



## **Professor Alan R. Champneys**

See:

<http://www.enm.bris.ac.uk/anm/staff/arc.html>

<http://www.enm.bris.ac.uk/staff/arc/newhomepage/>

[http://www.informatik.uni-trier.de/~ley/db/indices/a-tree/c/Champneys:Alan\\_R=.html](http://www.informatik.uni-trier.de/~ley/db/indices/a-tree/c/Champneys:Alan_R=.html)

[http://www.goodreads.com/author/show/491077.Alan\\_R\\_Champneys](http://www.goodreads.com/author/show/491077.Alan_R_Champneys)

[http://www.researchgate.net/researcher/70485154\\_Alan\\_R\\_Champneys](http://www.researchgate.net/researcher/70485154_Alan_R_Champneys)

[http://www.aipuniphy.org/Profile.bme/18659/Alan\\_R\\_Champneys](http://www.aipuniphy.org/Profile.bme/18659/Alan_R_Champneys)

<http://www.barnesandnoble.com/c/alan-r-champneys>

<http://65.54.113.26/Author/2441678/alan-r-champneys>

Professor of Applied Nonlinear Mathematics  
Applied Nonlinear Mathematics Group  
Department of Engineering Mathematics  
University of Bristol, UK

Date of and place of birth: 17/4/67, Tunbridge Wells , Kent, U.K. Nationality British.

Status Married to Sharon since 1992. Two sons: Max 19/6/95, Dominic 10/5/97. Daughter Emma 19/11/00

### **Brief Career History:**

1985-1988 BSc. in Mathematics, University of Birmingham Graduated with first class honours.

1988-1991 PhD. in Mathematics, Wadham College University of Oxford. Thesis title The nonlinear dynamics of articulated pipes conveying fluid, supervisor T. Brooke Benjamin FRS.

1992-1993 Postdoctoral Research Assistant in the School of Mathematical Sciences, University of Bath sponsored by the EPSRC (formerly SERC) on Numerical computation of invariant manifold bifurcations. Jointly supervised by John Toland and Alastair Spence .

1993- Lecturer in Nonlinear Systems. Department of Engineering Mathematics, University of Bristol. Reader since 1998. Professor since 2001.

1997-2002 EPSRC Advanced Fellowship

### **Current Research Interests:**

1. Applied dynamical systems. Understanding complicated dynamics (e.g. chaos) in physical systems governed by ordinary or partial differential equations in terms of bifurcation theory. Global bifurcations (homoclinic and heteroclinic orbits). Bifurcations (grazing and sliding) unique to piecewise-smooth systems. Parametric resonance; the 'Indian Rope trick'. Application across engineering to aircraft and structural dynamics, power electronics, fluid-structure interaction.

2. Numerical bifurcation theory . Path-following; use of the codes AUTO and CONTENT. Numerical analysis of homoclinic and heteroclinic bifurcations, including homoclinic orbits to periodic orbits, numerical branch-switching and stability calculations. Algorithms for periodic orbits of large systems.

3. Localised phenomena . Existence theories for multiplicities of homoclinic orbits in Hamiltonian and reversible systems. Applications to nonlinear elastic buckling. Localised buckling of cylinders , rods and struts. Solitary waves in suspension bridges. Applications to solitary water waves with surface tension, and generalised solitary waves (homoclinics to periodics). Applications to nonlinear optics; "embedded" solitons, second-harmonic generation, optical parametric oscillators. Localised modes of higher-order continuum models for lattice equations.

### **PhD Students and topics:**

Mario di Bernardo 1995-1998 Controlling chaos (joint supervision with Prof David Stoten, Mechanical Engineering )

Patrick Woods 1995-1999 Localised elastic buckling

Rob Clewley 1997-2001 Dynamical models of neural networks

Bart Oldeman 1998-2001 Homoclinic doubling bifurcations (joint supervision with Dr Bernd Krauskopf)

Matt Pearce 2000 - Embedded solitons in nonlinear optics

Richard Eyres 2001- Modelling lag dampers on helicopter rotors (joint supervision with Dr Nick Lieven - Aerospace Engineering - & John Hogan)

Csoba Hos 2002 Visiting student from Technical University of Budapest.

### **Selected Publications:**

Champneys, A.R. 1991 Homoclinic orbits in the dynamics of articulated pipes conveying fluid. *Nonlinearity* 4, 747--774.

Champneys, A.R., Kuznetsov, Yu.A. & Sandstede, B. 1996 A numerical toolbox for homoclinic bifurcation analysis. *International Journal of Bifurcation and Chaos* 6, 867-887.

Champneys, A.R. 1998 Homoclinic orbits in reversible systems and their applications in mechanics, fluids and optics *Physica D* 112 , 158-186.

Champneys, A.R., Hunt G.H. and Thompson, J.M.T. (Eds.) 1999 Localization and solitary waves in solid mechanics. *World Scientific Advanced Series in Nonlinear Dynamics*. Volume 12. 396 pages.

Champneys, A.R. and Fraser, W.B. 2000 The 'Indian rope trick' for a parametrically excited flexible rod: I linearised analysis. Proc. Roy. Soc. Lond. A 456 553-570.

Skryabin, D.V, Champneys, A.R. and Firth W.J. 2000 Frequency selection by soliton excitation in nondegenerate intracavity downconversion. Physical Review Letters 84 463-466.

di Bernardo, M., Budd, C.J. and Champneys, A.R. 2001 Grazing and Border-Collision in Piecewise-smooth Systems: A Unified Analytical Framework. Physical Review Letters 86 2553-2556

Champneys, A.R., Vanden-Broek J.-M. and Lord, G.J. 2002 Do true elevation solitary waves exist? A numerical investigation. J.Fluid Mech. 454 403-417.

### **Software for Homoclinic Bifurcation Analysis:**

HomCont, jointly developed with Yuri A. Kuznetsov of the University of Utrecht, Bjoern Sandstede Ohio State University. A toolbox for numerical homoclinic bifurcation analysis. the numerical continuation package AUTO written by Eusebius Doedel of Concordia University. Specifically, it deals with continuation of codim 1 homoclinic orbits to hyperbolic and saddle-node equilibria, including the detection of many codim 2 singularities and the continuation of these singularities in 3 or more parameters. Version 3.0 is available prepackaged with AUTO97 which is freely available from the auto website or by anonymous ftp from [ftp.cs.concordia.ca directory pub/doedel/auto/](ftp://ftp.cs.concordia.ca/directory/pub/doedel/auto/) .

### **Research Grants:**

1994-1996 Numerical Computation of Homoclinic Tangencies to Periodic Orbits. Nuffield Foundation "Newly appointed science lecturer" 4,000 pounds.

1994 British Council Travel Grant to visit Poul G. Hjorth of the Technical University of Denmark to work on adiabatic invariants in Hamiltonian systems.

1994 Novel Aspects of Codimension-Two Homoclinic Bifurcations. EPSRC Visiting Fellowship Grant to fund the visits of Bjoern Sandstede of the Weierstrass-Institute for Applied Analysis and Stochastics, Berlin and Joerg Haerterich of the Free University of Berlin.

1994-1997 Homoclinic Orbits and Localised Buckling of Axially-Compressed Cylindrical Shells. With Giles Hunt (Mechanical Engineering, University of Bath). EPSRC Applied Nonlinear Mathematics Initiative, 100,000 pounds to employ Gabriel Lord as a postdoctoral Research Assistant.

1997-2000 Localized homoclinic buckling of rods using nonlinear dynamics and bifurcation theory. With J.M.T. Thompson FRS. EPSRC Applied Nonlinear Mathematics (ANM) grant to fund a postdoc at UCL starting April 1997. 100,000 pounds (payable to UCL) to employ Gert van der Heijden.

1998 An Ethel Raybold Foundation grant to visit the University of Queensland to work with Dave Stump for 5 weeks in Sept-Oct 1998 on buckling of long rods hanging under gravity.

1999 A Benjamin Meaker grant for Boris Malomed of the University of Tel Aviv to visit for four weeks in March 1999.

1999 An NWO (Dutch Research Council) grant for Dr Paul Zegeling of the University of Utrecht to visit for 1 week in March 2000.

2000 An EPSRC visiting fellowship to fund Barrie Fraser of the University of Sydney to visit Bristol for 3 months in Summer 2000. Value

2000 BLADE Project JIF bid from the UK government. Part of the scientific case for this 15 Million pounds(!) award to revamp the Queen's Building into a state of the art facility for Advanced Dynamic Engineering

2000-2002 A Global Approach to Understanding Localized Structures in Nonlinear Dispersive Wave Systems. Co-principle investigator with Vassilis Rothos (University of Loughborough) to fund a postdoc and international visitor programme. Funds Andre Aigner Value 100,000 pounds.

2000-2001 London Mathematical Society network grant to fund meetings of the "Southern Bifurcation Theory" network at Bristol, Exeter, Southampton and Imperial College.

2001 EPSRC Mathematics Programme Workshop Grant to fund meeting on "Nonlinear Dynamics and Chaos; Where Should We Go From Here?" One of organising committee of 6. Value 16,630 pounds + 4,000 pounds from Colston Research Society and 2,000 pounds from LMS.

2001 "Local Bifurcations with Global Reinjection." Co-investigator on fast track EPSRC proposal by Bernd Krauskopf. Value 60,000 pounds.

2002 "Numerical Methods for Nonlinear Dynamics & Bifurcations" EPSRC and LMS workshop funding. One of four co-investigators. Value 10,000 pounds.

2002 "Bristol Centre for Applied Nonlinear Mathematics." Major interdisciplinary grant from the EPSRC Mathematics programme to fund RAs and research workshops/visitors 2002-2007. 2nd named investigator. Value 1.067 million pounds. 2002 EPSRC visiting fellowship for Keith Promislow (Vancouver) to visit Bath and Bristol May-June 2002. Co-investigator. Value  $\approx$  pounds 2K

2002 EU IST Framework V grant "SICONOS: Simulation and Control of Non-smooth Systems" co-ordinator of Bristol node. 2002-2006 Network of approx 9 sites. Total value 2 million euro. Bristol's share 330,000 euro.

#### **Other Interests:**

Keen Table Tennis player (watch out for those long pimples!).

Exploring the British countryside (e.g. Guide to the Cotswolds)

Watching England lose at cricket.

The music of David Bowie