ICIAM 99
5 - 9 July 1999

Wednesday, 7 July, Afternoon Session
Overview

	14.00 – 14.45 Plenary Lectures	
	A JAMESON, *Advances in Computional Fluid Dynamics*	MH
	A M LINAN, *The Role of Multiple Scales in Combustion Theory*	GS
	14.55 – 15.40 Plenary Lectures	
	H BERESTYCKI, *Some Nonlinear PDE's in Combustion Theory*	GS
	Olivier PIRONNEAU, *Domain Decomposition and Fast Parallel Solvers for the Navier-Stokes Equations*	MH
	16.00 – 18.00 Mini-Symposia	
MSP-024	New Developments in Partial Differential Equations, in the Calculus of Variations, in Simulation and Applications to Materials VI	WRB-11
MSP-043	Mathematical Aspects of Finance	WRB-8
MSP-049	Mathematical Modeling of Electromagnetics III	DHT-N
MSP-056	Modelling and Analysis for Optical Communications; Beam and Pulse Propagation; Dispersion-Management II	WRB-10
MSP-060	Mathematical Methods in Solid Mechanics II	DHT-C
MSP-064	Mathematics Applied to Quantum Chemistry: Theoretical, Computational and Experimental Aspects II	DHT-4.01
MSP-070	Applications of Optimal Mass Transfer Problems to Meteorology and Oceanography	DHT-S
MSP-117	New Developments in Shape Optimization	AFB-10
MSP-118	Computational Aspects of Distributed Parameter Estimation in Applications Involving PDEs	AT-2B
MSP-120	Large Numbers of Students of Mathematics: How to Assess II	AT-3
MSP-121	Characteristic-Based Accurate Simulations to Advection-Dominated Porous Media Flows	AT-1
MSP-124	Recent Advances on Splitting Methods for Partial Differential Equations in the Honour of Gilbert Strang	AT-4
MSP-131	Advances in Numerical Methods for Wave Propagation II	DHT-B
MSP-132	Kinetic and Relaxation Methods for Hyperbolic Conservation Laws	AT-6
MSP-144	Mathematical Problems in Circuit Simulation	AT-8
MSP-157	Multiphase Flows in Porous Media	MS-1
MSP-163	Parallel Software for Sparse Matrices and Applications	MS-3
MSP-170	The Mortar Element Method for High Order Discretizations: The Mortar Spectral Element Method, Other High Order Discretizations with Mortars II	AT-5
MSP-196	Phase Field Models and Prediction of Micro-Morphological Changes in Alloys II	WRB-2
MSP-206	Methods of Dimension Reduction II	WRB-4
MSP-224	High Accuracy Solutions of Partial Differential Equations	MS-4
MSP-227	Diffusion and Convection in Random Media	MS-5
MSP-231	Models, Analysis and Algorithms for Superconductivity II	WRB-9
MSP-236	MHD-IV: Liquid-Metal Flows at High Hartmann and Reynolds Numbers	AT-2
MSP-237	Multigrid Methods for Optimization Problems	DHT-4.18
MSP-244	Java for Computational Science and Engineering II	DHT-3.01
MSP-252	Mathematical Modelling and Computational Aspects in Blood Flow II	WRB-1
	16.00 – 18.00 Contributed Presentations: Lectures	
C-15	Numerical Methods in Differential Equations IV	AFB-13

C-16	Fluid Mechanics IV	AFB-14
C-17	Analysis	AFB-17
C-25	Computational Fluid and Solid Mechanics II	AFB-18
C-33	Numerical Linear Algebra and Discrete Mathematics	AT-2.A2
C-36	Simulation, Neural Networks, Geometric Modelling, Linear and Nonlinear Programming	AT-2D
C-40	Optimization II	WRB-3
16.00 – 18.00 Contributed Presentations: Posters		
This is the continuation of the morning session, see p. 96		

Also this evening		
17.00 - 19.00	**Mathematics and the Law Symposium**, see p. 222	Royal Society of Edinburgh
20.00 – 24.00	**Scottish Evening**, see p. 220	Teviot Row House

Wednesday, 7 July, Afternoon Session
Details

14.00 – 14.45 Plenary Lectures

Plenary Lecture McEwan Hall
A JAMESON (Princeton University, USA)
Advances in Computional Fluid Dynamics

Chair: J C R HUNT (Cambridge University, UK)

Plenary Lecture George Square Lecture Theatre
A M LINAN (Universidad Politecnico Madrid, Spain)
The Role of Multiple Scales in Combustion Theory

Chair: A A LACEY (Heriot-Watt University, UK)

14.55 – 15.40 Plenary Lectures

Plenary Lecture George Square Lecture Theatre

H BERESTYCKI (University of Paris VI, France)

Some Nonlinear PDE's in Combustion Theory

Chair: A A LACEY (Heriot-Watt University, UK)

Nonlinear partial differential equations of various kinds abound in the modelling of combustion phenomena. From a mathematical viewpoint, they often lead to challenging problems and new developments.
In view of the complexity of an exhaustive description, it is customary to study partial systems which emphasize some specific aspects. Indeed, the modelling of reactive flows involves fluid dynamics, chemical kinetics, diffusion, heat conduction and transport mechanisms.
The objective of this presentation is to review the progress and open problems in the study of several such systems set in the framework of the thermo-diffusive model. There, the underlying velocity field of the fluid is taken as prescribed and the equations have the form of reaction diffusion and convection systems. Flames are thought of as travelling front like solutions. Besides distributed equations, it is also classical to consider the limit of vanishing flame width. Through a singular limit, one is then led to free boundary problems in which flames are concentrated on surfaces.
Both types of models are discussed. The propagation of flames is considered in several geometrical settings : in tubes, in space, with various types of velocity fields, Bunsen burner type settings and flames under the influence of gravity.
One of the main themes is to understand how the existence and shapes of flames as well as the speed at which they propagate are related to the geometry and to the amplitude and frequency of oscillations of the velocity field. These considerations are relevant for models of turbulent combustion. A related topic is the influence of stirring on the limits of thermal explosions.

Plenary Lecture McEwan Hall

Olivier PIRONNEAU (University of Paris VI, France)

Domain Decomposition and Fast Parallel Solvers for the Navier-Stokes Equations

Chair: J C R HUNT (Cambridge University, UK)

Domain decomposition is a straightforward approach to parallelization of Partial Differential equations solvers. But the following difficulties must be solved:
- - Consistency of the approximations, whether the mesh match at the domain intersections with or without overlaping
- - Convergence and efficiency of the iteration schemes such as Schwarz algorithm, Chebichev or conjugate gradient iterations on the Schur complement problem. - - Implementation with PVM/MPI or others.
This talk will discuss these issues for the Navier-Stokes equations in 2 and 3 dimensions. Numerical results with several million points on unstructured mesh obtained by our team will also be discussed.

16.00 – 18.00 Mini-Symposia

MSP-024 William Robertson Building, Seminar Room 11

New Developments in Partial Differential Equations, in the Calculus of Variations, in Simulation and Applications to Materials VI

(see also Part I, MSP-019, p. 13; Part II, MSP-020, p. 29; Part III, MSP-021, p. 47; Part IV, MSP-022, p. 64; Part V, MSP-023, p. 82)

Organisers: FONSECA, Irene (Center for Nonlinear Analysis, Carnegie Mellon University, Pittsburgh, USA)
KINDERLEHRER, David (Center for Nonlinear Analysis, Carnegie Mellon University, Pittsburgh, USA)

MSP-043 William Robertson Building, Lecture Theatre 8

Mathematical Aspects of Finance

Organiser: KUSUOKA, Shigeo (University of Tokyo, Japan)

This mini-symposium aims to clarify theoretical and empirical aspects of financial modelling, option pricing and risk management. The topics may include financial time series analysis, efficient numerical computation of high-dimensional or infinite-dimensional integration and optimal stochastic control problems.

MSP-049 David Hume Tower, Faculty Room North

Mathematical Modeling of Electromagnetics III

(see also Part I, MSP-047, p. 66; Part II, MSP-048, p. 82)

Organisers: AMMARI, Habib (Ecole Polytechnique, France)
BAO, Gang (University of Florida, USA)

MSP-056

William Robertson Building, Seminar Room 10

Modelling and Analysis for Optical Communications; Beam and Pulse Propagation; Dispersion-Management II

(see also Part I, MSP-055, p. 83)

Organisers: SANDSTEDE, Björn (Ohio State University, Columbus, USA)
JONES, Christopher K R T (Brown University, Providence, USA)

GABITOV, Ildar R (Los Alamos National Laboratory, USA) *Four-wave mixing in soliton optical fiber links with dispersion management* (p. 60)
KUTZ, J Nathan (Department of Applied Mathematics, University of Washington, USA) *Dynamics and bifurcations of a planar map modelling dispersion managed breathers* (p. 61)
TURITSYN, Sergei K (Division of Electrical Engineering and Computer Science, Aston University, Birmingham, UK) *Internet equation* (p. 61)
WABNITZ, Stefan (University of Bourgogne, France) *Dynamics of soliton collisions in strongly dispersion managed fiber systems* (p. 61)
ZHARNITSKY, Vadim (Brown University, USA) *Stable pulse propagation in dispersion managed systems* (p. 62)

MSP-060

David Hume Tower, Lecture Theatre C

Mathematical Methods in Solid Mechanics II

(see also Part I, MSP-059, p. 84; Part III, MSP-061, p. 121; Part IV, MSP-062, p. 141)

Organisers: KAPLUNOV, Julius D (Institute for Problems in Mechanics, Russia)
WAN, Frederic Y M (University of California, Irvine, USA)

KOSSOVICH, Leonid Yu (Saratov State University, Russia) *Flexural transient waves in shells of revolution: An asymptotic approach* (p. 65)
LE, Khanh Chau (Lehrstuhl fuer Allgemeine Mechanik, Ruhr-Universitaet Bochum, Germany) *High-frequency vibrations of shells and rods: Variational-asymptotic approach* (p. 65)
SIMMONDS, James G (Univ. of Virginia, Charlottesville, USA) *Computing exact, elastodynamic linear three-dimensional solutions for plates from classical two-dimensional solutions* (p. 66)
SPENCER, Anthony J M (University of Nottingham, UK) *Exact solutions for inhomogeneous thick elastic plates* (p. 66)
WAN, Frederic Y M (University of California at Irvine, USA) *The outer asymptotic expansion solution without matching* (p. 66)

MSP-064

David Hume Tower, Room 4.01

Mathematics Applied to Quantum Chemistry: Theoretical, Computational and Experimental Aspects II

(see also Part I, MSP-063, p. 84; Part III, MSP-065, p. 121; Part IV, MSP-066, p. 141)

Organiser: LE BRIS, Claude (Ecole Nationale des Ponts et Chaussées, France)

CATTO, Isabelle (CNRS & CEREMADE, Université Paris-Dauphine, France) *Hartree-Fock type models for crystals* (p. 68)
BOKANOWSKI, Olivier (Universite Paris 7 and Paris 6, France) *High density limits to the Thomas-Fermi-von Weizsäcker-Dirac model via deformations of plane waves* (p. 67)
BLANC, Xavier (Ecole Nationale des Ponts et Chaussées, France) *On the algorithms in use in the simulation of the solid phase* (p. 67)
KRESSE, Georg (Institu für Materialphysik, Universität Wien, Austria) *VASP: An efficient and versatile plane wave pseudopotential program* (p. 69)
RAYBAUD, Pascal (Institut Français du Pétrole (IFP), France) *Ab-initio calculations applied to heterogeneous hydrodesulfurization catalysis* (p. 70)

MSP-070 David Hume Tower, Faculty Room South

Applications of Optimal Mass Transfer Problems to Meteorology and Oceanography

Organisers: DOUGLAS, Robert J (University of Reading, UK)
CULLEN, Michael J P (UK Meteorological Office)

Monge (1781) posed the prototype optimal mass transfer problem: given two sets of equal volume, find the optimal volume-preserving mapping between them, where optimality is measured against a cost function. Such problems arise when studying the semigeostrophic equations, which describe certain motions of the atmosphere and provide a mechanism for the modelling of fronts; these discontinuities can be described by singularities of a mapping. Recent research has focussed on regularity theory, and existence of optimal mappings when the sets are replaced by manifolds. The latter is relevant to semigeostrophic theory in spherical geometry. Both numerical work and theory will be discussed.

BENAMOU, Jean-David (INRIA-Rocquencourt, France) *Computation of generalized Monge-Kantorovich distances* (p. 73)
CULLEN, Michael J P (ECMWF, UK) *Applications of the Monge transport problem to meteorology and oceanography* (p. 73)
BRENIER, Yann (IUF and University Paris 6, France) *Kantorovich distance and particle schemes* (p. 73)
GANGBO, Wilfrid (Georgia Institute of Technology, USA) *Uniqueness of equlibrium configurations in solid crystals* (p. 74)
MCCANN, Robert J (University of Toronto, Canada) *Optimal transportation on manifolds with obstacles* (p. 74)

MSP-117 Adam Ferguson Building, Room 10

New Developments in Shape Optimization

Organisers: SOKOLOWSKI, Jan (Institut Elie Cartan, Université Henri Poincaré, Nancy, France)
PIERRE, Michel (ENS de Cachan, Antenne de Bretagne, Bruz, France)

Shape optimization is a specific area among optimization problems where the main variable is a subset of R^N. It comes out in lots of applications in engineering, mechanics, electromagnetism, material sciences, geometry, etc. It also raises new interesting and challenging mathematical and computational problems. Current research is very active in particular for the development of the numerical computation of shapes and for the analysis of optimal shapes : regularity, geometric properties, sensitivity,... The goal of this mini-symposium is to present some recently developed techniques in the field together with applications. A new notion of "domain derivative", so-called "topological derivative" will be discussed and applied to Laplace and elasticity problems; an original application of shape optimization in electromagnetism will be presented; a geometric study of optimal shapes will be described.

SOKOLOWSKI, Jan (Institut Elie Cartan, University Henri Poincare Nancy I, France) *Topological derivative, Part I. Laplace equation* (p. 114)
ZOCHOWSKI, Antoni (Systems Research Institute of the Polish Academy of Sciences, Poland) *Topological derivative, Part II. Elasticity system* (p. 114)
HÖMBERG, Dietmar (Weierstrass Institute for Applied Analysis and Stochastics, Germany) *Optimal shape design of inductor coils for surface hardening* (p. 114)
JOUVE, François (CMAP, Ecole polytechnique, France) *Eigenfrequency optimization in optimal design* (p. 114)
HENROT, Antoine (Ecole des Mines and Institut Elie Cartan, Nancy, France) *Convexity of optimal shapes* (p. 113)

MSP-118

Appleton Tower, Room 2B

Computational Aspects of Distributed Parameter Estimation in Applications Involving PDEs

Organisers: ASCHER, Uri M (Department of Computer Science, University of British Columbia, Vancouver, Canada)

HABER, Eldad (Department of Computer Science, University of British Columbia, Vancouver, Canada)

Many applications in diverse areas such as geophysical exploration and medical imaging involve the reconstruction of parameter functions from noisy observations on solutions of models consisting of PDEs. The usual approaches have been based on direct or indirect integral equation formulations. However, numerical approaches involving the discretized differential equations of the forward model hold the promise of increased efficiency. Such advantage can be gained by exploiting sparsity, multilevel approaches, and improved methods for solving the constrained, nonlinear data fitting problems that arise. This minisymposium will explore such computational methods.

VOGEL, Curtis R (Montana State University, USA) *Multilevel preconditioners for regularized inverse problems* (p. 115)

HANKE, Martin (Fachbereich 17 Mathematik, Johannes-Gutenberg-Universität Mainz, Germany) *A new method in impedance tomography imaging* (p. 115)

TAI, Xue-Cheng (Department of Mathematics, University of Bergen, Norway) *Identification of discontinuous coefficients from elliptic problems using total variation regularization* (p. 115)

HABER, Eldad (University of British Columbia, Canada) *Solution of large scale inverse problems using inexact Krylov-Newton method* (p. 115)

MSP-120

Appleton Tower, Lecture Theatre 3

Large Numbers of Students of Mathematics: How to Assess II

(see also Part I, MSP-119, p. 86)

Organisers: BARRY, Michael DJ (University of Bristol, UK)

SIMS WILLIAMS, Jonathan H (University of Bristol, UK)

SUTHERLAND, Rosamund (University of Bristol, Graduate School of Education, UK)

CLEMENTS, Dick R R (University of Bristol, UK) *Essential mathematical concepts needed by users of computer algebra* (p. 116)

LABORDE, Colette (Laboratoire Leibniz-IMAG, University Joseph Fourier, Grenoble, France) *Core geometrical knowledge for using the modelling power of geometry with Cabri-geometry* (p. 116)

MUSTOE, Leslie R (Loughborough University, UK) *How far should the residual core of mathematics be affected by the computer?* (p. 117)

CROFT, Anthony C (Loughborough University, UK) *A residual mathematical core for the incorporated engineer* (p. 116)

SUTHERLAND, Rosamund (University of Bristol, Graduate School of Education, UK) *School algebra and the symbol sense of the adult mathematician* (p. 117)

MSP-121

Appleton Tower, Lecture Theatre 1

Characteristic-Based Accurate Simulations to Advection-Dominated Porous Media Flows

Organisers: WANG, Hong (University of South Carolina, Columbia, South Carolina, USA)

LYONS, Stephen L (Mobil Technology Company, Dallas, Texas, USA)

The mathematical models for describing reservoir simulation, environmental fluid flows, and many other applications often lead to coupled systems of advection-dominated PDEs and constraining equations. Their numerical treatment presents severe difficulties. Conventional finite difference or finite element methods generate numerical solutions with severe oscillations. Various upwinding-based improvements tend to introduce excessive numerical dispersion and restrict the time step size, while characteristic-based methods have difficulty in treating general boundary conditions and conserving mass. In this minisymposium, the speakers will present improved numerical methods, based on or related to the ELLAM (Eulerian-Lagrangian Localized Adjoint Method) methodology, which allow large time steps to be used in generating accurate solutions and conserve mass, and their application to reservoir simulation, etc. This minisymposium is intended for audiences from academic and industrial areas, who are interested in advection-diffusion equations, porous media flows.

EWING, Richard E (Institute for Scientific Computation, Texas A&M University, College Station, Texas, USA) *Mathematical modeling and simulation for applications of fluid flow in porous media* (p. 117)
LYONS, Stephen L (Upstream Strategic Research Center, Mobil Technology Company, Texas, USA) *A family of Eulerian-Lagrangian localized adjoint methods for multi-dimensional advection-reaction equations* (p. 118)
QIN, Guan (Upstream Strategic Research Center, Mobil Technology Company, Texas, USA) *Analysis of a compositional model for fluid flow in porous media* (p. 118)
WANG, Hong (University of South Carolina, Columbia, USA) *An ELLAM-MFEM approximation to miscible displacement in porous media* (p. 118)
LIN, Tao (Department of Math., Virginia Tech., USA) *A non-conformal immersed finite element method for interface problems* (p. 117)

MSP-124

Appleton Tower, Lecture Theatre 4

Recent Advances on Splitting Methods for Partial Differential Equations in the Honour of Gilbert Strang

Organiser: KHALIQ, Abdul Q (Western Illinois University, USA)

Splitting methods for partial differential equations have been most frequently studied for several years. The splitting technique of breaking a multi-dimensional problem down into sequence of one dimensional problem has led to the development of so called Alternating Direction Implicit(ADI) methods and Locally One Dimensional (LOD) or fractional step methods. Splitting methods for time dependent PDEs, mainly based on Strang splitting have drawn considerable attention in the literature. Many physical models involve multidimensional PDEs thereby, requiring large scale computation and parallel algorithms. In this mini-symposium recent advances on splitting methods for multidimensional non linear system of PDEs in Computational air pollution modelling, climate related problems, isothermal autocatalytic chemical systems, and in mathematical biology are discussed.

VERWER, Jan G (Center for Mathematics and Computer Science (CWI), The Netherlands) *Results on splitting stiff advection-diffusion-reaction problems* (p. 121)
TEMAM, Roger (Indiana University, Department of Mathematics, USA) *Some remarks on dynamic multilevel methods* (p. 121)
FAIRWEATHER, Graeme (Colorado School of Mines, USA) *Alternating direction implicit orthogonal spline collocation methods for initial/boundary value problems* (p. 120)
KHALIQ, Abdul Q (Western Illinois University, USA) *Parallel LOD methods for reaction-diffusion systems* (p. 120)

MSP-131

David Hume Tower, Lecture Theatre B

Advances in Numerical Methods for Wave Propagation II

(see also Part I, MSP-130, p. 87)

Organiser: HAGSTROM, Thomas (University of New Mexico, New Mexico, USA)

ENGQUIST, Bjorn (KTH, Stockholm, Sweden) *To be announced*
LEVEQUE, Randall J (University of Washington, USA) *High-resolution methods for wave propagation in random media* (p. 126)
ALPERT, Bradley K (National Institute of Standards and Technology, USA) *Rapid evaluation of exact nonreflecting boundary conditions* (p. 125)
RADVOGIN, Yulian B (Keldysh Institute of Applied Mathematics, Moscow, Russia) *The characteristic surfaces method for constructing transparent boundary conditions in the nonseparable variables case* (p. 126)

MSP-132 Appleton Tower, Seminar Room 6

Kinetic and Relaxation Methods for Hyperbolic Conservation Laws

Organiser: NATALINI, Roberto (Istituto per le Applicazioni del Calcolo "M. Picone", Italy)

In recent years many people have started to consider the kinetic approximation of solutions to hyperbolic systems of conservation laws. The starting point is the kinetic approximation of fluid dynamic equations, a classical problem in mathematical physics: as well known the Euler equations can be formally obtained as the fluid dynamical limit of the Boltzmann equation. Important results about classical Boltzmann models as well as discrete velocities models has been obtained during the last decade. Actually there are now many formal and rigorous investigations about the fluid dynamical limit for that models, starting from the celebrated Broadwell model, as long as the limit solutions are smooth. The rigorous theory of kinetic approximations for (entropy) solutions with shocks is more recent and mainly developed when the limit equation is scalar. Some convergence results were given first by using continuous velocities BGK models. Other results have then been established for special systems or partially kinetic approximations. Another interesting approximation, in connection with the very closed framework of lattice Boltzmann and lattice BGK models, is given by the discrete velocities BGK models. These models arise as a generalization of the relaxation approximations and allow the construction of very good schemes with some important features: great simplicity, a very low cost (no need of Riemann solvers or MUSCL–type reconstruction), wide range of applicability, natural formulation for multidimensional problems. There are many recent rigorous results in this direction. The aim of the minisymposium could be to give an account of the problems and developments presented above, also in connection with the applications, by presenting some outstanding recent researches in the field.

AREGBA-DRIOLLET, Denise (Mathématiques Appliquées de Bordeaux, Université Bordeaux 1, France) *Some kinetic type schemes for gas dynamics* (p. 126)

SERRE, Denis A G (Ecole Normale Supérieure de Lyon, France) *The stability and convergence of semi-linear relaxation* (p. 127)

TZAVARAS, Athanasios E (University of Wisconsin-Madison, USA) *On the kinetic formulation of* 2×2 *systems of conservation laws* (p. 127)

GUARGUAGLINI, Francesca R (Dipartimento di Matematica Pura e Applicata, Universitá degli Studi dell'Aquila, Italy) *A kinetic hyperbolic approximation to quasilinear diffusion problems* (p. 127)

MSP-144 Appleton Tower, Seminar Room 8

Mathematical Problems in Circuit Simulation

Organisers: TISCHENDORF, Caren (Lunds Universitet, Sweden)
HIGUERAS, Inmaculada (Universidad Publica de Vavarra, Spain)

The numerical simulation of electrical networks is an important part of the development of integrated circuits. In general, the model equations arising from automatic circuit analysis tools form a differential-algebraic system (DAEs). Unfortunately, these DAEs are often highly nonlinear and not in Hessenberg form, but they provide some structure that should be used by numerical solvers. From the experience with ODEs, we know that the stability properties of the system should also be taken into account and that it would be desirable to maintain them for the numerical solution. On the other hand, some problems occurring during the numerical simulation of network equation systems are often due to inconsistent initial values. In this minisymposium we want to focus onto two problems. Firstly, asymptotic properties and new numerical methods preserving the asymptotic behaviour of solutions are discussed. Secondly, we argue new technics for computing consistent initial values for DAEs arising from circuit simulation.

HIGUERAS, Inmaculada (Universidad Pública de Navarra, Pamplona, Spain) *Numerical methods preserving contractivity* (p. 136)

TISCHENDORF, Caren (Lunds University, Sweden) *Asymptotic properties of DAEs in circuit simulation* (p. 137)

GÜNTHER, Michael (TU Darmstadt, Fachbereich Mathematik, Germany) *PDAE models for electrical network simulation* (p. 136)

LAMOUR, René (Humboldt-University of Berlin, Germany) *Calculation of consistent initial values of lower index DAEs* (p. 136)

SCHEIN, Oliver (Technische Universitaet Darmstadt, Germany) *Stochastic differential algebraic equations for noise in circuits* (p. 136)

MSP-157 Management School, Lecture Theatre 1
Multiphase Flows in Porous Media

Organisers: FASANO, Antonio (Department of Mathematics "U. Dini", Univ. of Florence, Italy)
VAN DUIJN, C J (Center for Mathematics and Computer Science (CWI), The Netherlands)

An important characteristic of multi-phase flow in porous media is capillary pressure between phases. In two-phase flow one often uses the Leverett model, in which the capillary pressure is a unique function of a fluid saturation and inversely proportional to a scaling factor which is related to the absolute permeability. It is shown how this leads to trapping of oil in heterogeneous media. Recently, the Leverett model has been modified to include dynamic effects. This modification involves the time derivative or the saturation. Its mathematical consequences will be discussed. In the steam problem (three phases) it is shown how different forms of capillary pressures carry over in the hyperbolic limit. Capillarity also plays a role in the penetration of wetting fronts through a porous layer with water absorbing granules, giving rise to a complex free boundary problem with a fluid being present in a trapped and in a flowing phase.

VAN DUIJN, C J (Center for Mathematics and Computer Science (CWI), Amsterdam, The Netherlands) *Oil trapping in heterogeneous porous media*
BRUINING, J (Fac. of Civil Engineering and Applied Earth Sciences, Delft, The Netherlands) *Uniqueness conditions in a hyperbolic model for oil recovery by steamdrive*
HULSHOF, Josephus (Mathematical Institute of the Leiden University, The Netherlands) *Mathematical analysis of dynamic capillary pressure* (p. 147)
FASANO, Antonio (Department of Mathematics "U.Dini", Univ. of Florence, Italy) *Flows in porous media with hydrophile granules* (p. 147)

MSP-163 Management School, Lecture Theatre 3
Parallel Software for Sparse Matrices and Applications

Organisers: HAMMARLING, Sven (NAG Ltd, Oxford, UK)
DUFF, Iain S (Rutherford Appleton Laboratory, UK)

In this minisymposium we shall look at two EC funded projects, PARASOL and PINEAPL, that are involved with the development of parallel software for sparse matrix computations, and the use of that software in industrial applications. There will be two talks describing the algoriths and software being developed in the projects, and two talks describing end user applications that are utilising the software.

DUFF, Iain S (Rutherford Appleton Laboratory, UK) *Sparse matrix software in the Parasol project* (p. 152)
DERAKHSHAN, Mishi (NAG Ltd, UK) *The PINEAPL project and the solution of sparse linear equations* (p. 152)
BJØRSTAD, Petter (University of Bergen, Norway) *PARASOL, A parallel library for large sparse linear systems* (p. 151)
D'AMBRA, Pasqua (Center for Research on Parallel Computing and Supercomputers (CPS-CNR), Italy) *When PINEAPL met KIVA: Library usage in industrial applications* (p. 151)

MSP-170 Appleton Tower, Lecture Theatre 5
The Mortar Element Method for High Order Discretizations: The Mortar Spectral Element Method, Other High Order Discretizations with Mortars II

(see also Part I, MSP-169, p. 88)

Organisers: BERNARDI, Christine (CNRS and Université Pierre et Marie Curie, Paris, France)
BEN BELGACEM, Faker (MIP, Université Paul Sabatier, Toulouse, France)

KARAGEORGHIS, Andreas (Department of Mathematics and Statistics, University of Cyprus, Cyprus) *Spectral element methods for problems in circular domains* (p. 158)
BERTOLUZZA, Silvia (Istituto di Analisi Numerica del CNR, Pavia, Italy) *Substructuring techniques for mortar wavelets methods* (p. 158)
PERRIER, Valérie (Laboratoire d'Analyse, Géométrie et Applications, Université Paris Nord, 93430 Villetaneuse, France) *The mortar method in the wavelet context* (p. 159)
SURI, Manil (University of Maryland Baltimore County, USA) *Optimal convergence rates of hp mortar finite element methods* (p. 159)

MSP-196 William Robertson Building, Seminar Room 2

Phase Field Models and Prediction of Micro-Morphological Changes in Alloys II

(see also Part I, MSP-195, p. 89)

Organisers: MULLER, Wolfgang H (Department of Mechanical & Chemical Engineering, Heriot-Watt University, UK)

DREYER, Wolfgang (Weierstrass Institute for Applied Analysis and Stochastics, Berlin, Germany)

MSP-206 William Robertson Building, Seminar Room 4

Methods of Dimension Reduction II

(see also Part I, MSP-205, p. 90)

Organisers: KREUZER, Edwin (Technische Universitaet Hamburg-Harburg, Germany)

TROGER, Hans (Technical University Vienna, Austria)

MSP-224 Management School, Lecture Theatre 4

High Accuracy Solutions of Partial Differential Equations

Organiser: GUPTA, Murli M (The George Washington University, USA)

This minisymposia would bring together researchers developing high accuracy methods for the solution of partial differential equations of mathematical physics. The emphasis would be on the use of highly efficient computational techniques such as multigrid methods and parallel computation.

MSP-227 — Management School, Lecture Theatre 5

Diffusion and Convection in Random Media

Organisers: BOURGEAT, Alain P (UJM-Universite St Etienne, France)
PIATNITSKI, Andrey (P N Lebedev Physical Institute, Russian Academy of Sciences, Russia)

We present some works related to the Scaling up of properties like permeability, conductivity, for randomly heterogeneous media, by mean of Stochastic Homogenization. All problems are modelized, at the Local level, by PDEs with randomly oscillating coefficients, and the Scaling up is intended to give a Global model, associated to purely deterministic PDEs under ergodicity or mixing assumptions. Such problems are important, for instance, in composite material design, in hydrogeology or in oil recovery.

CAMPILLO, Fabien (INRIA/LATP, France) *Homogenization of random difference operators and calculation of effective coefficient* (p. 200)
MICHEL, Julien (Unité de Mathématiques Pures et Appliquées, ENS Lyon, France) *Large deviations estimates in stochastic homogenization* (p. 200)
ABABOU, Rachid (Institut de Mecanique des Fluides de Toulouse, France) *Dispersive transport in random porous media: Particles, fluxes, concentrations, and moment inverse problem* (p. 200)
PIATNITSKI, Andrey (P N Lebedev Physical Institute, Russian Academy of Sciences, Russia) *Averaging of random nonstationary convection-diffusion equations* (p. 201)
BOURGEAT, Alain P (University of St Etienne, France) *Scaling up filtration laws in randomly heterogeneous porous media, by stochastic homogenization* (p. 200)

MSP-231 — William Robertson Building, Seminar Room 9

Models, Analysis and Algorithms for Superconductivity II

(see also Part I, MSP-096, p. 85)

Organiser: DU, Qiang (Hong Kong Univ of Science and Technology, Hong Kong, China)

PAN, Xingbin (Zhejiang University, Hangzhou, China) *Surface nucleation of superconductivity* (p. 97)
STYLES, Vanessa (Oxford Brookes University, UK) *Analysis of mean field models of superconducting vortices in one and two-dimensions* (p. 98)
DU, Qiang (Hong Kong University of Science and Technology, Hong Kong, China) *Ginzburg-Landau vortices in d-wave superconductors* (p. 97)
RICHARDSON, Giles W (Ecole Normale Superieure, France) *The bifurcation structure of a thin superconducting loop with small variations in its thickness* (p. 98)

MSP-236 — Appleton Tower, Lecture Theatre 2

MHD-IV: Liquid-Metal Flows at High Hartmann and Reynolds Numbers

Organiser: MOLOKOV, Sergei (Coventry University, UK)

Current understanding of magnetohydrodynamic phenomena in strong magnetic fields is largely based on the assumption of the inertialess flow. Most theoretical results have been obtained under this assumption, which strictly speaking is rarely fulfilled in the industrial applications. The aim of the mini-symposium is to discuss the stability, asymptotics and numerical modelling of flows at high Hartmann and Reynolds numbers. Several recent experiments will also be discussed. The mini-symposium is intended for those interested in fundamental issues of liquid-metal magnetohydrodynamics, as well as its applications to fusion and semiconductor crystal growth.

MOLOKOV, Sergei (Coventry University, UK) *Asymptotic structure of parallel layers at high Hartmann and Reynolds number* (p. 206)
BURR, Ulrich (Forschungszentrum Karlsruhe
Institut für Angewandte Thermo- und Fluiddynamik (IATF), Germany) *Turbulent transport of momentum and heat in magnetohydrodynamic rectangular duct flow with strong side wall jets* (p. 206)
LEBOUCHER, Laurent (Centre for numerical modelling and process analysis, University of Greenwich, UK) *Numerical simulation of internal flows at high Hartman and Reynolds numbers* (p. 206)
THESS, Andre (Ilmenau University of Tech., Germany) *Natural convection in a liquid metal heated from above influenced by a magnetic field* (p. 207)
MOREAU, Rene J (Lab MADYLAM, Grenoble, France) *Inertial and 3D effects in MHD boundary layers* (p. 207)

MSP-237
David Hume Tower, Room 4.18

Multigrid Methods for Optimization Problems

Organiser: SCHULZ, Volker H (Interdisciplinary Center for Scientific Computing, University of Heidelberg, Germany)

Multigrid methods provide a well established approach to the numerical solution of large systems of equations derived from discretized differential equations. However, they can be used profitably as well in the context of large-scale optimization problems. These include such diverse areas as inverse problems, shape optimization, layout optimization, optimal control, etc. Multigrid optimization methods are especially useful, if the number of optimization degrees of freedom is in a sense scalable and therefore algorithmical concepts of optimal complexity are needed. The focus of this minisymposium is on the current theoretical and algorithmical status in the field of optimization multigrid methods as well as on recent developments. They are discussed from an application point of view.

MOHR, Marcus (Universität Erlangen–Nürnberg, Germany) *Multigrid methods for inverse bioelectric field problems* (p. 207)
TA'ASAN, Shlomo (Carnegie Mellon University, USA) *One shot multigrid methods for optimization problems* (p. 208)
SCHULZ, Volker H (Interdisciplinary Center for Scientific Computing, University of Heidelberg, Germany) *Simultaneous multigrid SQP methods for optimal control problems* (p. 207)

MSP-244
David Hume Tower, Room 3.01

Java for Computational Science and Engineering II

(see also Part I, MSP-199, p. 90)

Organisers: BOISVERT, Ronald F (National Institute of Standards and Technology, USA)
TREFETHEN, Anne E (The Numerical Algorithms Group, Ltd., UK)

PETZOLD, Linda (Computational Science and Engineering University of California, Santa Barbara, USA) *The JMPL reconfigurable interface for CSE applications development* (p. 182)
MOREIRA, Jose E (IBM, Thomas J Watson Research Center, USA) *Achieving high performance in numerical computing with Java* (p. 182)
CHATTERJEE, Siddhartha (Department of Computer Science, University of North Carolina, Chapel Hill, USA) *High performance numerics in Java: The importance of design* (p. 182)
TREFETHEN, Anne E (The Numerical Algorithms Group, Wilkinson House, Oxford, UK) *The Java library interface* (p. 183)

MSP-252
William Robertson Building, Seminar Room 1

Mathematical Modelling and Computational Aspects in Blood Flow II

(see also Part I, MSP-164, p. 88)

Organiser: PONTRELLI, Giuseppe (IAC-CNR, Viale del Policlinico 137, Rome, Italy)

VENEZIANI, Alessandro (University of Verona, Italy) *Boundary issues for blood flow problems* (p. 153)
NOBILE, Fabio (Departement de Mathematiques, Ecole Polytechnique Federale de Lausanne, Switzerland) *Numerical modelling of fluid-structure interaction problems in hemodynamics* (p. 153)
ZANETTI, Gianluigi (CRS4, Italy) *Viva: The virtual vascular project at CRS4* (p. 154)
DICARLO, Antonio (Università degli Studi "Roma Tre", Italy) *How to model distensible blood vessels* (p. 152)

16.00 – 18.00 Contributed Presentations: Lectures

C-15
Adam Ferguson Building, Room 13

Numerical Methods in Differential Equations IV
Chair(s): XANTHIS; ZHU

16.00–16.15 MICHELETTI, Stefano (Politecnico di Milano, Dipartimento di Matematica “F. Brioschi”, Milan, Italy) *Mixed finite volumes for advanced transport models in semiconductors* (p. 287)
16.15–16.30 BOTCHEV, Mike A (CWI, The Netherlands) *A zoom technique for advection schemes in air pollution modelling* (p. 243)
16.30–16.45 XANTHIS, Leonidas S (Centre for Techno-Mathematics & Scientific Computing Laboratory, University of Westminster, London, UK) *Robust iterative methods for thin elastic shells, plates and rods* (p. 328)
16.45–17.00 RAKOWSKY, Natalja (Alfred-Wegener-Institut for Polar and Marine Research, Bremerhaven, Germany) *Schur complement method as parallel elliptic solver in ocean modelling* (p. 302)
17.00–17.15 JALICS, Miklos (Ohio State University, USA) *Steady crystal growth in long ampoules in a vertical Bridgman device* (p. 274)
17.15–17.30 HANSEN, Olaf (Fachbereich Mathematik, Johannes Gutenberg-Universität Mainz, Germany) *Solving numerically the heat equation in unbounded domains in* R^2 (p. 267)
17.30–17.45 ZHU, Jianping (Mississippi State University, USA) *On an efficient higher order algorithm for solving partial differential equations* (p. 332)
17.45–18.00 CHEUNG, C W (Department of Mechanical Engineering and Aeronautics, City University, UK) *An asynchronus algorithm for the solution of unsteady subsonic compressible flow* (p. 248)

C-16
Adam Ferguson Building, Room 14

Fluid Mechanics IV
Chair(s): COWLEY; HARPER

16.00–16.15 MASON, David P (University of the Witwatersrand, Johannesburg, South Africa) *On the effect of interfacial tension on slow viscous flow past a spherical liquid drop* (p. 286)
16.15–16.30 BRAUN, Richard J (University of Delaware, USA) *Two phase viscous drop spreading* (p. 243)
16.30–16.45 COWLEY, Stephen J (University of Cambridge, UK) *Spiral-type vortex breakdown on a trailing vortex: A weakly nonlinear marginal instability?* (p. 250)
16.45–17.00 VAN DER SCHRIER, Gerard (Netherlands Institute for Sea Research, The Netherlands) *The diffusionless Lorenz-equations; Shil'nikov bifurcations and reduction to an explicit map* (p. 321)
17.00–17.15 MCKINLEY, Iain S (University of Strathclyde, Glasgow, UK) *Stability of a ridge subject to a jet of air* (p. 287)
17.15–17.30 NICOLAS, Jose Antonio (ETSI Aeronauticos, Universidad Politecnica de Madrid, Spain) *Three-dimensional oscillatory boundary layers* (p. 292)
17.30–17.45 HARPER, John F (Victoria University of Wellington, New Zealand) *Why bubbles rise anomalously slowly in water with air present* (p. 268)
17.45–18.00 IVANOVIĆ, Dečan (Mechanical Engineering Department, University of Montenegro, Podgorica, Yugoslavia) *Unsteady boundary layer of incompressible fluid flow on aerofoil* (p. 273)

C-17 Adam Ferguson Building, Room 17

Analysis

Chair(s): EASTON; ZAFER

16.00–16.15 TKACHENKO, Igor M (Polytechnic University, Valencia, Spain) *Orthogonal polynomials and power moment sets for matrix distributions* (p. 317)
16.15–16.30 SMIRNOV, Georgi (University of Porto, Portugal) *Adsorption integral equation via complex approximation* (p. 311)
16.30–16.45 EASTON, Alan K (Swinburne University of Technology, Australia) *Stability of the selective lumped mass scheme for the shallow water equations* (p. 257)
16.45–17.00 LIMAYE, Balmohan V (Indian Institute of Technology Bombay, India) *Accelerated refinement of approximate eigenelements of integral operators* (p. 284)
17.00–17.15 AVRACHENKOV, Konstantin (University of South Australia, Australia) *Perturbation analysis of reduced resolvents and generalized inverses* (p. 239)
17.15–17.30 SIDOROV, Nikolay A (Irkutsk State University, Russia) *Uniformization of the branching solutions and iterations in nonlinear analysis* (p. 310)
17.30–17.45 ZAFER, Ağacık (Middle East Technical University, Ankara, Turkey) *The controlability of boundary-value problems for quasilinear impulsive systems* (p. 331)
17.45–18.00 VALUSESCU, Ilie (Institute of Mathematics of the Romanian Academy, Romania) *An operatorial view on infinite-variate prediction* (p. 321)

C-25 Adam Ferguson Building, Room 18

Computational Fluid and Solid Mechanics II

Chair(s): NOWAKOWSKI; KERR

16.00–16.15 MARCHENKO, Nikolay A (Keldysh Institute for Applied Mathematics, Russia) *Structures of two-phase flow through double porosity media: numerical analysis* (p. 286)
16.15–16.30 MIYAZAKI, Teruo (Kokushikan University, Department of Mechanical Engineering, Japan) *Unsteady three-dimensional cascade flow solver using complex temperature gradients* (p. 289)
16.30–16.45 NOWAKOWSKI, Andrzej F (University of Manchester Institute of Science and Technology, UK) *A three dimensional simulation of fluid flow within a hydrocyclone* (p. 293)
16.45–17.00 ILIESCU, Traian (University of Pittsburgh, USA) *Numerical analysis for large eddy simulation* (p. 272)
17.00–17.15 ZHMAKIN, Alexander I (A.F.Ioffe Physical Technical Institute, St Petersburg, Russia) *Adaptive multi-grid methods for steady viscous flows on unstructured grids* (p. 332)
17.15–17.30 OHTSUKA, Kohji (Hiroshima-Denki Institute of Technology, Hiroshima, Japan) *Theoretical and numerical analysis of fracture in 2D case* (p. 294)
17.30–17.45 KERR, Gilbert (New Mexico Tech, USA) *An effective numerical algorithm for the annular crack problem* (p. 276)
17.45–18.00 NEDELKOVSKI, Igor (Faculty of Technical Sciences, St Kliment Ohridski University, Bitola, Macedonia) *Computational simulation of steam flow and heat transfer in power plant condensers using finite element method* (p. 292)

C-33 Appleton Tower, Room 2.A2

Numerical Linear Algebra and Discrete Mathematics

Chair(s): ARBENZ; DEBNATH

16.00–16.15 ALAM, Rafikul (Indian Institute of Technology Guwahati, India) *On the approximation of stable invariant subspaces* (p. 235)
16.15–16.30 HIRANO, Hiroyuki (Okayama University of Science, Japan) *The two-step preconditioned iterative method* (p. 270)
16.30–16.45 ARBENZ, Peter (ETH Zürich, Institut für Wissenschaftliches Rechnen, Switzerland) *A comparison of Eigenvalue solvers for electromagnetic fields in cavities* (p. 237)
16.45–17.00 LI, Lei (Faculty of Science, Yamaguchi University, Yamaguchi, Japan) *Fast parallel algorithms for Vandermonde determinants* (p. 283)
17.00–17.15 LU, Tzon-Tzer (Department of Applied Mathematics, National Sun Yat-sen University, Kaohsiung, Taiwan) *Inverses of 2×2 block matrices* (p. 285)
17.15–17.30 TAN, Roger C E (National University of Singapore, Singapore) *Computation of mixed partial derivatives of eigenvalues and eigenvectors by simultaneous iteration* (p. 316)
17.30–17.45 DEBNATH, Narayan C (Winona State University, USA) *SGPG: A graph for modelling concurrency* (p. 253)
17.45–18.00 SHIODE, Narushige (University College London, UK) *Application of graph theory for measuring the inter-connectivity of WWW sites* (p. 310)

C-36 Appleton Tower, Room 2D

Simulation, Neural Networks, Geometric Modelling, Linear and Nonlinear Programming

Chair(s): DORNINGER; GOFFIN

16.00–16.15 KIM, Hyeock-Jin (Chungwoon Univ, Korea) *Data exchange by the degree reduction of B-splines* (p. 278)

16.15–16.30 NAKAGAWA, Noritoshi (Hiroshima University, Faculty of Engineering, Japan) *Vibration characteristics of isolator using magneto-spring* (p. 292)

16.30–16.45 DORNINGER, Dietmar (Vienna University of Technology, Austria) *A cellular automaton model for chromosome pairing* (p. 255)

16.45–17.00 ZIMMERMANN, Wayne J (Texas Woman's University, Denton, USA) *A computational model to estimate the probability of impact with space debris* (p. 332)

17.00–17.15 HEITZER, Michael (Institute of Safety Research and Reactor Technology, Forschungszentrum Jülich GmbH, Germany) *Large scale nonlinear optimization for FEM-based limit and shakedown analysis* (p. 269)

17.15–17.30 POLLATSCHEK, Moshe A (Management, Technion, Haifa, Israel) *Graphic interface for model formulations* (p. 298)

17.30–17.45 GOFFIN, Jean-Louis (McGill University, Montreal, Canada) *Multiple cuts in the analytic center cutting plane method* (p. 263)

17.45–18.00 KREJIĆ, Nataša (Institute of Mathematics, University of Novi Sad, Yugoslavia) *A newton-like method with modification of right-hand side vector* (p. 280)

C-40 William Robertson Building, Seminar Room 3

Optimization II

Chair(s): RORRES; VARGA

16.00–16.15 TAN, Yongji (Institute of Mathematics, FuDan University, China) *Parameters optimization of continuous casting problem* (p. 316)

16.15–16.30 MOMBAUR, Katja D (IWR, University of Heidelberg, Germany) *Open-loop stable control of running and hopping robots* (p. 289)

16.30–16.45 RORRES, Chris (Drexel Unversity, USA) *The turn of the screw: the optimal design of an Archimedes screw* (p. 304)

16.45–17.00 LAZAREV, Alexander A (Kazan State University, Russia) *Analize of structure of optimal schedule the problem minimizing maximum lateness for single machine* (p. 283)

17.00–17.15 FRIEDLANDER, Ana (State University of Campinas, Brazil) *On the resolution of the generalized nonlinear complementarity problem* (p. 260)

17.15–17.30 STEFANOV, Stefan M (Neofit Rilski University, Blagoevgrad, Bulgaria) *Convex separable optimization problems - results, algorithms and some applications* (p. 313)

17.30–17.45 VARGA, Laszlo (Hungarian Power Companies Ltd., Hungary) *Approximation algorithms for maintenance scheduling in electric power systems* (p. 321)

17.45–18.00 DJURANOVIC-MILICIC, Nada (Faculty of Technology and Metallurgy, Yugoslavia) *A generalized curvilinear path step-size algorithm* (p. 254)