs.
- February 12 : CAMBRIDGE. Jonathan Sherratt (Heriot-Watt). Dynamic stability of wavetrains behind invasion in reaction-diffusion equations.
- February 12 : OXFORD. Raphael Hauser (Oxford). Title to be confirmed.
- February 19 : OXFORD. Christian Mehl, (Birmingham). Numerical methods for palindromic eigenvalue problems.
- February 20: READING. Nina Snaith (Bristol). Riemann zeros, elliptic curves and random matrices.

February 26 : OXFORD. Richard Katz (Oxford, Earth Sciences). Golden syrup, lubrication theory, and PETSc – a recipe for models of ice-sheet dynamics.

February 27: READING. Paschalis Karageorgis (Trinity College Dublin). Title to be confirmed.

MARCH 2009

March 5 : LIVERPOOL. P G Batchelor (Kings College London). MR Imaging and Reconstruction.

March 5 : OXFORD. Reinout Quispel (Latrobe University Melbourne). Title to be confirmed.

March 6 : READING. Daniel Read (Leeds). Randomly branched polymers: from reactions to rheology.

March 10: CARDIFF. James Seddon (Manchester/Twente). Bifurcations in flow through a suddenly expanding pipe.

March 11 : EDINBURGH. Istvan Deak (Corvinus University, Budapest). Title to be confirmed.

March 12 : RUTHERFORD. Ke Chen (Liverpool). Title to be confirmed.

March 13 : READING. Paul Ledger (Swansea). Title to be confirmed.

March 16 : BRUNEL. Dave Hewett (Oxford). Bangs and reverberations - sound propagation in an urban environment

March 18 : EDINBURGH. Erling Andersen (MOSEK ApS, Denmark). Title to be confirmed.

March 20 : READING. Jenya Ferapontov (Loughborough). Soliton equations in 2+1 dimensions: deformation of dispersionless limits.

APRIL 2009

April 29 : LIVERPOOL. B J Matuszewski (University of Central Lancashire). Biomedical Computer Vision.

9 Forthcoming Meetings and Conferences

JANUARY 2009

Finite Element Methods in Engineering and Science, January 5-9.

Lake Tahoe, USA. http://servac.math.utep.edu/femtec_2008/home

Annual Meeting UK and Republic of Ireland SIAM Section, January 9.

Limerick, Ireland. <http://www.numerical.rl.ac.uk/people/hsd/ukiesiam/>

Annual GAMM Seminar, January 22-24.

Leipzig, Germany. <http://www.mis.mpg.de/scicomp/gamm25/index.html>

MARCH 2009

SIAM Conference on Computational Science and Engineering (CSE09), March 2-6.

Miami, Florida. <http://www.siam.org/meetings/cse09/>

International Conference on High Performance Scientific Computing, March 2-6.

Hanoi, Vietnam. <http://hpsc.iwr.uni-heidelberg.de/HPSCHanoi2009>

Thirteenth Copper Mountain Conference on Multigrid Methods, March 22-27.

Copper Mountain, Colorado. <http://grandmaster.colorado.edu/~copper/2009>

APRIL 2009

33rd South African Symposium on Numerical and Applied Mathematics (SANUM 2009), 6-9 April.

University of Stellenbosch, Cape Town. <http://dip.sun.ac.za/sanum/>

Annual European Rheology Conference (AERC), 15-17 April.

Cardiff. <http://www.rheology-esr.org/AERC/2009>

MAY 2009

4th International Conference on Grid and Pervasive Computing (GPC 2009), May 4-8.

Geneva, Switzerland. <http://gpc09.eig.ch/>

SIAM Conference on Applications of Dynamical Systems (DS09), May 17-21.

Snowbird, Utah. <http://www.siam.org/meetings/ds09/>

Numerical Analysis and Scientific Computation with Applications, May 18-22.

Agadir, Morocco. <http://www-lmpa.univ-littoral.fr/NASCA09/>

International Conference on Engineering and Computational Mathematics (ECM2009), May 27-29.

The Hong Kong Polytechnic University. <http://www.polyu.edu.hk/ama/events/conference/ECM2009/>

International Conference on Scientific Computation and Differential Equations (SciCADE09), May 25-29.

Beijing, China. <http://lsec.cc.ac.cn/~scade09/>

JUNE 2009

Large-Scale Scientific Computations (LSSC), June 4-6.

Sozopol, Bulgaria <http://parallel.bas.bg/Conferences/SciCom09.html>

23rd International Conference on Supercomputing, June 9-11.

IBM T.J. Watson Research Center Metro New York City Area, USA. <http://www.ics-conference.org>

Conference on Scientific Computing and Differential Equations celebrating Ernst Hairer's 60th birthday, June 17-19.

University of Geneva, Switzerland. <http://www.unige.ch/math/hairer60/>

Mathematical Modelling and Computational Methods in Applied Sciences and Engineering, June 22-26.

Roznov pod Radhostem, Czech Republic <http://www.ugn.cas.cz/link/modelling09>

8th International Conference on Spectral and High Order Methods (ICOSAHOM), June 22-26.

Trondheim, Norway. <http://www.math.ntnu.no/icosahom>

23rd Biennial Conference on Numerical Analysis, June 23-26.

Strathclyde University, Glasgow. <http://www.maths.strath.ac.uk/naconf>

European Conference on Numerical Mathematics and Advanced Applications, (ENUMATH 2009) June 29 - July 3.

Uppsala, Sweden. <http://www.akademikonferens.uu.se/enumath2009/>

14th Leslie Fox Prize meeting, June 29.

University of Warwick.

JULY 2009

Sparse Matrices for Scientific Computation: In Honour of John Reid's 70th Birthday, July 15-16.

Abingdon, Oxfordshire. <http://www.numerical.rl.ac.uk/>

AUGUST 2009

20th International Symposium of Mathematical Programming (ISMP), August 23-29.

Chicago, Illinois. <http://www.ismp2009.org/>

Preconditioning 2009, August 24-26.

Hong Kong. <http://www.math.hkbu.edu.hk/precond09/index.html>

EURO-PAR 2009, August 25-28.

Delft University of Technology, The Netherlands. <http://europar2009.ewi.tudelft.nl/>

SEPTEMBER 2009

12th Seminar NUMDIFF on Numerical Solution of Differential and Differential-Algebraic Equations, September 14-18.

CWI, Amsterdam. <http://www.mathematik.uni-halle.de/numdiff>

6th Conference on Applied Mathematics and Scientific Computing, September 14-18.

Zadar, Croatia <http://www.math.hr/~rogina/AplMath09/first.html>

14th Belgian-French-German Conference on Optimization (BFG09), September 14-18.

Leuven, Belgium. <http://www.kuleuven.be/bfg09>

OCTOBER 2009

SIAM Conference on Mathematics for Industry: Challenges and Frontiers (MI09), October 5-8.

San Francisco, USA. <http://www.siam.org/meetings/mi09/>

Woudschoten Numerical Analysis Conference, October 7-9.

Woudschoten Conference Centre, Zeist, The Netherlands.

<http://wsc.project.cwi.nl/conferentieE.php>

SIAM Conference on Applied Linear Algebra (LA09), October 26-29.

Seaside, California.

<http://www.siam.org/meetings/calendar.php>

SIAM Combinatorial Scientific Computing (CSC09), October 29-31.

Seaside, California <http://www.siam.org/meetings/calendar.php>

10 Highlighted Conferences and Workshops

British Applied Mathematics Colloquium 2009
School of Mathematical Sciences, University of Nottingham

The conference will have a compact, three-day format, beginning on Tuesday 7th April and finishing on Thursday 9th April. We wish to attract participation of researchers from all areas of applied and applicable mathematics. The programme will consist of invited plenary lectures, minisymposia, parallel sessions for contributed talks, and poster sessions. It will include a general interest lecture as well as an outreach event on Monday 6th April.

Confirmed plenary speakers are:

- Michael P. Brenner (Harvard University)
- Franco Brezzi (University of Pavia)
- L. Pamela Cook (University of Delaware)
- Alain Goriely (University of Arizona)
- Bjrn Sandstede (Brown University)

There will be the following minisymposia:

- Quantum Chaos and Disordered Systems
- Scientific Computation
- Cells and Networks
- Stochastic Systems and Uncertainty
- Multiphase flow in porous media
- Approaches to Nanofluidics
- Nonlinear Optics and Optical Coherent Structures
- Delay and Difference Equations
- Regenerative Medicine
- Mathematics Education

For further information, see <http://www.bamc2009.org.uk/>

Please send queries to: bamc@nottingham.ac.uk.

Annual European Rheology Conference (AERC) 2009
Cardiff, 15-17 April 2009

AERC 2009 is being organized by the Institute of Non-Newtonian Fluid Mechanics (Wales) and the British Society of Rheology. The aim of AERC 2009 is to contribute to the advancement of Rheology by bringing together interested researchers from Europe and the rest of the world, and bridging traditional themes with modern trends.

Following the tradition of previous European Rheology meetings, AERC 2009 will be a three day conference split into symposia that reflect mainstream or emerging areas of Rheology. There will be minisymposia on blends, copolymers and nanocomposites; process modelling; rheometry and beyond: advanced experimental methods; interfacial phenomena, surfactants and foams; suspensions and colloids; viscoplasticity, solids rheology; biopolymers, biorheology and food rheology; constitutive modelling; non-Newtonian fluid mechanics; computational modelling; flow-induced phase transitions and instabilities; industrial rheology and processing.

Plenary Speakers:

- Christian Bailly (Universite catholique de Louvain, Belgium)
- Jae Hyun (Korea University, Korea)
- Gareth McKinley (Massachusetts Institute of Technology, USA)

In addition, the meeting will include the 2009 Weissenberg Award Lecture and the 2009 BSR Gold Medal Lecture.

For more information see: <http://www.rheology-esr.org/AERC/2009>

**Sparse Matrices for Scientific Computation:
In Honour of John Reid's 70th Birthday
July 15-16, Abingdon, Oxfordshire**

This meeting will bring together leading numerical analysts from the UK and abroad in honour of John Reid's 70th birthday. John is an eminent UK numerical analyst who, over a career spanning five decades, has made many important contributions, particularly in the development of sparse matrix technology. His main contributions include: conjugate gradients as an iterative method, Markowitz' pivoting for sparse matrices, estimating sparse Jacobians, factorizing and updating linear programming bases, steepest-edge simplex algorithm, the multifrontal method for sparse linear systems, using 2×2 pivots for sparse symmetric indefinite matrices, and ordering sparse matrices for small wavefront and profile.

The meeting will be held over two days, with a celebratory dinner on 15 July. All talks will be by invitation. Speakers will include:

- Andrew Cliffe, University of Nottingham
- Jack Dongarra, University of Tennessee
- Iain Duff, STFC Rutherford Appleton Laboratory
- Al Erisman, Seattle Pacific University
- Roger Fletcher, FRS, University of Dundee
- Shaun Forth, Cranfield University
- Sven Hammarling, Principal Consultant at NAG
- Kaj Madsen, Technical University of Denmark
- Nancy Nichols, University of Reading
- Beresford Parlett, University of California
- Michael Powell, FRS, University of Cambridge
- John Reid, STFC Rutherford Appleton Laboratory
- Michael Saunders, Stanford University
- Jennifer Scott, STFC Rutherford Appleton Laboratory
- Nick Trefethen, FRS, Oxford University

The meeting will be held at Cosener's House. Cosener's House occupies a picturesque Thames side position in the grounds of the ancient abbey of Abingdon in south Oxfordshire. Please note that the number of places available at this meeting is limited. It is expected to be a popular event and so, if you are interested in attending, you are advised to secure a place by registering as soon as possible. Thanks to partial funding from the IMA and the LMS, we are able to offer a special rate for students and postdocs.

For further details and to register, please go to <http://www.numerical.rl.ac.uk/people/hsd/jkr/>

Jennifer Scott (jennifer.scott@stfc.ac.uk)

**Third International Symposium on
Instabilities and Bifurcations in Fluid Dynamics
10-13 August 2009, Nottingham**

This symposium will include papers covering all aspects of instabilities, particularly those relevant to fluid mechanics and heat and mass transfer. Topics will range from basic research and development to applied and advanced technology, including novel experimental and computational techniques focusing on multiscale phenomena. Interdisciplinary papers that bridge theoretical, experimental, and computational approaches and papers that provide innovative concepts and analyses, or especially new insight into hydrodynamics and nonlinear instabilities are most welcome.

Invited speakers (with tentative titles of their lectures):

- Tom Mullin, University of Manchester. *Bifurcation phenomena in pipes and channels.*
- Dwight Barkley, University of Warwick. *Direct optimal growth analysis for timesteppers.*

- Fabian Waleffe, University of Wisconsin. *The coherence of turbulence: 3D unstable coherent states in canonical shear flows.*

You are invited to submit an extended abstract of up to 500 words on any of the topics covered by the symposium. Abstracts should be submitted no later than **January 31, 2009**.

More information is available at <http://www.eng.tau.ac.il/conferences/Bifurcations-and-Instabilities>.

Andrew Cliffe (University of Nottingham, e-mail: andrew.cliffe@nottingham.ac.uk)

11 Software News

NAG

The editor's request for contributions has been well-timed. Not only can I take the opportunity to wish you all a very 'Happy New Year', but I can impose upon your good natures to help us with planning for future Libraries whilst you are still in a holiday mood.

The code for Mark 22 of our Fortran Library is now 'frozen' and the contents thus fixed; developers are now starting the implementations and code for the C library is being derived and processed. As ever with the NAG Libraries a large part of the library effort is devoted to the development of test programs and C library Mark 9 is no exception. We anticipate early releases to take place in the latter part of 2009.

We now need your help in suggesting what functionality you would like to see in future libraries. We have a database of requests and our first planning meeting has made a first pass through these to determine which we can meet at Marks 23 and 10 of our libraries. It would not be too late to add to this list, so please, tell us what routines you would like to see. You may email me (david.sayers@nag.co.uk, or mick.pont@nag.co.uk) and we will ensure that it gets entered into our 'functionality requests' database.

One area we discussed concerned sparse matrix representation. We looked at whether we should include utility routines to convert between different storage conventions. The general feeling was that these would be a valuable addition.

Of course, a new library means new NAG Toolboxes for MATLAB with increased functionality. These will be rolled out next year as our Mark 22 libraries are produced. Our existing toolboxes have proved very popular and one question has arisen concerning MATLAB sparse matrix types. Currently none of our Toolbox routines accept the Sparse Array type as legitimate arguments; sparse arrays must be converted to full arrays using the MATLAB 'full' procedure. For example if A is sparse array you need to type `AA=full(A)` and enter AA as the actual argument to the NAG Toolbox routine.

Readers may wish to look at <http://www.cise.ufl.edu/research/sparse/RBio/>. This has no connection to NAG but some of our users have employed utilities from this site in conjunction with the NAG Toolbox for MATLAB. RBio is distributed under the GNU GPL license and seems to be a very useful suite of routines to aid conversion between sparse matrix representations.

David Sayers (David.Sayers@nag.ac.uk)

12 PhD Theses

Bath

Richard Norton. Numerical Computation of Band Gaps in Photonic Crystal Fibres.

<http://www.maths.ox.ac.uk/ldapcontact/userdetails/norton>

Zhivko Stoyanov Spectral Graph Theory and Algorithms for Networks.

<http://people.bath.ac.uk/mapzvs/>

13 MSc Dissertations

Reading: MSc Course Mathematical Modelling of the Atmosphere and Oceans

Fawzi Al Busaidi. Flood Prediction and Uncertainty by Evangelia-Maria Giannakopoulou Discretization On Non-uniform Meshes: Tests solving Shallow-Water Equations.

David Mincham. Adaptive Mesh Refinement.

Gillian Morrison. Numerical Modelling of Tidal Bores using a Moving Mesh.

Victoria Heighton. Every snowflake is different - investigating the effect of the variability in snowflake shape on aggregation.

Rachel Pritchard. Evaluation of Fractional dispersion Models.

Tom Jordan. Does self-organised criticality occur in the tropical convective system?

Chris Bowden. A first step towards the calculation of a connectivity matrix for the Great Barrier Reef.

Reading: MSc course for Mathematics of Scientific and Industrial Computation

Elena Panti. Boundary Element Method for Heat Transfer in a Buried Pipe.

Andrew Ash. Examination of non-Time Harmonic Radio Waves Incident on Plasmas.

Chloe Ward. Oscillatory integrals.

Cassandra Moran. Harbour Modelling and Resonances.

Muhammad Akram. Linear and Quadratic Finite elements for Moving Mesh Method.

Christopher Warner. Forward and inverse water-wave scattering by topography.

Modelling water uptake in rice using moving meshes.

Juri Parrinello. Blow-up in the nonlinear schrodinger equation using an adaptive mesh method.

Ashley Twigger. Examination of non-Time Harmonic Radio Waves Incident on Plasmas.

14 Vacant positions and studentships

Heriot-Watt University: Chair in Computational Biology - Ref 169/08/W

The Life and Physical Sciences Interface Theme at Heriot-Watt University wishes to appoint a Professor of Computational Biology. The post is based in the School of Mathematical and Computer Sciences (MACS) and a major element of the role is to build multidisciplinary interactions with other groups in the university with excellent research in the Life Sciences and Interfaces. Applicants should have a track record in a mathematical, statistical or computational aspect of biology.

Applicants are welcome from outstanding applicants at all career stages and an appointment may be made at any level up to Chair. For recruitment to senior levels, an outstanding track record of winning research funding as a principal investigator is required.

Closing date: 31 January 2009. Please see : http://www.hw.ac.uk/hr/v_academic.php#16808

University of Warwick: Faculty Positions, Math/Applied Math

There are several openings in Applied Mathematics and Pure Mathematics at the Mathematics Institute, University of Warwick:- 3 Assistant Professorships (permanent) and 2 three year fixed position Assistant Professorships (a. k. a. Warwick Zeeman Lectureships). Applications are invited in all areas of Applied and Pure Mathematics. See <http://www2.warwick.ac.uk/fac/sci/mathsjobs>.

Informal enquiries from potential applicants in numerical analysis, computational applied mathematics, mathematical analysis, modelling and PDEs with applications in the physical and life sciences may be addressed to Charlie Elliott (C.M.Elliott@warwick.ac.uk) or Andrew Stuart (A.M.Stuart@warwick.ac.uk).

Imperial College: Research Associate

A research position is available to work within a large vibrant team (<http://amcg.ese.ic.ac.uk>) within the Department of Earth Science and Engineering developing a multi-scale ocean model based upon unstructured adaptive meshes and finite element-control volume methods. Applicants with experience of numerical methods development or scientific computing are encouraged to apply.

This is a fixed term post for three years in the first instance. Salary in the range 26,580 – 38,730 GBP per annum. Closing date: 10 January 2009. Further details may be found at <http://www3.imperial.ac.uk/employment/research/en20080274>

University of Warwick: Postdoctoral Positions

2 postdoctoral positions in Bayesian Inverse Problems in Differential Equations are available from 1 October 2009, to work with Andrew Stuart (Warwick University). In addition, a postdoctoral position in Nonlinear Filtering in High Dimensions is available from 1 October 2009, to work with CKRT Jones and AM Stuart (Warwick University) and T. J Lyons and J Norbury (Oxford). For details, see <http://www.warwick.ac.uk/~masdr/postdoc.html>

University of Oxford: Postdoctoral Position

Professor Nick Trefethen is looking for a post-doc to work with him for two years at Oxford University Computing Laboratory on the subject of Adaptive Spectral Methods for Solving PDEs in 1D and 2D. If you have interest in areas such as spectral methods, complex variables, polynomial and rational approximation of functions, and elegant programming in Matlab, please apply! See <https://www.maths.ox.ac.uk/node/8186> for details. Note that the application deadline is 9 January, 2009 and the position is available from April 1.

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- 862-887 Arieh Iserles and Syvert P. Norsett.
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- 888-908 Hendrik Speleers, Paul Dierckx, and Stefan Vandewalle.
Multigrid methods with Powell Sabin splines.

For further details see: www.imanum.oupjournals.org

16 Postgraduate Courses

Only those courses that were not included in the newsletter from October 2008 (available at http://www.ima.org.uk/learned_soc/interestgroups.htm) are listed here.

Heriot-Watt University: MSc in Computational Mathematics

This is a new postgraduate course to provide students with a clear understanding of the main issues in performing and analysing scientific computations. Accurate and efficient scientific computations lie at the heart of most cross-discipline collaborations. It is key that such computations are performed in a stable, efficient manner and that the numerics converge to the true solutions, dynamics of the physics, chemistry or biology in the problem. We are currently recruiting for entry in September 2009. The course can be taken full time over 12 months or part-time over a longer period.

Funding of fees should be available through SAAS for those eligible.

Details at <http://www.ma.hw.ac.uk/mscapmasc/cmindex.php>

Postgraduate Open Afternoon 11 March 2009 Come to see what we can offer MSc and PhD students.

Gabriel Lord (gabriel@ma.hw.ac.uk)

17 Acknowledgements

I would like to thank the following people for contributing to this issue of the Newsletter.

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Gabriel Lord (Heriot-Watt)
Tim Phillips (Cardiff)
David Sayers (NAG)
Anne Trefethen (Oxford)
Jan van Lent (Bath)