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Qualifications

Applied Mathematics, PhD, The University of Western Australia
Award Date: 28 Jun 1998
Pure Mathematics, BSc(Hons), The University of Western Australia
Award Date: 8 Dec 1994
Fellow of The Australia Mathematics Society, FAustMS
Senior Member of IEEE, SnrMIEEE

Employment

UWA Data Institute

The University of Western Australia
21 Mar 2022 → present

Professor

Mathematics and Statistics
School of Physics, Maths and Computing
5 Jan 2012 → present

Planning and Transport Research Centre

School of Social Sciences
7 May 2024 → 7 May 2029

CSIRO-UWA Chair of Complex Engineering Systems

CSIRO - Mineral Resources
Canberra, Australia
1 Jan 2016 → present

Research outputs

Cognitive dissonance and introversion effects on opinion dynamics and echo chamber formation

Tan, E., Stemler, T. & Small, M., 15 Nov 2024, In: Physica A: Statistical Mechanics and its Applications. 654, 14 p., 130130.

A mutual information statistic for assessing state space partitions of dynamical systems

Lu, J. & Small, M., Nov 2024, In: Chaos (Woodbury, N.Y.). 34, 11, 15 p., 111102.

Modeling Ordinal First Return Dynamics from Time Series

Shahriari, Z., Algar, S. D., Walker, D. M. & Small, M., 23 Oct 2024, (E-pub ahead of print) In: International Journal of Bifurcation and Chaos. 20 p., 2430031.

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Gong, Y. & Small, M., 1 Oct 2024, In: Chaos (Woodbury, N.Y.). 34, 10, 103105.

Recent achievements in nonlinear dynamics, synchronization, and networks

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Ding, J., Lei, Y., Xie, J. & Small, M., Sept 2024, In: Chaos, Solitons and Fractals. 186, 13 p., 115241.

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Tan, E., Algar, S., Corrêa, D., Small, M., Stemler, T. & Walker, D., Sept 2024, In: Chaos (Woodbury, N.Y.). 34, 9

Focus on the disruption of networks and system dynamics

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Aggregate size and density estimation from settling tests: An evaluation of available approaches using computational fluid dynamics

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A Backpropagation Algorithm for Inferring Disentangled Nodal Dynamics and Connectivity Structure of Dynamical Networks

Tan, E., Correa, D., Stemler, T. & Small, M., 1 Jan 2024, In: IEEE Transactions on Network Science and Engineering. 11, 1, p. 613-624 12 p.

Information cascade prediction of complex networks based on physics-informed graph convolutional network

Yu, D., Zhou, Y., Zhang, S., Li, W., Small, M. & Shang, K. K., Jan 2024, In: New Journal of Physics. 26, 1, 013031.

Network representations of attractors for change point detection

Tan, E., Algar, S. D., Corrêa, D., Stemler, T. & Small, M., Dec 2023, In: Communications Physics. 6, 1, 14 p., 340.

Reservoir computing with higher-order interactive coupled pendulums

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Synchronization of multiple mobile reservoir computing oscillators in complex networks

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Searching for Key Cycles in a Complex Network

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Ordinal Poincaré sections: Reconstructing the first return map from an ordinal segmentation of time series

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Consistency Hierarchy of Reservoir Computers

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Epidemic dynamics on higher-dimensional small world networks

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Reservoir computing with swarms

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Revisiting the memory capacity in reservoir computing of directed acyclic network

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The distinct roles of initial transmission and retransmission in the persistence of knowledge in complex networks

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A social communication model based on simplicial complexes

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Navigating differential structures in complex networks

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Revising the simple measures of assortativity in complex networks

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Synchronisation during electrically-stimulated gamma oscillation bursts in mouse somatosensory cortex in vitro

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Three structural properties reflecting the synchronizability of complex networks

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Unified framework for detecting phase synchronization in coupled time series

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Sun, J., Zhang, J., Zhou, J., Xu, X. & Small, M., 2008, In: *Physical Review E*. 77, 4, p. 046213-1 to 046213-7

Epidemic dynamics on scale-free networks with piecewise linear infectivity and immunization

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Extension of the local subspace method to enhancement of speech with colored noise

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Pinning synchronization of delayed neural networks

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Correlation structures in short-term variabilities of stock indices and exchange rates

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Deterministic and random synthesis of discrete chaos

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Estimating the distribution of dynamic invariants: illustrated with an applicaiton to human photo-plethysmographic time series

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From phase space to frequency domain: A time-frequency analysis for chaotic time series

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Improved parameter estimation from noisy time series for nonlinear dynamical systems

Nakamura, T., Hirata, Y., Judd, K., Kilminster, D. J. & Small, M., 2007, In: *International Journal of Bifurcation and Chaos*. 17, 5, p. 1741-1752

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Tests of the random walk hypothesis for financial data

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Inferring epidemiological control strategies from complex network models of disease propagation

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A Comparative Study of Information Criteria for Model Selection

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Detecting unstable fixed points using Kalman Filters with constraints

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Super-spreaders and the rate of transmission of the SARS virus

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Testing for correlation structures in short-term variabilities with long-term trends of multivariate time series

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Chaotic dynamics and simulation of Japanese vowel sounds

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Applied Nonlinear Time Series Analysis: Applications in Physics, Physiology and Finance

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Clustering model for transmission of the SARS virus: application to epidemic control and risk assessment

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Equivalence between "feeling the pulse" on the human wrist and the pulse pressure wave at fingertip

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Optimal phase-space projection for noise reduction

Luo, X., Zhang, J. & Small, M., 2005, In: Physical Review E - Statistical, Nonlinear, and Soft Matter Physics. 72, p. 046710-1 to 046710-5

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Xia, Y., Tse, C. K., Tam, W. T., Lau, F. C. M. & Small, M., 2005, In: Physical Review E - Statistical, Nonlinear, and Soft Matter Physics. 72, p. 026116-1 to 026116-7

Small-shuffle surrogate data: Testing for dynamics in fluctuating data with trends

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Small world and scale free model of transmission of SARS

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Surrogate test to distinguish between chaotic and pseudoperiodic time series

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Telemetry system driven by radiation power for use in gravitational wave detectors

Zhao, Y., Zhao, C., Ju, L., Small, M. & Blair, D., 2005, In: Review of Scientific Instruments. 76, 8, p. 084503-1-084503-4

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Combining local and global models to capture fast and slow dynamics in time series data

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Deterministic propagation of blood pressure waveform from human wrists to fingertips

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Chaos communication using chaos

Small, M., Tse, C. K. & Lau, F. C. M., 2004, In: DYNAMICS OF CONTINUOUS DISCRETE AND IMPULSIVE SYSTEMS-SERIES B-APPLICATIONS & ALGORITHMS. 11A, p. 104-111

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Small, M. & Tse, C. K., 2004, In: Physica D: Nonlinear Phenomena. 194, p. 283-296

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Applying the method of surrogate data to cyclic time series

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Minimum description length neural networks for time series prediction

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Modeling continuous processes from data

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Uncovering non-linear structure in human ECG recordings

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Surrogate test for pseudoperiodic time series data

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Variation in the Dominant Period During Ventricular Fibrillation

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Automatic identification and recording of cardiac arrhythmia

Small, M., Yu, D. J., Grubb, N., Simonotto, J., Fox, K. A. A. & Harrison, R. G., 1 Dec 2000, In: Computers in Cardiology. p. 355-358 4 p.

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Small, M., Yu, D. J., Clayton, R. H., Simonotto, J. & Harrison, R. G., 1 Dec 2000, In: Computers in Cardiology. p. 525-528 4 p.

Nonlinear analysis of human ECG during sinus rhythm and arrhythmia

Small, M., Yu, D. J., Simonotto, J. & Harrison, R. G., 1 Dec 2000, In: Computers in Cardiology. p. 147-150 4 p.

Deterministic nonlinearity in ventricular fibrillation

Small, M., Yu, D., Harrison, R. G., Robertson, C., Clegg, G., Holzer, M. & Sterz, F., 2000, In: Chaos. 10, 1, p. 268-277

Efficient implementation of the Gaussian kernel algorithm in estimating invariants and noise level from noisy time series data

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Yu, D., Small, M., Harrison, R. G., Robertson, C., Clegg, G., Holzer, M. & Sterz, F., 2000, In: Physics Letters, Section A: General, Atomic and Solid State Physics. 265, p. 68-75

Towards long-term prediction

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Characterizing nonlinearity in Ventricular Fibrillation

Small, M., Yu, D. J., Harrison, R. G., Robertson, C., Clegg, G., Holzer, M. & Sterz, F., 1 Dec 1999, In: Computing in Cardiology. p. 17-20 4 p.

Complexity measurements for analysis and diagnosis of early ventricular fibrillation

Yu, D., Small, M., Harrison, R. G., Robertson, C., Clegg, G., Holzer, M. & Sterz, F., 1 Dec 1999, In: Computing in Cardiology. p. 21-24 4 p.

Linear and nonlinear characteristics of ECG signals produced by simulations of ventricular tachyarrhythmias

Clayton, R. H., Yu, D. J., Small, M., Biktashev, V. N., Harrison, R. G. & Holden, A. V., 1 Dec 1999, In: Computers in Cardiology. p. 479-482 4 p.

Nonlinear dynamics in infant respiration

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Detecting periodicity in experimental data using linear modeling technique

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Is breathing in infants chaotic? Dimension estimates for respiratory patterns during quiet sleep

Small, M., Judd, K., Lowe, M. & Stick, S., 1999, In: Journal of Applied Physiology. 86, p. 359-376

Comparisons of new nonlinear modelling techniques with applications to infant respiration

Small, M. & Judd, K., 1998, In: Physica D. 117, p. 283-298

Correlation dimension: A pivotal statistic for non-constrained realizations of composite hypotheses in surrogate data analysis

Small, M. & Judd, K., 1998, In: Physica D. 120, p. 386-400

Detecting nonlinearity in experimental data

Small, M. & Judd, K., 1998, In: International Journal of Bifurcation and Chaos. 8, 6, p. 1231-1244

Linear modelling techniques detect periodic respiratory behaviour in infants during regular breathing in quiet sleep

Small, M., Judd, K. & Stick, S., 1998, *American Journal of Respiratory Critical Care Medicine*. Vol. 153. p. A79

Variable prediction steps and longer term prediction

Small, M. & Judd, K., 1998, Department of Mathematics and Statistics: The University of Western Australia.

Using surrogate data to test for nonlinearity in experimental data

Small, M. & Judd, K., 1997, *Proceedings of the 1997 International Symposium on Nonlinear Theory and its Applications*. Tanaka, M. (ed.). Hawaii ed. Japan: Research Society of Nonlinear Theory and its Applications (IEICE), Vol. 2. p. 1133-1136

Engagement/activities

IEEE Transactions on Network Science and Engineering (Journal)

Small, M. (Associate Editor)

2022 → ...

Physica A: Statistical Mechanics and its Applications (Journal)

Small, M. (Editor in chief)

2021 → ...

Raise The Bar (UWA)

Small, M. (Speaker)

29 Oct 2019

OZ Minerals Explorer Challenge

Small, M. (Speaker)

11 Jun 2019 → 12 Jun 2019

AngloAmerican FutureSmart Mining Open Forum: Non-stop Operations

Small, M. (Consultant)

19 Nov 2018 → 21 Nov 2018

Geoscientists to Data Scientist

Small, M. (Consultant)

2018 → ...

IEEE TRANSACTIONS ON CIRCUITS AND SYSTEMS (Journal)

Small, M. (Editor)

2016 → 2020

Chaos: an interdisciplinary journal of nonlinear science (Journal)

Small, M. (Editor)

2015 → ...

International Journal of Bifurcation and Chaos in Applied Sciences and Engineering (Journal)

Small, M. (Editor)

2012 → 2022

Prizes/awards**Adjunct Professor**

Small, M. (Recipient), 2019

Australian Research Council Future Fellowship

Small, M. (Recipient), 2012

Fellow Australian Mathematics Society

Small, M. (Recipient), 2015

Outstanding Referee

Small, M. (Recipient), 2016

UWA Senior Research Award

Small, M. (Recipient), 2016

UWA Senior Research Award

Small, M. (Recipient), 2014

V. Afraimovich Award

Small, M. (Recipient), 2022

Grants (InfoEd projects)

A data-driven approach to improve roundabout modelling using drone video content analytics

Sun, C. (Investigator 01), Stemler, T. (Investigator 02), Small, M. (Investigator 03), Olaru, D. (Investigator 04) & Biermann, S. (Investigator 05)

iMove CRC

1/04/22 → 31/03/24

ARC Research Hub for Transforming Energy Infrastructure Through Digital Engineering

Watson, P. (Investigator 01), Jones, N. (Investigator 02), Draper, S. (Investigator 03), Bransby, F. (Investigator 04), Cripps, E. (Investigator 05), O'Loughlin, C. (Investigator 06), Hansen, J. (Investigator 07), An, H. (Investigator 08), Karrech, A. (Investigator 09), Doherty, J. (Investigator 10), Ivey, G. (Investigator 11), Randolph, M. (Investigator 12), Zhao, W. (Investigator 13), Wolgamot, H. (Investigator 14), Stemler, T. (Investigator 15), Cheng, L. (Investigator 16), French, T. (Investigator 17), Mian, A. (Investigator 18), Small, M. (Investigator 19), Hodkiewicz, M. (Investigator 20) & Grime, A. (Investigator 21)

ARC Australian Research Council

1/07/21 → 30/06/26

ARC Training Centre for Transforming Maintenance through Data Science

Rohl, A. (Investigator 01), Small, M. (Investigator 02), Hodkiewicz, M. (Investigator 03), Loxton, R. (Investigator 04), O'Halloran, K. (Investigator 05), Tan, T. (Investigator 06), Calo, V. (Investigator 07), Reynolds, M. (Investigator 08), Liu, W. (Investigator 09), While, R. (Investigator 10), French, T. (Investigator 11), Cripps, E. (Investigator 12), Cardell-Oliver, R. (Investigator 13) & Correa, D. (Investigator 14)

ARC Australian Research Council

1/01/19 → 24/02/25

Building a Culturally Safe Mental Health System for Aboriginal and Torres Strait Islander Young People

Milroy, H. (Investigator 01), Dudgeon, P. (Investigator 02), Mitchell, M. (Investigator 03), Watson, M. (Investigator 04), Hood, S. (Investigator 05), Lin, A. (Investigator 06), Coleman, M. (Investigator 07), Small, M. (Investigator 08), Kashyap, S. (Investigator 09), Woolard, A. (Investigator 10) & Collova, J. (Investigator 11)

Medical Research Future Fund MRFF

1/06/22 → 31/05/25

Complex Dynamical Systems - Inferring Form & Function of Interacting Biological Systems

Small, M. (Investigator 01)

ARC Australian Research Council

1/01/11 → 31/12/14

Control Points in Nitrogen Uptake - Enhancing the Response of Cereals to Nitrogen Supply and Demand

Garnett, T. (Investigator 01), Heuer, S. (Investigator 02), Roessner, U. (Investigator 03), Small, M. (Investigator 04), Gupta, R. (Investigator 05) & Kuchel, H. (Investigator 06)

ARC Australian Research Council

1/01/14 → 31/12/17

CSIRO-UWA Chair of Complex Engineering Systems

Small, M. (Investigator 01)

Commonwealth Scientific & Industrial Research Organisation

4/07/22 → 3/07/25

Development of a Vulnerability Index to Predict Adolescent Suicide.

Page, A. (Investigator 01), Small, M. (Investigator 02), Lawrence, D. (Investigator 03) & Hooke, G. (Investigator 04)
Young Lives Matter Foundation

1/01/20 → 31/12/20

Generating Indigenous patient-centred, clinically and culturally capable models of mental health care

Dudgeon, P. (Investigator 01), Milroy, H. (Investigator 02), Milroy, J. (Investigator 03), Calma, T. (Investigator 04), Wright, M. (Investigator 05), Gee, G. (Investigator 06), Ewen, S. (Investigator 07), Hood, S. (Investigator 08), Walker, R. (Investigator 09) & Small, M. (Investigator 10)

Medical Research Future Fund MRFF

1/01/19 → 31/05/25

Mapping the effects of land clearing on temperature extremes across Oceania and Indonesia's deforestation hotspots

Thompson, S. (Investigator 01), Small, M. (Investigator 02), Correa, D. (Investigator 03) & Duncan, J. (Investigator 04)
National Geographic Society

1/08/20 → 31/07/21

Mathematical modelling of multiphase transport and aggregation in turbulent flows

Small, M. (Investigator 01) & Fawell, P. (Investigator 02)

Commonwealth Scientific & Industrial Research Organisation

12/12/19 → 1/10/22

Navigating tipping points in complex dynamical systems

Small, M. (Investigator 01), Lesterhuis, W. (Investigator 02), Bosco, A. (Investigator 03) & Zaitouny, A. (Investigator 04)

ARC Australian Research Council

1/01/18 → 31/12/21

Parameters for Roundabout Modelling

Sun, C. (Investigator 01), Stemler, T. (Investigator 02), Small, M. (Investigator 03) & Polpo, A. (Investigator 04)

Main Roads Western Australia

1/05/20 → 30/04/21

Quantifying complexity and measuring structure within complex systems

Small, M. (Investigator 01)

ARC Australian Research Council

1/01/14 → 31/12/16

Reducing self-harm and suicidal behaviours in young people in Western Australia

Page, A. (Investigator 01), Houghton, S. (Investigator 02), Chapman, E. (Investigator 03), Small, M. (Investigator 04), Freshwater, D. (Investigator 05), Hood, S. (Investigator 06), Sawyer, M. (Investigator 07), Milroy, H. (Investigator 08), Fitzgerald, T. (Investigator 09) & Sheil, B. (Investigator 10)

ARC Australian Research Council

31/03/23 → 28/02/26

Subsurface Big Data Visualisation and Analysis: Oil/Gas Reservoirs

Small, M. (Investigator 01), Portes dos Santos, L. (Investigator 02) & Correa, D. (Investigator 03)

Woodside R2D3

20/12/18 → 19/12/19

TSuNAMi: Time Series Network Animal Modelling

Walker, D. (Investigator 01), Small, M. (Investigator 02), Correa, D. (Investigator 03) & Blache, D. (Investigator 04)

ARC Australian Research Council

1/09/20 → 31/08/25

UWA Young Lives Matter Foundation: Reducing self-harm and suicidal behaviours in young people in Western Australia

Lawrence, D. (Investigator 01), Houghton, S. (Investigator 02), Chapman, E. (Investigator 03), Page, A. (Investigator 04), Small, M. (Investigator 05), Sheil, B. (Investigator 06), Freshwater, D. (Investigator 07), Milroy, H. (Investigator 08), Sawyer, M. (Investigator 09) & Fitzgerald, T. (Investigator 10)

Stan Perron Charitable Foundation

30/11/20 → 31/12/24

Teaching units (UWA)

MATH1002: Mathematical Methods 2

Small, M.

23/02/15 → 27/06/15

MATH1721: Mathematics Foundations: Methods

Small, M.

25/07/22 → 26/11/22

MATH3021: Nonlinear Dynamics and Chaos

Small, M.

27/02/12 → 30/06/18

MATH4021: Dynamical Systems

Small, M.

25/02/19 → ...

SHPC4001: Principles of Scientific Computing

Small, M.

23/02/15 → 22/06/18