

Heriot-Watt University

Department of Mathematics

ANNUAL REPORT 1987-88

The Department of Mathematics continues to expand its activities in all areas. The first year undergraduate intake for the BSc Mathematics degrees in 1987 was a record high, and total number of full-time equivalent student numbers taught by the department throughout the University has also increased. On the postgraduate side, the new joint MSc with the Department of Mathematics at Edinburgh, "The Mathematics of Nonlinear Models", has been granted SERC support. A large proportion of the departmental research activities was devoted to a special year on reaction-diffusion equations and their applications, sponsored by the SERC as part of the programme on Nonlinear Systems. Almost 60 mathematicians, scientists and engineers visited the department during the year, and a focal point for the programme was a conference held at the end of May. Topics discussed ranged from the theoretical abstract analysis of nonlinear partial differential equations to mathematical ecology and biology. We were particularly honoured to have Professor Paul Fife of the University of Utah, a pre-eminent researcher in reaction-diffusion equations, as a long-stay visitor in the department from January to August.

Another important facet of the department's research effort was highlighted in March, when the department hosted a week-long symposium organised by the Royal Society of Edinburgh and the Mathematical Study Group with Industry. Over 40 university mathematicians from the UK, Europe and North America discussed industrial problems with a group of 11 industrialists from major UK and foreign companies.

It is especially gratifying to the department that Professor J L Erickson of the University of Minnesota, who has been a frequent visitor and is distinguished for his many fundamental contributions to nonlinear continuum mechanics, had conferred upon him by the university the Honorary degree of DSc.

It is also a pleasure to record the promotion of three members of staff, Dr A R Prince to a Senior Lectureship, Dr M van den Berg to a Readership, and Dr J Carr to a Personal Chair, while Professor R J Knops, formerly Head of Department and Dean of Science has been appointed Vice Principal.

Professor J M Ball spent the year as a Directeur de Recherches of CNRS in the Laboratoire d'Analyse Numérique at the Université Pierre et Marie Curie, Paris.

J C Eilbeck

Head of Department

The cover picture shows a numerical solution of the 2-dimensional Ginzburg-Landau Equation $u_t = \epsilon \Delta u + u(1-u^2)$ calculated on a transputer array.

STAFF

Head of Department

Professor J Chris Eilbeck

Professors

John M Ball
Jack Carr¹
R J Knops²
Oliver Penrose

Professor Emeritus

John H Williamson

Readers

Michiël van den Berg¹

Andrew A Lacey

Senior Lecturers

C E Beevers
Kenneth J Brown³

R N Hills
Alan R Prince⁴

Lecturers

François Bavaud
James Bree
Douglas E R Clark
Penny J Davies¹
Brian P Dodds
Dugald B Duncan
James Howie

Anthony J A Lawrence⁴
George R McGuire
Laurence E Nicholas
Christine Noble⁵
Habib H Rahman
David C Wilkinson
Martin A Youngson

Research Associates

A J Duncan,⁶
R G Flesch⁷
M S Floater
Maureen Glen Foster⁸
Jacques Furter⁹

Michael Crinfield¹⁰
Z Li
Pablo V Negrón-Marrero⁴
S Srisatkunarajah⁸
John M Veroksy⁴

Visiting Mathematicians

P C Fife¹⁰
X Mora

K Zhang⁸

Technical Support/Systems Programmer

Brigid S G Cherry¹¹

Secretaries

Miss Isabel Fraser
Mrs Maureen Gardiner⁵
Mrs Patricia Hampton

1 from 1.8.88
2 Vice Principal 1988-90
3 Deputy Head of Department
4 1987-88
5 part-time
6 1988-1991

7 1988-1990
8 1988-1989
9 1986-1988
10 1988
11 1985-88
12 from 13.6.88

Visitors to the Department

The following made long-term visits:

D Aronson (Minnesota)
J Bebernes (Colorado)
J Bell (New York, Buffalo)
C Cosner (Miami)
P Fife (Utah)
R Gardner (Massachusetts)

G Gill (Brigham Young University)
J Hernandez (Madrid)
M Mimura (Hiroshima)
D Terman (Ohio)
J Vazquez (Madrid)

In addition short-term visits were made and seminars given by the following:

N Alikakos (Tennessee)
M J Baines (Reading)
F Ball (Nottingham)
P Bates (Brigham Young University)
M Bertsch (Torino)
W Blyth (Melbourne)
C Brauner (Bordeaux)
T Boddington (Leeds)
C Branner (Bordeaux)
M Britton (Bath)
C Budd (Oxford)
V Capasso (Bari)
P Colli (Pavia)
D J Collins (Queen Mary College)
P V Covey (Bangor)
W W Crawley-Bovey (Liverpool)
H A M Daniels (Tilburg)
C Dean (Chicago/Leeds)
J Dewynne (Oxford)
P Donnelly (UCL)
P G Drazin (Bristol)
S-I Ei (Hiroshima)
J L Erickson (Minnesota)
J Fleckinger (Toulouse)
A P Fordy (Leeds)
C Grant (Brigham Young University)
R E Grundy (St Andrews)
D Heermann (Mainz)
M Herrero (Madrid)
G Higman (Oxford)
Y Hosono (Kyoto Sangyo/Oxford)
S D Howison (Oxford)
J Hulshof (Leiden)
C Kaas Petersen (Leeds)
Y Kevrekidis (Princeton)

M Kirane (Rome)
Y Kuramoto (Kyoto)
A Leung (Cincinnati)
J Lennox (Cardiff)
J T Lewis (Dublin)
J Lopez Gomez (Madrid)
S McKee (Strathclyde)
V Manoranjan (Surrey)
A I Mees (W. Australia/Cambridge)
J D P Meldrum (Edinburgh)
E Mitidieri (Trieste)
X Mora (Barcelona)
Y Nishitara (Kyoto)
R W Ogden (Glasgow)
R L Pego (Michigan)
I C Percival (Queen Mary)
E F Robertson (St Andrews)
C Schmidt-Lainé (Lyon)
R Shivaaji (Mississippi)
M Shillor (Claremont/Imperial)
S Scott (Leeds)
D Sloan (Strathclyde)
J Smoller (Michigan)
J T Stafford (Leeds)
I Stewart (Strathclyde)
C Stuart (Lausanne)
F Takens (Groningen)
D Tzanetis (Athens)
L Velazquez (Madrid)
C Wake (Massey University)
J Walsh (Manchester)
K Walters (Aberystwyth)
D Wood (Nottingham)
E Yu (Melbourne)

Invited Papers and Seminars given by members of staff

Professor J M Ball

- Seminar, University of Wisconsin, Madison, 11 November '87, 'Young measures and the microstructure of crystals'.
- Seminar, University of Victoria, The Lansdowne Lectures, 18-19 November '87, 'Elasticity and the microstructure of solids', and 'Minimizing sequences and the asymptotic behaviour of infinite-dimensional dynamical systems - some examples'.
- Seminar, Collège de France, Paris, 7 November '87, 'Suites minimisantes et la microstructure de cristaux'.
- Seminar, Département de Mathématiques, École Polytechnique Fédérale de Lausanne, 7 December '87, 'Les équations de coagulation-fragmentation', and 14 December '87, 'Remarques sur le calcul des variations et l'élasticité nonlinéaire'.
- Seminar, Forschungsinstitut für Mathematik, ETH Zurich, 16 December '87, 'Mathematical models of phase transitions in solids'.
- Seminar, Département de Mathématiques, Université Paris Sud (Orsay), 28 January '88, 'Mesures de Young et la théorie cristallographique de martensite'.
- Seminar, Département de Mathématiques, Université de Nancy, 3 February '88, 'Des modèles mathématiques pour les transformations de phase dans les solides'.
- Seminar, Elektronenmikroskopie voor Materiaal-onderzoek, Universiteit Antwerpen (RUCA), 11 February '88, 'Fine phase mixtures as minimizers of energy'.
- Seminar, Département de Mathématiques, Université de Paris Dauphine, 1 March '88, 'Est-ce que le rang-un convexité implique le quasiconvexité?'.
- Seminar, IAC 'Mauro Picone', Rome 7 April '88, 'Young measures and the microstructure of crystals'.
- Seminar, Mathematisches Institut A, Universität Stuttgart, 9 May '88, 'Weak convergence and the microstructure of crystals'.
- Seminar, Laboratoire d'Analyse Numérique, Université Pierre et Marie Curie, Paris, 3 June '88, 'Relations de rang un, quasiconvexité et cristaux'.
- Seminar, Department of Mathematics, Fudan University, Shanghai, 3-8 September '88, 4 lectures on 'Recent developments in elasticity and the calculus of variations'.
- Seminar, Department of Mathematics, Jiaotong University, Xian, 13 September '88, 'Applications of the calculus of variations to nonlinear elasticity'.
- Seminar, Department of Mathematics, Peking University, 17 September '88, 'Young measures and the microstructure of crystals', and 19 September '88, 'The Lavrentiev phenomenon and numerical detection of singular minimizers'.

Professor J M Ball

- Seminar, Department of Mathematics, Tsing Hua University, Beijing, 22 September '88, 'Coagulation-fragmentation equations'.
- Seminar, System Science Institute, Academia Sinica, Beijing, 23 September '88, 'Does rank-one convexity imply quasiconvexity?'.
- Invited lecture at Conference on Partial Differential Equations and Phase Transitions, Nice, 18 January '88, 'Young measures and the microstructure of crystals I'.
- Invited lecture at European Collaborative Programme on Nonlinear Mechanics, University of Nice, 1 April '88, 'The mathematics of crystal microstructure'.
- Invited Plenary lecture at British Theoretical Mechanics Colloquium, Imperial College, London, 11 April '88, 'Young measures and the microstructure of crystals'.
- Invited Plenary lecture at 20^{ème} Congrès Nationale d'Analyse Numérique, Evian, France, 20 May '88, 'Résultats et problèmes ouverts en élasticité nonlinéaire'.
- Invited lecture at Workshop on The Mathematical Analysis of Material Microstructure, Cornell University, 16 June '88, 'Sets of gradients with and without rank-one connections'.
- Seminar, Glasgow College of Technology, December '87, 'Computer aided learning in mathematics'. (In collaboration with M Foster).
- Seminar, Estonian Academy of Science, Tallinn, USSR, May '88, 'Thermodynamics and stability in nonlinear continuum mechanics'.
- Seminar, Birmingham University, Workshop on CAL, June '88, 'The CALM project'. (In collaboration with M Foster).
- Seminar, University of Groningen, 28 November '87, 'Heat flow and brownian motion'.
- Seminar, Université Paris VI, 15 December '87, 'On a problem of F Spitzer'.
- Seminar, Dublin Institute for Advanced Studies, 4 January '88, 'Entropy estimates and models of an interacting boson gas'.
- Seminar, Dublin Institute for Advanced Studies, 4 January '88, 'On a problem of F Spitzer'.
- Seminar, University of Cambridge, 23 February '88, 'On a problem of F Spitzer'.
- Seminar, University College of Swansea, 29 March '88, 'Mean curvature and the heat equation'.
- Seminar, Dublin Institute for Advanced Studies, 'Gaussian lower bounds for heat kernels'.
- Invited lecture at Workshop in Probability, Edinburgh, 20-24 June '88, 'Gaussian bounds for the Dirichlet heat kernel'.
- Invited lectures at Workshop on Applications of Large Deviations, Heidelberg, 25-29 July '88, 'Mean curvature and the heat equation', and 'Gaussian bounds for the Dirichlet heat kernel'.

Dr C E Beevers

Dr M van den Berg

- Professor J Carr
- Seminar, University of Cambridge, October '87, 'Trends in research in differential equations'.
Seminar, King's College Research Centre, Cambridge, October '87, 'Singular perturbations and invariant manifolds'.
Seminar, University of St Andrews, February '88, 'Metastable patterns'.
Seminar, University of Wisconsin, April '88, 'Metastable patterns'.
Seminar, University of Wisconsin, May '88, 'Coagulation-fragmentation dynamics'.
Invited lecture at Conference on Nonlinear Systems at University of California, January '88, 'Coagulation-fragmentation dynamics'.
Invited lecture at Conference on Partial Differential Equations at University of Minnesota, April '88, 'Metastable patterns'.
- Dr P J Davies
- Talk, 30th British Theoretical Mechanics Colloquium, April '88, 'Buckling and barrelling instabilities in nonlinear elasticity'.
- Dr D B Duncan
- Seminar, University of Oxford, 18 February '88, 'A moving mesh for the enthalpy formulation of phase change problems'.
Talk, University of Nice, European Collaborative Programme on Nonlinear Mechanics, 1 April '88, 'Numerical approximation of phase change problems'.
- Professor J C Eilbeck
- Seminar, University of Bath, 23 October '87, 'Numerical study of bifurcations in coupled reaction-diffusion equations'.
Seminar, University of Leeds, 29 February '88, 'Numerical study of bifurcations in coupled reaction-diffusion equations'.
Graduate lecture, University of Arizona, Tucson, 28 September '88, 'Pattern formation in reaction-diffusion systems'.
- Dr J E Furter
- Seminar, University of Fudan (Shanghai), 10 November '87, 'Local and nonlocal interactions in a scalar parabolic partial differential equation'.
Talk, Workshop on Symmetry and Groups in Nonlinear Continuum Mechanics, Cornell University, 9-14 June '88, 'Stationary solutions of 2 2 RD Systems: the S'elkov model'.
Talk, University of Dundee, 10th Conference on Differential Equations, 5-8 July '88, 'Bifurcation of stationary solutions of 2 RD systems: local and some global analysis'.
- Dr M Grinfeid
- Talk, Conference on Partial Differential Equation Models of Phase Transition, University of Nice, 22 January '88, 'Existence of cavitation waves'.
- Dr J Howie
- Seminar, University of Nottingham, 30 October '87, 'Small cancellation groups and projective planes'.
- Dr J Howie
- Seminar, University of Edinburgh, 20 November '87, 'The Jacobian conjecture: a knotty problem?'.
Seminar, University of Glasgow, 3 March '88, 'Small cancellation groups and projective planes'.
Seminar, University of Newcastle, 29 April '88, 'Small cancellation groups and projective planes'.
Seminar, University of Durham, 23 September '88, 'Locally indicable groupoids'.
Seminar, Dipartimento di Matematica e Applicazioni, Università degli Studi di Napoli, 18 April '88, 'Phragmen-Lindelof theorems in elasticity'.
Seminar, Mathematisches Institut A, University of Stuttgart, 6 June '88, 'Decay estimates for the constrained elastic beam'.
Seminar, Department of Mathematics, École Polytechnique Fédérale de Lausanne, 10 June '88, 'Asymptotic behaviour of the solution to systems of equations on non-compact regions'.
Invited talk, European Collaborative Programme on Nonlinear Mechanics, University of Nice, 29 March - 1 April '88, 'On Saint-Venant's principle'.
Invited talk, Accademia Nazionale dei Lincei, Rome, A Signorini Anniversary Meeting, 12 - 14 April '88, 'Some remarks on Saint-Venant's principle'.
Seminar, University of Birmingham, 10 December '87, 'Global blow-up of some semilinear diffusion equations'.
Invited lecture at Reaction-Diffusion Equations Meeting, Leeds, 12-13 May '88, 'Blow-up of semi-linear diffusion equations'.
Seminar, University of Bath, 15 June '88, 'Singular bifurcation problems for the buckling of plates'.
Seminar, University of Glasgow, 20 October '87, 'Statistical mechanics and finite elasticity'.
Talk, King's College London one-day conference on Statistical Mechanics, 26 May '88, 'Rigorous treatment of metastable states for the Becker-Döring cluster kinetic equations'.
- Professor R J Knops
- Dr A A Lacey
- Dr P V Negrón-Harrero
- Professor O Penrose

Research and other grants during the year ended 30 September 1988

- £89,820 from Science and Engineering Research Council for the period 1 October 1988 to 30 September 1990 for investigation into nonlinear systems, under the direction of Professor J M Ball, Professor J C Eilbeck, Professor R J Knops and Professor O Penrose.
- £43,990 from Science and Engineering Research Council, for the period from 1 October 1988 to 30 September 1991, for investigations into one-relator products of groups and related topics, under the direction of Dr J Howle.
- £1000 from Consiglio Nazionale della Ricerca, Italy, for travel and subsistence, September 1987, awarded to Professor R J Knops.
- £900 from Royal Society, for travel of Professor J M Ball to China, in connection with visits to Fudan University (Shanghai), Xian Jiaotong University, and Peking University.
- £510 from the Danish Technical University, Lyngby, for travel and subsistence for a visiting professorship, May 1988, awarded to Professor J C Eilbeck.
- £440 from the Carnegie Trust, for travel and subsistence for a research visit to the USA, August/September 1987, awarded to Professor J C Eilbeck.
- £400 from the Royal Society, travel grant to visit Institute of Cybernetics, Estonian Academy of Sciences, May 1988, awarded to Dr C E Beavers.
- £200 from Edinburgh Mathematical Society Centenary Fund, for one-day conference at Heriot-Watt University on 5 March 1988, organised by Drs K A Brown (Glasgow), J Howle and I H Lenagan (Edinburgh).

PUBLICATIONS - OCTOBER 1987 - SEPTEMBER 1988

Theses

- P J Davies Stability problems in nonlinear elasticity (PhD).
- I W Stewart Coagulation-fragmentation dynamics (PhD).
- S Srisatkunrajah On the asymptotics of the heat equation for polygonal domains (PhD).

Papers

- J M BALL 'Loss of the constraint in convex variational problems'. In 'Analyse Mathématique et Applications', contribution en l'honneur de J-L Lions, Cauthier-Villars, 1988, pp.39-53.
- J M BALL (Editor) 'Material Instabilities in Continuum Mechanics and Related Mathematical Problems', 1988, Oxford University Press.
- J M BALL and J CARR 'Coagulation-fragmentation dynamics'. In 'Dynamics of Infinite Dimensional Systems', Vol. 37 of NATO Conference Series, 1987, Springer, 23-30.
- 'Asymptotic behaviour of solutions to the Becker-Döring equations for arbitrary initial data', Proc. R. Soc. Edin. A, 1988, 108, 109-116.
- J M BALL and R D James 'Fine phase mixtures as minimizers of energy', Arch. Rat. Mech. Anal., 1987, 100, 13-52.
- J Bebernes, A Bressan and A A LACEY 'Total blow-up versus single point blow-up', J. Differential Equations, 1988, 73, 30-44.
- C E BEEVERS, B S G CHERRY, D E R CLARK, M FOSTER, G R MCGUIRE and J H RENSHAW 'The CALM before the STORM! CAL in University Mathematics', Comp. Educ., 1988, 12, 1, 43-47.
- 'TUTTI FRUTTI - Tutorials to improve first-year results using technological teaching initiatives', Mathematics Teaching 1987 Conference Report, 1987, 24-27.
- M van den BERG and S SRISATKUNARAJAH 'Heat equation for a region in R^2 with a polygonal boundary', J. London Math. Soc., 1988, 37, 119-127.
- M van den BERG, J T Lewis 'A limit theorem for a stochastic process with a boson gas', Springer Lecture Notes in Mathematics, 1988, 1325, 16-23.
- M van den BERG, J T Lewis, J V Pule 'Large deviations and the boson gas', Springer Lecture Notes in Mathematics, 1988, 1325, 24-39.
- 'The large deviation principle and some models for condensation in an interacting boson gas', Comm. Math. Phys., 1988, 118, 61-85.

- K DUNCAN and J C EILBECK
 'Numerical studies of symmetry-breaking bifurcations in reaction-diffusion systems'. In 'Biomathematics and Related Computational Problems', Ed. L M Ricciardi, Kluwer: Dordrecht, 1988, 439-448.
- M EDJIVET and J HOWIE
 'Star graphs, projective planes and free subgroups in small cancellation groups', *Proc. London Math. Soc.*, 1988, 57(3), 301-328.
- J C EILBECK, P S Lomdahl and A C Scott
 'Biomolecular dynamics by computer analysis', *J. Comp. Appl. Math.*, 1988, 22, 297-299.
- B Fine, J HOWIE and G Rosenberger
 'One-relator quotients and free products of cyclics', *Proc. Amer. Math. Soc.*, 1988, 102, 248-254.
- J N Flavin and R J KNOPS
 'Some convexity considerations for a two-dimensional traction problem', *Zeit. Angew. Math. Phys.*, 1988, 39, 166-176.
 'Some decay and other estimates in two-dimensional linear elastostatics', *Quart. J. Mech. Appl. Math.*, 1988, 41, 223-238.
- A Friedman and A A LACEY
 'Blow-up of solutions of semilinear parabolic equations', *Jl. Math. Anal. Appl.*, 1988, 132, 171-186.
- R N HILLS and P H Roberts
 'Relaxation effects in a mixed phase region 1. General theory', *J. Non-Equilib. Thermodyn.*, 1987, 12, 169.
 'Relaxation effects in a mixed phase region 1. Illustrative examples', *J. Non-Equilib. Thermodyn.*, 1987, 12, 183.
 'Towards a non-local theory of helium II', *Q. Jl. Mech. Appl. Math.*, 1987, 40, 279.
 'On the use of Fich's law in regions of mixed phase', *Int. Comm. Heat Mass Transfer*, 1988, 15, 113.
 'On the formulation of diffusive mixture theories for two-phase regions', *J. Engrg. Math.*, 1988, 22, 93.
- J HOWIE
 'A Magnus theorem for $T(6)$ groups', *Math. Proc. Camb. Phil. Soc.*, 1988, 103, 1-3.
- S D Howison, A A LACEY and J R Ockendon
 'Hele-Shaw free-boundary problems with suction', *Q. Jl. Mech. Appl. Math.*, 1988, 41, 183-193.
- R J KNOPS
 'Well-posedness without hyperbolicity'. In 'Symposium on Kinetic Theory and Extended Thermodynamics', Eds. I. Müller, T. Ruggeri, Pitagora Editrice, 1987, 165-180.
- R J KNOPS and A A LACEY (Editors)
 'Non-Classical Continuum Mechanics', Proceedings of the LMS Symposium, Durham, July 1986. *LMS Lecture Note Series* 122, 1987, Cambridge University Press.
- R J KNOPS and L E Payne
 'Improved estimates for continuous data dependence in linear elastodynamics', *Math. Proc., Camb. Phil. Soc.*, 1988, 103, 535-559.
- A A LACEY and M Shillor
 'Electrochemical and electro-discharge machining with a threshold current', *IMA Jl. Appl. Maths.*, 1987, 39, 121-142.
- O PENROSE
 'Statistical mechanics and the kinetics of phase separation'. In 'Material Instabilities in Continuum Mechanics', Ed. J.M. Ball, Oxford University Press, 1988, 373-394.
 'Analyticity properties of the surface free energy of the Ising model', *Commun. Math. Phys.*, 1988, 115, 691-699.
- A R PRINCE
 'Regular orbits of collineation groups', *Bull. London Math. Soc.*, 1988, 20, 129-130.
- N Rivier and A J A LAWRENCE
 'Quasiperiodic ordering in grain boundaries', *Quasicrystalline Materials*, Proceedings of the I.L.L./Codest Workshop, World Scientific, 1988, 255-263.
- W T SULAIMAN
 'On V, λ, k summability factors of Jacobi series', *Pure and Applied Matematika Sciences*, 1988, XXVII, No. 1-2, 27-39.
 'Multipliers for $(C, 1)$ summability of Jacobi series', *Indian J. pure appl. Math.*, 1987, 18(12), 1121-1130.
 'On the degree of approximation of functions belonging to class $LIP(\alpha, p)$ by triangular matrix of its Fourier series', *Tamkang Journal of Mathematics*, 1987, 18(4).
 'On (N, P, k) summability factors of Fourier series', *Portugaliae Mathematica*, 1988, 45(1).
- J VEROSKY
 'An example of a Miura map: the shallow water wave equations', *J. Phys. A.: Math. Gen.*, 1988, 21, 1913-1915.

- M Arik, F Neyzi, Y Nutku, P J Oliver and J VEROSKY
'Hamiltonian structures for the Born-Infeld equation'.
- J M BALL
'A version of the fundamental theorem for Young measures'.
'Sets of gradients with no rank-one connections', *J. Math. Pures et Appliqués*.
- J M BALL and R D James
'Minimizing sequences and the microstructure of crystals', *Proc. Phase Transformations '87*.
- J M BALL and F Murat
'Remarks on Chacon's biting lemma'.
- C E BEEVERS, B CHERRY, D E R CLARK, M FOSTER and G R McGUIRE
'Software for computer aided learning in mathematics', *Conf. Proc. Int. Tech. Educ.*
- C E BEEVERS, B CHERRY, D E R CLARK, M FOSTER, G R McGUIRE and J RENSHAW
'Software tools for mathematical CAL', *Proc. 5th Int. Conf. for Technology in Education*, Edinburgh 1988.
'The CALM project - evaluation and development', *Proc. Conf. on Maths. and Stats. in Higher Education*, Napier College, 1988.
- M van den BERG
'Heat equation and the principle of not feeling the boundary'.
'Torsional rigidity and heat flow for large time'.
- M van den BERG and E B Davies
'Heat flow out of regions in R^m '.
- M van den BERG and S SRISATKUNARAJAH
'Heat flow and brownian motion for a region in R^2 with a polygonal boundary'.
- A R Bishop, R FLESCH, M Gregory Forest, D W McLaughlin and Edward Overman II
'Correlations between the perturbed Sine-Gordon equation and a novel truncated model system'.
- K J BROWN, S S Lin and A Tertikas
'Existence and nonexistence of steady-state solutions for a selection-migration model in population genetics', *Jour. Math. Biology*.
- K J BROWN and A Tertikas
'On the bifurcation of radially symmetric steady-state solutions arising in population genetics'.
- C Carbonera and P V NEGRÓN-MARRERO
'The numerical computation of compressed states for nonlinearly elastic plates'.
- J CARR and R L Pego
'Metastable patterns in solutions of $u_t = \epsilon^2 u_{xx} - f(u)$ ', *Communications Pure Appl. Math.*
'Very slow phase separation in one dimension', *Springer Lecture Notes*.
- D B DUNCAN
'A simple and effective self-adaptive moving mesh for enthalpy formulations of phase change problems'.
- J C EILBECK
'Numerical studies of symmetry-breaking bifurcations in reaction-diffusion systems II'.
'Pattern formation and pattern selection in reaction diffusion systems', *Proceedings of the Waddington Memorial Meeting, Oaxtepec, 6 - 12 September 1987*, eds. B. Goodwin, L. Wolpert and P.T. Saunders.
- J C EILBECK, P C FIFE, J E FURTER, M GRINFELD and M Mimura
'Stationary states associated with phase separation in a pure material. I
- The large latent heat case'.
- J C EILBECK, J E FURTER and M GRINFELD
'On a stationary state characterization of transition from spinodal decomposition to nucleation behaviour in the Cahn-Hilliard model of phase separation'.
- J M Flavin, R J KNOX and L E Payne
'Energy bounds in dynamical problems for a semi-infinite elastic beam'.
'Decay estimates in the constrained elastic beam', *Quart. Appl. Math.*
- J E FURTER, and M GRINFELD
'Local versus non-local interactions in one-species population dynamics', *J. Math. Biol.*
- R N Hunter and G R McGUIRE
'Microcomputer prediction of cooling profiles in chipped hot rolled asphalt wearing course', *Eng. Comp.*
- A LACEY and D Tzanetis
'Complete blow-up for a semilinear diffusion equation with a sufficiently large initial condition', *INA JI. Appl. Math.*
- P V NEGRÓN-MARRERO
'Necked states of nonlinearly elastic plates'.
'A numerical method for computing singular minimizers in multidimensional nonlinear elasticity'.
- L E NICHOLAS
'The differential equation $\left(\frac{dy}{dx}\right)^2 - 2y\left(\frac{dy}{dx}\right) = x$ revisited'.

O PENROSE
'Metastable states for the Becker-Döring cluster equations'.

A R PRINCE

'On certain permutation representations of the Hall-Janko group', *Proc. Royal Soc. Edinburgh*.
'Collineation groups of projective planes and the Hall-Janko group', *Quart. J. Math.*
'The commutative ring of a symmetric design', *Discrete Math.*

A C SCOTT, L BERNSTEIN and J C EILBECK

'Energy levels of the quantized Discrete Self-Trapping equation'.

J VEROSKY

'Boundary conditions and the first-order conserved density for gas dynamics', *J. Phys. A: Math. Gen.*
'Differential algebra of the "even order Korteweg-de Vries equations"'. .

Copies of the above reports or reprints can be obtained by writing to the authors or to:

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