Department of Automatic Control and Systems Engineering

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Professor Peter J Fleming

Professor of Industrial Systems and Control

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Research interests
Recent Awards
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Research interests

- Evolutionary Computing and Multi-Criteria Decision Making
- Applications include aerospace, power generation, automobile, food processing, pharmaceuticals and manufacturing.

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Recent Awards

- Edgeworth-Pareto Award (International Society on Multiple Criteria Decision Making), 2015
- Franklin V. Taylor Memorial Award (best paper at IEEE International Conference on Systems, Man, and Cybernetics SMC 2013)
- Elected Fellow, International Federation of Automatic Control, 2009
- Guest Professor, Chongqing University, China, 2009
- Appointed Lifetime Adviser to International Federation of Automatic Control, 2008.
- Elected Fellow, Royal Academy of Engineering, 2005
- IFAC Outstanding Service Award, 2005
- Achievement Medal, University of Miskolc, Hungary, 1999
- Sir Harold Hartley Medal (Institute of Measurement and Control), 1997
- FC Williams Premium (Institution of Electrical Engineers), 1996

Recent Keynote Lectures

EVOLVE 2013 Conference, Leiden, Netherlands on "Real-World Decision Making: Contextualising the Role of Search and Optimization"

UKACC Control 2012 Conference, Cardiff, on "Control Systems Engineering – a Business-Driven Approach"

7th Advanced Signal Processing and Engineering Systems (ASPES) Conference, Trivandrum, India on "Multiple Criteria Decision Making and Systems Design" and "Gas Turbine Engine Monitoring and Control"

7th International Symposium on Instrumentation and Control Technology (ISICT´2008) Beihang University, Beijing, 2008 on `Designing aerospace engineering systems with multiple objectives´

International Conference on Engineering & ICT (ICEI 2007), Malaysia, 2007 on `Multicriteria decision making in engineering design and planning´

`Partners in Science´ Workshop on Aerospace Engineering: Challenges and Opportunities, May 2007, Singapore on `Gas Turbine Engine Control and Health Monitoring´.

IEEE Symposium on Computational Intelligence in Multicriteria Decision Making, Honolulu, Hawaii, USA, April 2007 on `Tools and techniques for managing many criteria decision-making´.

Controlo 2006 Conference, Lisbon: Innovative research challenges arising in gas turbine engine control

UKACC International Control Conference, Control 2006, Glasgow: Managing Competing Objectives in Control Systems Engineering Design

Third International Conference on Evolutionary MultiCriteria Optimisation, EMO 2005, Mexico: Many-Objective Optimisation: an engineering design perspective

WACEIO Industrial Optimisation Symposium, Perth, Australia, 2002: Managing competing objectives: using evolutionary multicriteria optimisation

IFAC Conference on New Technologies for Computer Control, Hong Kong, 2001: Evolutionary computing: Opportunities for control.

Recent Grants

EPSRC /Jaguar Land Rover, Optimization for robust design: Integrating model-based systems engineering with multi-criteria decision-making support in a distributed framework (2014-2018), **£1,074,420**

Ford Research, Developing an Open Framework for Industrial Applications of Optimization – Phase 2 (2013-2014), **£65,320**

Ford Research, Developing an Open Framework for Industrial Applications of Optimization (2012-2013), **£34,300.**

University of Sheffield R&D Collaborative Research Grant, Framework for the solution of industrial optimisation problems (2012-2013) **£19,960.**

Rolls-Royce, Extension to Rolls-Royce University Technology Centre in Control and Systems Engineering (2012) with Investigator Prof V Kadirkamanathan, **£270,000.**

EU FP7 International Research Staff Exchange Scheme, New Horizons for Multi-Criteria Decision Making (2012-2015), **€287,700.**

UKIERI, Integrated Sensing, Monitoring and Healing for Autonomous Systems with Investigators Prof V Kadirkamanathan and Dr SA Pope (2012-2014), **£22,140.**

EPSRC/RR Dorothy Hodgkin Postgraduate Award, Power management for autonomous systems (2011-2014), **£90,000.**

EPSRC/RR Dorothy Hodgkin Postgraduate Award, Wireless control (2010-2013) **£90,000.**

EPSRC/RR Dorothy Hodgkin Postgraduate Award, Prognostics and data modelling techniques (2010-2013), **£90,000.**

EPSRC/RR Dorothy Hodgkin Postgraduate Award, System architecture design (2009-2012), **£90,000.**

Rolls-Royce, Fleming PJ, Extension to Rolls-Royce University Technology Centre in Control and Systems Engineering (2011), **£295,002**

EU/RAISME, Platform for Rapid Application Development, 2010-2012, **€145,000**

EPSRC, (University of Sheffield component), White Rose Grid E-Science Centre Platform Grant, 2008-2012, **£168,604**

UKIERI Award for `Optimal Vibration Control of Composite Structures´, 2009-2011, **£44,680**

OMEGA Award for `Control Strategies For A Cleaner Exhaust´, 2008, **£60,000**

Rolls-Royce, Fleming PJ, Extension to Rolls-Royce University Technology Centre in Control and Systems Engineering (2008-2010), **£976,221**

EPSRC, Fleming PJ with University of Leeds (lead) and University of York, `The White Rose Grid e-Science Centre´ (2006 – 2008), **£272,083**

DTI, Fleming PJ with V Kadirkamanathan and HA Thompson, BROADEN - Business Resource Optimisation for

Aftermarket and Design on Engineering Networks (2005 – 2007), **£201,756**

Rolls-Royce, Fleming PJ, Rolls-Royce University Technology Centre in Control and Systems Engineering (2004-2007), **£764,430**

EPSRC, Fleming PJ with V Kadirkamanathan and HA Thompson, Decision support for integrated logistics (2002-2005), **£89,700**

EPSRC, Fleming PJ with V Kadirkamanathan and HA Thompson, Distributed Aircraft Maintenance Environment – E-Science GRID Demonstrator - Sheffield, (2002-2005), **£480,622**

Selected Professional Activities

	Activity
1	IFAC Advisor
2	Chair, Elsevier/IFAC Publications Management Committee (2011-present)
3	Director, Rolls-Royce University Technology Centre in Control and Systems Engineering (1993-2012)
4	Consulting Editor, International Journal of Systems Science; formerly Editor-in-Chief (2000-2016)
5	Vice-President, International Federation of Automatic Control (IFAC) (2002 - 2008)
6	Lead Assessor, Electrical and Electronic Engineering, Standing Committee for Research and Secondment Schemes, The Royal Academy of Engineering (2007 – 2010)
7	Panel Member, Systems Engineering, Romanian Research Assessment Exercise, 2011.
8	Member, Series Advisory Board, Lecture Notes in Control and Information Sciences
9	Member, Editorial Board, Journal of Control Engineering and Applied Informatics (2012 – present)
10	Member, Editorial Board, Journal of Memetic Computing (2007 – present)
11	Member, Editorial Board, International Journal of General Systems (2005 – present)
12	External Examiner for Undergraduate Degree Programmes at University of Glasgow (2010-2013), Queen's University, Belfast (2011-present), University of Mauritius (2013-present)
13	Recent Major Contributions to Conferences: • Member, Steering Committee, Evolutionary Multicriteria Optimisation Conference Series (2001 – present) • General Vice-Chair, European Control Conference/IEEE Decision and Control CDC/ECC 2005, Seville • Treasurer, Organising Committee, European Control Conference ECC 2003, Cambridge • Chair, International Programme Committee, IFAC International Conference on Intelligent Control Systems and Signal Processing (ICONS 2003), 8-11 April 2003, Universidade do Algarve, Portugal • General Chair, Second International Conference on Evolutionary Multi-Criterion Optimization (EMO 2003), 8-11 April 2003, Universidade do Algarve, Portugal • Chair, UKACC Control 2002 Conference, Sheffield, 2002 • Joint General Chair, 7th International Conference on Evolutionary Multi-Criterion Optimization (EMO 2013), March, 2013, Sheffield, UK

Recent Key Publications

Oree V, Hassen SZ and Fleming PJ: Generation expansion planning optimisation with renewable energy integration: a review, to appear in *Renewable & Sustainable Energy Reviews*, 69, pp 790-803, 2017.

Salomon S, Avigad G, Purshouse RC and Fleming PJ: Gearbox design for uncertain load requirements using active robust optimization, *Engineering Optimization*, 48, pp 652-671, 2016.

Wang R, Purshouse RC, Giagkiozis I and Fleming PJ: The iPICEA-g: A new hybrid evolutionary multi-criteria decision making approach using the brushing technique, *Eur J Operations Research*, 243, pp 442-453, 2015.

Wang R, Purshouse RC and Fleming PJ: Preference-inspired co-evolutionary algorithms using weight vectors, *Eur J Operations Research*, 243, pp 423-441, 2015.

De Freitas A, Guimaraes FG and Fleming PJ: Aggregation Trees for Visualization in Many-Objective Optimization, *Information Sciences*, 298, pp 288-314, 2015.

Giagkiozis I and Fleming PJ: Methods for multi-objective optimization: an analysis, *Information Sciences*, 293, pp. 338–350, 2015.

Salomon S, Avigad G, Fleming PJ, and Purshouse RC: Active Robust Optimization - Enhancing Robustness to Uncertain Environments, *IEEE Transactions on Cybernetics*, 44(11), pp 2221-2231, 2014.

Giagkiozis I, Purshouse RC and Fleming PJ: Generalized decomposition and cross entropy methods for many-objective optimization, *Information Sciences*, 282, pp. 363-387, 2014.

Giagkiozis I and Fleming PJ: Pareto front estimation for decision making, *Evolutionary Computation*, 22, 4, pp 651-678, 2014.

Wang R, Purshouse RC and Fleming PJ: General framework for localised multi-objective evolutionary algorithms, *Information Sciences*, 258, pp. 29-53, 2014.

Giagkiozis I, Purshouse RC and Fleming PJ: An Overview of Population-Based Algorithms for Multi-Objective Optimization, *Int J Systems Science*, 46, pp 1572-1599, 2015.

Wang R, Purshouse RC and Fleming PJ: Preference-inspired co-evolutionary algorithms for many-objective optimisation, *IEEE Trans Evolutionary Computation*, 17(4), pp 474-494, 2013.

Adra SF and Fleming PJ: Diversity Management in Evolutionary Many-Objective Optimization, *IEEE Trans Evolutionary Computation*, 15 (2), pp 183-195, 2011.

Silva VVR, Fleming PJ, Sugimoto J and Yokoyama R: Multiobjective optimization using variable complexity modelling for control system design, *Applied Soft Computing*, 8 (1), pp. 392-401, 2008.

Shenfield A, Fleming PJ, Kadirkamanathan V and Allan GM: Optimisation of maintenance scheduling strategies on the grid, *Annals of Operations Research*, 180, pp. 213-231, 2010.

Adra, SF, Dodd TJ, Griffin IA and Fleming PJ: A Convergence Acceleration Operator for Multiobjective Optimisation, *IEEE Trans Evolutionary Computation*, 13 (4), pp 825-847, 2009.

Wanner EF, Guimaraes FG, Takahashi RHC and Fleming PJ: Local search with quadratic approximations into memetic

algorithms for optimization with multiple criteria, *Evolutionary Computation*, 16(2), pp 185-224, 2008.

Purshouse RC and Fleming PJ: On the evolutionary optimisation of many conflicting objectives, *IEEE Trans Evolutionary Computation*, 11(6), pp 770-784, 2007.

Fleming PJ and Pashkevich MA: Optimal advertising campaign generation for multiple brands using MOGA, *IEEE Trans Systems, Man and Cybernetics*, vol 37, pp. 1190-1201, 2007.

Choi IS, Rossiter AP and Fleming PJ: Looper and Tension Control in Hot Rolling Mills: A Survey, *Journal of Process Control*, vol 17, pp 509-521, 2007.

Kadirkamanathan V, Selvarajah K and Fleming PJ: Stability analysis of the particle dynamics in particle swarm optimizer, *IEEE Transactions on Evolutionary Computation*, vol 10, pp 245-255, 2006.

Breikin TV, Herbert ID, Kim SK, Regunath S, Hargrave SM, Thompson HA and Fleming PJ: Staged combustion control design for aero engines, *Control Engineering Practice*, vol 14, pp 387-396, 2006.

Fleming PJ, Purshouse RC, Lygoe RJ: Many-objective optimization: An engineering design perspective, *Lecture Notes in Computer Science*, 3410, pp 14-32, 2005.

Rodriguez-Vazquez K, Fonseca CM, and Fleming PJ: Identifying the structure of nonlinear dynamic systems using multiobjective genetic programming, *IEEE Transactions on Systems Man and Cybernetics Part A-Systems And Humans*, vol 34, pp 531-545, 2004.

Gillet VJ, Khatib W, Willett P, Fleming PJ and Green DVS: Combinatorial library design using a multiobjective genetic algorithm, *J Chemical Information and Computer Sciences*, vol 42, pp 375-385, 2002

Fleming PJ and Purshouse RC: Evolutionary algorithms in control systems engineering: a survey, *Control Engineering Practice*, vol 10, pp 1223-1241, 2002.

Schroder P, Green B, Grum N and Fleming PJ: On-line evolution of robust control systems: An industrial active magnetic bearing application, *Control Engineering Practice*, vol 9, no 1, 2001, pp 37-49

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Quick Links

Complex Optimization and Decision-Making Laboratory *Arrow*

Rolls-Royce University Technology Centre in Control and Systems Engineering *Arrow*

Genetic Algorithm Toolbox for MATLAB *Arrow*

See also

International Journal of Systems Science (IJSS) *Arrow*

International Federation of Automatic Control (IFAC) *Arrow*

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