



The Department of Mathematics at Heriot-Watt University has had a good year. In May the University Grants Committee awarded their highest rating, "outstanding", to the Department for their research in Applied Mathematics. Only one other mathematics department in Scotland, Dundee, achieved this starred rating. Whilst many would disagree with some of the UGC decisions, both within Heriot-Watt and elsewhere, this does not detract from this official recognition of the Department's research excellence. A few weeks before the UGC announcement, the SERC confirmed an award to the Department of a grant of £157K as part of a special initiative for research into nonlinear systems. In making this award the SERC acknowledged the Department as one of the leading centres for nonlinear studies in Britain, along with Warwick, Oxford and Imperial College.

During the year Professor J M Ball organised a highly successful symposium year on Material Instabilities in Continuum Mechanics, in connection with which four research meetings were held, culminating in a three day conference in July. Over eighty leading mathematicians and scientists visited the Department during the year to participate in this programme. The department was particularly pleased to welcome Professor J-L Lions of the Collège de France, currently President of the French National Space Agency, on the occasion of his visit to receive an honorary degree of Doctor of Science. Dr A A Lacey and Professor R J Knops also organised a very successful two week London Mathematical Society Symposium on Non-classical Continuum Mechanics at the University of Durham in July.

The research activities of the Department have been further strengthened by the appointment of Professor O Penrose of the Open University to a vacant chair in the Department. Other staff changes made during the year include the appointment of Dr J Howie and Dr D Duncan to permanent lectureships in the Department. The Head of Department, J C Eilbeck, was appointed to a personal chair in Applied Numerical Analysis in February and Dr J Carr was elected a Fellow of The Royal Society of Edinburgh. The Department was sorry to learn that it will be losing the services of Mr C J Wood at the end of the year. Mr Wood has been a much respected member of the Department for almost 20 years. However our loss is the University's gain, as his previously part-time job as Schools Liaison Officer will become his full-time concern from September 1986.

The easing of restrictions on student numbers enabled an increase in the enrolment for undergraduate courses in the department. The Restructured Mathematics with Education degree, now offered at both Honours and Ordinary levels, is due to come on stream this year, with the education component being taught by the Education Department at the University of Stirling. A number of meetings have taken place with science and engineering departments during the year to discuss improvements to existing service courses, and a new fourth year course in computational geometry and computer graphics is now being offered to CAD students in the Department of Mechanical Engineering.

J C Eilbeck

Head of Department

STAFF

Head of Department 1986-89

Professor J Chris Ellbeck

Professors

John H Ball
R J Knops
Oliver Penrose

Professor Emeritus

John H Williamson

Visiting Professor

Jack K Hale¹ (Brown University)

Reader

Jack Carr

Senior Lecturers

C E Beevers
Kenneth J Brown

Lecturers

Laurence E Nicholas
Christine Noble¹
Alan R Prince
Habib H Rahman
James H Renshaw²
David W Reynolds³
Julian D R Stock²
David G Wilkinson
Martin A Youngson

Michiel van den Berg
James Bree
Douglas E R Clark
Penny J Davies⁴
Brian P Dodds
Dugald B Duncan³
H Edjvet²
James Howie⁴
Andrew A Lacey
George R McGuire

Research Associates

Jacques E Furter⁷
Michael Grinfeld⁸

Technical Support/Systems Programmer

Brigid S G Cherry⁸

Programmers

Maureen Foster^{1, 6}
Andrew R Agnew^{1, 11}

Secretaries

Miss Isabel Fraser
Mrs Maureen A Gardiner
Mrs Patricia Hampton¹

Miss Denyse S Lyon¹⁰
Mrs V A McDonald¹

¹ 1.6.86 - 30.11.86
² 1986-87
³ from 22.9.86
⁴ from 1.10.86
⁵ part-time
⁶ 1985-86

⁷ 1986-88
⁸ 1986-87
⁹ 1985-88
¹⁰ from 20.10.86
¹¹ from 10.11.86

Visitors to the Department

The following made long-term visits:

Professor C Calderer (Delaware)
Professor C Davini (Udine)
Professor R DiPerna (Berkeley)
Professor L E Fraenkel (Sussex)
Professor J Goodman (Courant)
Professor D Heermann (Mainz)
Professor R Illner (Victoria)
Professor R James (Minnesota)
Professor C Jones (Arizona)
Professor R V Kohn (Courant)
Professor V J Mizel (Carnegie-Mellon)
Professor F Murat (Paris VI)
Mr T Sakamoto (Brown)
Professor A C Scott (Arizona)
Professor H Schonbek (Santa Cruz)
Dr H Silhavy (Czechoslovakian Academy of Sciences)
Professor M Slemrod (Rensselaer Polytechnical Institute)
Dr N Stavrakakis (Brown)

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

Professor E Acerbi (Pisa)
Professor C J Amick (Chicago and Bath)
Professor S Antaan (Maryland)
Sir Michael Atiyah, FRS (Oxford)
Professor S A Ayupov (Uzbek SSR Academy of Sciences)
Professor P Bates (Brigham Young)
Professor B Botteron (Lausanne)
Professor A J Braudao Correia (CMAF Lisbon)
Professor G Buttazzo (Pisa)
Professor E Cabib (Udine)
Professor G Cagnina (Pittsburgh)
Professor G Capriz (Pisa)
Professor E Carlen (Princeton)
Professor P Charrier (Bordeaux)
Dr D Chillingworth (Southampton)
Professor H Chipot (Metz)
Professor D Cloranesco (Paris VI)
Professor B D Coleman (Carnegie-Mellon)
Professor B Dacorogna (Lausanne)
Professor G Dal Maso (Trieste)
Professor E Dancer (Armidale)
Professor G Dassios (Patras)
Professor J Dunwoody (Queen's University, Belfast)
Professor Y Engelbrecht (Estonian Academy of Science)
Dr A H England (Nottingham)
Dr A C D van Enter (Heidelberg)
Professor J E Ericksen (Minnesota)
Professor J Flavin (Galway)
Professor I Fonseca (Lisbon)
Dr B Fornberg (Exxon)
Professor G Francfort (Laboratoire Central des Ponts et Chaussées)
Professor N Fusco (Naples)

Professor F Gastaldi (Pavia)
 Dr N Goldenfeld (Illinois)
 Professor J Goodman (Courant)
 Professor G W Greenwood (Sheffield)
 Professor H Hattori (West Virginia)
 Professor D Heermann (Mainz)
 Professor D Holm (Los Alamos)
 Professor S Kaniel (Hebrew University, Jerusalem)
 Professor G Keady (University of Western Australia)
 Professor D Kinderlehrer (Minnesota)
 Professor H Le Dret (Paris VI)
 Professor J T Lewis (Dublin Institute for Advanced Studies)
 Professor E Lieb (Princeton)
 Professor J L Lions (College de France)
 Dr G W Lorimer (UMIST)
 Professor J Maddocks (Maryland)
 Professor P Marcellini (Firenze)
 Professor M Mascarenhas (Lisbon)
 Professor E Mascolo (Salerno)
 Dr D G McCartney (Liverpool)
 Professor D W McLaughlin (Arizona)
 Professor J Nohel (Wisconsin)
 Professor A Novick-Cohen (Rensselaer Polytechnic Institute)
 Professor J Ockendon (Oxford)
 Professor O Oleinik (Moscow)
 Dr D F Parker (Nottingham)
 Dr G P Parry (Bath)
 Professor M Pitteri (Padova)
 Professor M Rascle (St Etienne)
 Professor S Rionero (Naples)
 Professor V Roytburd (Rensselaer Polytechnic Institute)
 Professor H Schatzman (Lyon)
 Professor R Schianchi (Napoli)
 Professor D Serre (St Etienne)
 Professor J Serrin (Minnesota)
 Professor M Shillor (Imperial)
 Dr J Sivaloganathan (Bath)
 Dr M Sullivan (University College Dublin)
 Professor S Spector (South Illinois)
 Professor K Pericak-Spector (South Illinois)
 Professor G Strang (Massachusetts Institute of Technology)
 Professor L Tartar (Limeil)
 Professor A G Thomas (Malaysian Rubber Producers' Research Assoc.)
 Professor F Tomarelli (Pavia)
 Professor L Trabucho di Campos (Lisbon)
 Professor A Visintin (Pavia)

Invited Papers and Seminars

Professor J M Ball
 2-week visit to USSR as guest of Soviet Academy of Sciences in September 85
 2 lectures at Steklov Institute, 1 at Ioffe Institute Leningrad, 1 lecture at University of Yerevan, Armenia; 1 lecture at Moscow State University.
 Invited lecture at Symposium on Partial Differential Equations, Mathematics Research Center, Wisconsin October 28-30, 1985.
 Lecture to MacLaurin Society, University of Glasgow, February 12, 1986.
 Lecture at Oberwolfach meeting on Elasticity Theory, March 13-19, 1986.
 Invited Lecture at Lisbon meeting on Dynamics of Infinite-dimensional Systems.
 Conference at Canterbury on 'Mathematics Teaching with a Computer'
 Conference at Edinburgh on 'Mathematics Teaching'.
 Seminar at University of Edinburgh.
 Dr C E Beevers
 Stochastic Mechanics Symposium, Dublin Institute for Advanced Studies.
 Conference on Stochastic Mechanics, Swansea.
 Seminars at King's College, London and University College Swansea.
 Dr M van den Berg
 Conference on 'Dynamics of Infinite-dimensional Systems', Portugal.
 10 lectures on Dynamical Systems, India.
 Lecture at College de France.
 Dr J Carr
 Canadian Applied Mathematics Society Annual Conference.
 Dr D B Duncan
 Communication at Conference 'Groups - Galway 1986'.
 Professor J C Ellbeck
 Conference on 'Bifurcation - analysis, algorithms and applications', Dortmund, West Germany.
 MIDIT 1986 Workshop on Structure, coherence and chaos in dynamical systems', Technical University of Denmark.
 One-day meeting on 'The dynamics of nonlinear systems', University of Leeds.
 Seminar at University of Glasgow.
 Professor J K Hale
 Conference on 'Differential Equations', University of Dundee.
 Conference on 'Variational problems', Heriot-Watt University.

Dr J Howie British Mathematical Colloquium, University of Hull.
 Conference on 'Topological methods in Group Theory', Oberwolfach, West Germany.

Dr R L Pego Conference on 'The Calculus of Variations and Nonlinear Elasticity', Heriot-Watt University.

Professor O Penrose Open University Conference on 'Statistical Mechanics' December 1985.
 Symposium talk at Heriot-Watt University.
 Seminars at King's College London and Oxford University.

Dr A R Prince Mathematics Colloquium, University of Birmingham.
 Conference on 'Combinatorics', University of Stirling.
 Mathematics Colloquium, University of California, Santa Cruz.
 Conference on 'The Hall-Janko Group', University of Birmingham.

Dr J H Renshaw Semigroup Conference, University of St Andrews.

Dr Tang Qi Seminar at Heriot-Watt University.

Dr M A Youngson Yorkshire Functional Analysis Group, Sheffield University.
 Seminar at University of Edinburgh.

Dr H T Williams Seminar at Heriot-Watt University.

Research and other grants during the year ended 30 September 1986

£157,477 from Science and Engineering Research Council, for 3½ years from July 1986 to November 1989, for investigation into nonlinear systems under the direction of Professor J M Ball, Dr J Carr, Professor J C Eilbeck and Professor R J Knops.

£900 from Royal Society of London, travel grant to attend ICH Conference in Berkeley, California, August 1986, to Professor J M Ball.

£2,216 from Science and Engineering Research Council for one year to 23 April 1987, for a Visiting Fellowship for Professor J T Lewis, to undertake research into the theory of large deviations, with Dr M van den Berg.

£150 from Royal Society of London, supplementary travel allowance for travel to Portugal in May 1986, awarded to Dr J Carr.

£7,500 from Shell UK Ltd for mathematical video films for schools, awarded jointly with Department of Actuarial Mathematics and Statistics, to Professor J C Eilbeck.

£6,000 from Carnegie Trust for the Universities of Scotland, Visiting Fellowship for six months from 1 June - November 30, 1986, awarded to Professor J K Hale.

£346 from Science and Engineering Research Council, to attend British Mathematical Colloquium conference, 8 - 10 April, 1986 in Hull, and a conference on Topological Methods in Group Theory, from 1 - 7 June 1986 in Oberwolfach, awarded to Dr J Howie.

£22,076 from Science and Engineering Research Council for two years from 1 October 1986, support for programme on the behaviour of moving free boundaries, awarded to Dr A A Lacey.

£300 from the Royal Society of London, to attend 8th International Conference on Mathematical Physics, Marseilles, France, 16-25 July 1986, awarded to Professor O Penrose.

£1,000 from Science and Engineering Research Council, for one year to 30 September 1986, for investigation into projective planes, awarded to Dr A R Prince.

PUBLICATIONS OCTOBER 1985 TO SEPTEMBER 1986

Theses

Bohareldin Hurain Path following techniques for bifurcation diagrams arising from ordinary differential equations (MSc).

Nicholas C. Owen Existence and stability of drawing and necking deformations for nonlinearly elastic rods (PhD)

Dimitrios E. Tzanetis Global existence and asymptotic behaviour of unbounded solutions for the semilinear heat equation (PhD)

Papers

- J.H. BALL
'Energy-minimizing configurations in nonlinear elasticity', *Proceedings of the International Congress of Mathematicians*, 1983, Warsaw.
- J.H. BALL and V.J. Mizel
'One-dimensional variational problems whose minimizers do not satisfy the Euler-Lagrange equation', *Arch. Rat. Mech. Anal.*, 1985, 90, 325-388.
- J.H. BALL, J. CARR and O. PENROSE
'The Becker-Döring cluster equations: basic properties and asymptotic behaviour of solutions', *Comm. Math. Physics*, 1986, 104, 657-692.
- J.H. BALL and G. KNOWLES
'Lyapunov functions for thermoelasticity with spatially varying boundary temperatures', *Arch. Rat. Mech. Anal.*, 1986, 92, 193-204.
- H. van den BERG
'On a classical two component plasma with a logarithmic interaction', *Proc. Roy. Soc. Edinburgh Sect. A*, 1985, 101, 187-192.
- A.R. Bishop, J.C. EILBECK, I. Satija and G. Wysin
'Pattern selection and low-dimensional chaos in dissipative many degrees-of-freedom systems', *Lectures in Applied Mathematics*, 1986, 23, 125-135.
- J. Blat and K.J. BROWN
'A reaction-diffusion system modelling the spread of bacterial infections', *Math. Methods in the Applied Sciences*, 1986, 8, 234-246.
- J. CARR, S.N. Chow and J.K. Hale
'Abelian integrals and bifurcation theory', *J. Differential Equations*, 1985, 59, 413-436.
- J. CARR
'The Unpredictability of Life', 30 minute video for schools.
- K.R. Chaplin, D.B. DUNCAN and R. Parker
'Ultrasonic computer model verification', *Proceedings of World Conference on Nondestructive Testing*, 1985.

- R. Craggs and J. HOWIE
'Group presentations, coproducts and inverses', *Ann. of Math. Stud.*, 1986, 111, 53-78.
- D.B. DUNCAN
'Computer Simulation of Ultrasonic Testing'. In "Ultrasonics International 1985 Conference Proceedings", Butterworths, pp.581-585.
- H. EDJWET
'On the "largeness" of one-relation groups', *Proc. Roy. Soc. Edinburgh Sect. A*, 1986, 29, 263-269.
- J.C. EILBECK
'The pseudo-spectral method and path following in reaction-diffusion bifurcation studies', *J. Sci. Statist. Comput.*, 1986, 7, 599-610.
- J.C. EILBECK and V.S. Manoranjan
'A comparison of basis functions for the pseudo-spectral method for a model reaction-diffusion problem', *J. Comp. Appl. Math.*, 1986, 15, 371-378.
- D. Fordyce, R. Hunter and G.R. McGUIRE
'The cooling of bituminous layers', *Highways and Transportation*, 1986, 33 No.5, 2-8.
- G.P. Galdi, R.J. KNOPS and S. Rionero
'Uniqueness and continuous dependence in the linear elastodynamic exterior and half-space problems', *Math. Proc. Camb. Phil. Soc.*, 1986, 99, 357-366.
- H. GRINFELD and L.A. Segel
'Implementation and extension of MacWilliams model for pre-stalk pre-spore regulation in cellular slime mold', *J. Theoret. Biol.*, 1986, 121, 23-44.
- J.K. HALE
'Flows on center manifolds for scalar functional differential equations', *Proc. Roy. Soc. Edinburgh Ser. A*, 1985, 101 (part 3/4), 193-202.
'Asymptotic behaviour and dynamics in infinite dimensions'. In 'Nonlinear Differential Equations', Ed. J.K. Hale and P. Martinez-Amores, Research Notes in Mathematics, 1985, 132, 1-42, Pitman.
'Local flows for functional differential equations', *Contemporary Mathematics*, 1986, 56, 185-192.
'Large diffusivity and asymptotic behavior', *J. Math. Anal. Appl.*, 1986, 118, 455-466.
- J.K. HALE and X.-B. Lin
'Examples of transverse homoclinic orbits in delay equations', *Nonlinear Analysis*, 1986, 10 No.7, 693-710.
'Symbolic dynamics and nonlinear semiflows', *Annali di Mat. Pura Appl.*, 1985, IV 114, 217-235.
- J. HOWIE
'How to generalize one-relator group theory', *Ann. of Math. Stud.*, 1986, 111, 53-78.

J. HOWIE and S.J. Pride
'The word problem for one-relator semigroups', *Math. Proc. Cambridge Philos. Soc.*, 1986, 99, 33-44.

S.D. Howison, A.A. LACEY and J.R. Ockendon
'Singularity development in moving boundary problems', *Quart. J. Mech. Appl. Math.*, 1985, 38, 343-360.

R. Hunter and G.R. McGUIRE
'A fast and efficient method for predicting cooling profiles in bituminous materials', *Civil Engineering*, 1986, 24-25.

A.A. LACEY
'Design of a cathode for an electromachining process', *IMA J. Appl. Math.*, 1985, 34, 259-267.
'Singularity formation in moving boundary problems'. In "Free boundary problems: applications and theory, volume III", Ed. A. Bossavit, A. Damiani and M. Fremont, Pitman, 1985.
'Tool design for electrochemical machining in the presence of overpotentials', *IMA J. Appl. Math.*, 1985, 35, 357-364.
'A limiting solution for an ill-posed membrane problem', *Proc. Roy. Soc. Edinburgh Sect. A*, 1986, 102, 305-313.

A.A. LACEY and J.R. Ockendon
'Ill-posed free boundary problems', *Control and Cybernetics*, 1985, 14, 275-296.

R.L. PEGO
'Stability in systems of conservation laws with dissipation'. In "Nonlinear Systems of Partial Differential Equations in Applied Mathematics", Ed. B. Nicolaenko et al., *Amer. Math. Soc.*, Providence 1986.
'Compactness in L^2 and the Fourier transform', *Proc. Amer. Math. Soc.*, 1985, 95, 252-254.
'Nonexistence of a shock layer in gas dynamics with a nonconvex equation of state', *Arch. Rat. Mech. Anal.*, 1986, 94, 165-178.

A.R. PRINCE
'A commutative ring associated with any finite projective plane', *J. Algebra*, 1986, 99, 295-303.
'Steiner triple systems of order 19 associated with a certain type of projective plane of order 10', *Period. Math. Hungar.*, 1986, 17, 177-184.

R. Quintanilla and H.T. WILLIAMS
'An existence and uniqueness theorem for incremental viscoelasticity', *Quart. Appl. Math.*, 1985, 43, 287-294.

J.H. REMSHAW
'Extension and amalgamation in monoids and semigroups', *Proc. London Math. Soc. (3)*, 1986, 52, 119-141.
'Flatness and amalgamation in monoids', *J. London Math. Soc. (2)*, 1986, 33, 73-88.
'Extension and amalgamation in rings', *Proc. Roy. Soc. Edinburgh Sect. A*, 1986, 102, 103-115.

A. SADI
'A uniqueness theorem for hyperharmonic functions', *J. Math. Anal. Appl.*, 1985, 112, 502-508.

Reports submitted for publication 1985-86

J.M. BALL
'Singular minimizers and their significance in elasticity', *Proc. Symposium on Partial Differential Equations*, Math. Research Center, University of Wisconsin, 1985, Academic Press.
'Minimizing sequences in thermoelasticity', *Prof. Conference on Finite Thermoelasticity*, Rome, June 1985.
'Does rank-one convexity imply quasiconvexity?', *Proc. of Workshop on Metastability and partial differential equations*, IMA, University of Minnesota.

J.M. BALL and J. CARR
'Coagulation-fragmentation dynamics', *Proc. NATO Symposium on Infinite-dimensional Dynamical Systems*, Lisbon, 1986.

J.M. BALL and R.D. JAMES
'Fine phase mixtures as minimizers of energy', *Arch. Rat. Mech. Anal.*

J.M. BALL and G. Knowles
'A numerical method for detecting singular minimizers', *Numerische Math.*

H. van den BERG
'A note on the asymptotics of a series', *SIAM J. on Applied Mathematics*.

M. van den BERG and J.T. Lewis
'On the asymptotics of a Wiener Integral', *Proceedings of the Royal Soc. Edinburgh A*.

M. van den BERG, J.T. Lewis and J.V. Puile
'The large deviation principle and some models for condensation in an interacting boson gas', *Comm. Math. Phys.*

M. van den BERG and S. SRISATKUNARAJAH
'Heat equation for a region in R^2 with a polygonal boundary', *London Math. Soc.*

C. Breen, A. Deans and D.V. REYNOLDS
'Sorption kinetics of methanol, propan-2-ol and 2-methylpropan-2-ol by Al^{3+} , Cr^{3+} and Fe^{3+} -exchanged montmorillonite', *Clays and Clay Science*.

K.A. Brown, J. HOWIE and M. Lorenz
'Induced resolutions and Grothendieck groups of polycyclic-by-finite groups'.

K.J. BRONN
'Non-trivial solutions of predator-prey systems with small diffusion', *Nonlinear Analysis*.

R. Burley, G.R. McGUIRE and P. Mai
 'Dynamic behaviour of a model reactive packed bed absorption systems - a study of radial and axial flow dyeing machines', *Journal of the Textile Institute*.

E.A. Cox and D.W. REYNOLDS
 'Periodic solutions of an integro-differential equation modelling resonant sloshing'.

I.H. Dunbar, S.A. Ramsdale, S. Simons, J.D.R. STOCK and M.M.R. Williams
 'The numerical implementation of multicomponent aerosol modelling'.

D.B. DUNCAN and B.J. Lewis
 'An analytical model for depositing fission products'.
 'A model for iodine release from defective fuel elements'.

M. EDJVET and J. HOWIE
 'A Cohen-Lyndon Theorem for one-relator products', *Journal of Pure and Applied Mathematics*.

J.C. EILBECK
 'Nonlinear vibrational modes in a hexagonal molecule'.
 'Numerical study of bifurcation in reaction-diffusion models using pseudo-spectral and path-following methods'.

J.C. EILBECK and A.C. Scott
 'The quantized discrete self-trapping equation', *Physics Letts*.
 'On the CH stretch overtones of benzene', *J. Chem. Phys.*

B. Fine, J. HOWIE and G. Rosenberger
 'One-relator quotients and free products of cyclics'.

A. Friedman and A.A. LACEY
 'The blow-up time for solutions of nonlinear heat equations with small diffusion'.
 'Blow-up of solutions of semilinear parabolic equations', *Arch. Mech. Anal. Appl.*

J.K. HALE, X.-B. Lin and G. Raugel
 'Approximation of attractors for semigroups and parabolic equations', *J. Math. Computation*.

J.K. HALE and G. Raugel
 'Attractors for a singular perturbed hyperbolic equation', *J. Differential Equations*.

J.K. HALE and C. Rocha
 'Interaction of diffusion and boundary conditions', *J. Nonlinear Analysis*.

J.K. HALE and N. Stavrakakis
 'Attractors for weak dynamical systems', *Applicable Analysis*.

J. HOWIE
 'The quotient of a free product of groups by a single high-powered relator'.
 'Examples of two-relator groups of arbitrary cohomological dimension'.

R. Hunter and G.R. McGUIRE
 'Specification weather limitations applied to surfacing operations - are they necessary?', *Highways and Transportation*.

A.A. LACEY
 'Global blow-up of a nonlinear heat equation', *Proc. Roy. Soc. Ed.*

A.A. LACEY and D.E. TZANETIS
 'Global existence and convergence to a singular steady state for a semilinear heat equation'.

M.C. Owen and H.T. WILLIAMS
 'Bulging of non-linear elastic tubes'.

O. PENROSE
 'Phase transitions on fractal lattices', *Journal of Statistical Physics*.

A.R. PRINCE
 'Biplane and $SL(2,2^n)$ '.
 'Collineation groups of projective planes and the Hall-Janko group'.

D.W. REYNOLDS
 'Bifurcation of superharmonic solutions of an integro-differential equation modelling resonant sloshing'.

A. SADI
 'Superharmonic functions outside compact sets', *Proc. London Math. Soc.*,
 'Some new types of regularity for the Dirichlet problem', *Ann. Inst. Fourier*.

M. Shirvani and J.D.R. STOCK
 'On the pre-gelation solutions of the discrete coagulation equation'.

J.D.R. STOCK
 'The removal time for an aerosol undergoing vapour condensation'.
 'The discretisation of the condensation term in the code AEROSIM'.

TANG QI
 'Fonctions convexes de mesures obtenues par homogenisation', *C.R. Acad. Paris*, 1986.
 'Homogenisation en plasticite', *C.R. Acad. Paris*, 1986.

Copies of any of the above reports or reprints can be obtained by writing to the authors or to the Departmental Secretary.