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Mathematics and Statistics  
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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

### Professor

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

### Adjunct Professor

Curtin University of Technology  
Perth, Australia  
1 Jan 2019 → present

### CSIRO-UWA Chair of Complex Engineering Systems

CSIRO Mineral Resources Australia  
Kensington, Australia  
1 Jan 2016 → present

## Research outputs

### Exploring the optimal network topology for spreading dynamics

Wang, D., Small, M. & Zhao, Y., 15 Feb 2021, In : PHYSICA A-STATISTICAL MECHANICS AND ITS APPLICATIONS. 564, 8 p., 125535.

### Inclusivity enhances robustness and efficiency of social networks

Moore, J. M., Small, M. & Yan, G., 1 Feb 2021, In : PHYSICA A-STATISTICAL MECHANICS AND ITS APPLICATIONS. 563, 13 p., 125490.

### A social communication model based on simplicial complexes

Wang, D., Zhao, Y., Leng, H. & Small, M., 17 Dec 2020, In : Physics Letters, Section A: General, Atomic and Solid State Physics. 384, 35, 126895.

### Identification and prediction of bifurcation tipping points using complex networks based on quasi-isometric mapping

Peng, X., Zhao, Y. & Small, M., 15 Dec 2020, In : Physica A: Statistical Mechanics and its Applications. 560, 125108.

### Navigating differential structures in complex networks

Portes, L. L. & Small, M., 7 Dec 2020, In : Physical Review E. 102, 6, 13 p., 062301.

**A Network Data Analytics Approach to Assessing Reservoir Uncertainty and Identification of Characteristic Reservoir Models**

Tan, E., Zafari, M., Small, M. & Portes, L. L., Nov 2020, *SPE Asia Pacific Oil & Gas Conference and Exhibition*. Society of Petroleum Engineers (SPE), 12 p. SPE-202379-MS

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

Wang, H., Moore, J. M., Wang, J. & Small, M., 20 Oct 2020, In : *Applied Mathematics and Computation*. 392, 14 p., 125730.

**Mapping topological characteristics of dynamical systems into neural networks: A reservoir computing approach**

Chen, X., Weng, T., Yang, H., Gu, C., Zhang, J. & Small, M., Sep 2020, In : *Physical Review E*. 102, 3, 033314.

**Permutation Entropy of State Transition Networks to Detect Synchronization**

Shahriari, Z. & Small, M., 1 Aug 2020, In : *International Journal of Bifurcation and Chaos*. 30, 10, 2050154.

**Global Stability of Epidemic Models with Imperfect Vaccination and Quarantine on Scale-Free Networks**

Chen, S., Small, M. & Fu, X., 1 Jul 2020, In : *IEEE Transactions on Network Science and Engineering*. 7, 3, p. 1583-1596 14 p., 8844772.

**Quantifying the generalization capacity of Markov models for melody prediction**

Corrêa, D. C., Jüngling, T. & Small, M., 1 Jul 2020, In : *Physica A: Statistical Mechanics and its Applications*. 549, 124351.

**Particle-resolved direct numerical simulation of drag force on permeable, non-spherical aggregates**

Mola, I. A., Fawell, P. D. & Small, M., 8 Jun 2020, In : *Chemical Engineering Science*. 218, 115582.

**Constrained Markov order surrogates**

Corrêa, D. C., Moore, J. M., Jüngling, T. & Small, M., 1 May 2020, In : *Physica D: Nonlinear Phenomena*. 406, 132437.

**Growing networks with communities: A distributive link model**

Shang, K. K., Yang, B., Moore, J. M., Ji, Q. & Small, M., 1 Apr 2020, In : *Chaos (Woodbury, N.Y.)*. 30, 4, 1 p.

**A novel metric for community detection**

Shang, K. K., Small, M., Wang, Y., Yin, D. & Li, S., Mar 2020, In : *EPL*. 129, 6, 68002.

**Network using Michaelis-Menten kinetics: Constructing an algorithm to find target genes from expression data**

Krishnan, M., Small, M., Bosco, A. & Stemler, T., 20 Feb 2020, In : *Journal of Complex Networks*. 8, 1, cnz016.

**Fast automatic detection of geological boundaries from multivariate log data using recurrence**

Zaitouny, A., Small, M., Hill, J., Emelyanova, I. & Clennell, M. B., Feb 2020, In : *Computers & Geosciences*. 135, 104362.

**Laminar chaos in nonlinear electronic circuits with delay clock modulation**

Jüngling, T., Stemler, T. & Small, M., 29 Jan 2020, In : *Physical Review E*. 101, 1, p. 1-7 012215.

**Reciprocal characterization from multivariate time series to multilayer complex networks**

Zhao, Y., Peng, X. & Small, M., 22 Jan 2020, In : *Chaos*. 30, 1, 013137.

**Modelling Strong Control Measures for Epidemic Propagation with Networks - A COVID-19 Case Study**

Small, M. & Cavanagh, D., 2020, In : *IEEE Access*. 8, p. 109719-109731 13 p., 9113296.

**Quantifying Robustness and Capacity of Reservoir Computers with Consistency Profiles**

Lymburn, T., Jüngling, T. & Small, M., 2020, *Artificial Neural Networks and Machine Learning – ICANN 2020 - 29th International Conference on Artificial Neural Networks, Proceedings*. Farkaš, I., Masulli, P. & Wermter, S. (eds.). Springer

Science + Business Media, p. 447-458 12 p. (Lecture Notes in Computer Science (including subseries Lecture Notes in Artificial Intelligence and Lecture Notes in Bioinformatics); vol. 12397 LNCS).

#### **Markov modeling via ordinal partitions: An alternative paradigm for network-based time-series analysis**

Sakellariou, K., Stemler, T. & Small, M., 18 Dec 2019, In : Physical Review E. 100, 6, 062307.

#### **Modelling the effect of heterogeneous vaccination on metapopulation epidemic dynamics**

Gong, Y. & Small, M., 16 Dec 2019, In : Physics Letters A. 383, 35, 8 p., 125996.

#### **Learned emergence in selfish collective motion**

Algar, S. D., Lymburn, T., Stemler, T., Small, M. & Jüngling, T., 2 Dec 2019, In : Chaos: an interdisciplinary journal of nonlinear science. 29, 12, p. 1-10 123101.

#### **Predator-prey games on complex networks**

Weng, T., Yang, H., Gu, C., Zhang, J., Hui, P. & Small, M., 1 Dec 2019, In : Communications in Nonlinear Science and Numerical Simulation. 79, 104911.

#### **Synchronization of reservoir computers with applications to communications**

Weng, T., Song, J., Yang, H., Gu, C., Zhang, J. & Small, M., 6 Nov 2019, In : Physica A: Statistical Mechanics and its Applications. 123453.

#### **Network science meets algebraic topology**

Shen, L., Walker, D. M. & Small, M., 1 Nov 2019, In : National Science Review. 6, 6, p. 1064-1065 2 p.

#### **Identification of Dynamical Behavior of Pseudoperiodic Time Series by Network Community Structure**

Han, X., Zhao, Y. & Small, M., Nov 2019, In : IEEE Transactions on Circuits and Systems II: Express Briefs. 66, 11, p. 1905-1909 5 p., 8663348.

#### **Faint phase synchronization detection through structured orthomax rotations in singular spectrum analysis**

Portes, L. L. & Small, M., 29 Oct 2019, In : Physical Review E. 100, 4, 9 p., 042218.

#### **Quadrant scan for multi-scale transition detection**

Zaitouny, A., Walker, D. M. & Small, M., 1 Oct 2019, In : Chaos. 29, 10, 103117.

#### **The reservoir's perspective on generalized synchronization**

Lymburn, T., Walker, D. M., Small, M. & Jüngling, T., 30 Sep 2019, In : Chaos: an interdisciplinary journal of nonlinear science. 29, 9, 093133.

#### **An Adaptive-Phasor Approach to PMU Measurement Rectification for LFOD Enhancement**

Chau, T. K., Yu, S., Fernando, T. L., Iu, H. H. C., Small, M. & Reynolds, M., 1 Sep 2019, In : IEEE Transactions on Power Systems. 34, 5, p. 3941-3950 10 p., 8674594.

#### **Introduction to Focus Issue: Complex Network Approaches to Cyber-Physical Systems**

Xia, Y., Small, M. & Wu, J., 1 Sep 2019, In : Chaos. 29, 9, 093123.

#### **The key to the weak-ties phenomenon**

Shang, K. K., Small, M., Yin, D., Li, T. C. & Yan, W., 1 Aug 2019, In : EPL. 127, 4, 48002.

#### **The reliability of recurrence network analysis is influenced by the observability properties of the recorded time series**

Portes, L. L., Montanari, A. N., Correa, D. C., Small, M. & Aguirre, L. A., 1 Aug 2019, In : Chaos. 29, 8, 083101.

#### **Sensitization to immune checkpoint blockade through activation of a STAT1/NK axis in the tumor microenvironment**

Zemek, R., de Jong, E., Chin, M., Schuster, I., Fear, V., Casey, T., Forbes, C., Dart, S., Leslie, C., Zaitouny, A., Small, M., Boon, L., Forrest, A. R. R., O Muiir, D., Degli-Esposti, M., Millward, M., Nowak, A., Lassmann, T., Bosco, A., Lake, R. & 1

others, Lesterhuis, W., 17 Jul 2019, In : Science Translational Medicine. 11, 501, 14 p., eaav7816.

#### **Detecting and Predicting Tipping Points**

Peng, X., Small, M., Zhao, Y. & Moore, J. M., Jul 2019, In : International Journal of Bifurcation and Chaos. 29, 8, 11 p., 1930022.

#### **The active selfish herd**

Algar, S. D., Stemler, T. & Small, M., 21 Jun 2019, In : Journal of Theoretical Biology. 471, p. 82-90 9 p.

#### **Link prediction for tree-like networks**

Shang, K. K., Li, T. C., Small, M., Burton, D. & Wang, Y., 1 Jun 2019, In : Chaos. 29, 6, 061103.

#### **Reconstruction of Complex Dynamical Systems from Time Series using Reservoir Computing**

Jüngling, T., Lymburn, T., Stemler, T., Corrêa, D., Walker, D. & Small, M., 1 May 2019, *2019 IEEE International Symposium on Circuits and Systems, ISCAS 2019 - Proceedings*. IEEE, Institute of Electrical and Electronics Engineers, 8702137. (Proceedings - IEEE International Symposium on Circuits and Systems; vol. 2019-May).

#### **Synchronization of chaotic systems and their machine-learning models**

Weng, T., Yang, H., Gu, C., Zhang, J. & Small, M., 5 Apr 2019, In : Physical Review E. 99, 4, 042203.

#### **Long-range correlation properties of stationary linear models with mixed periodicities**

Nakamura, T., Small, M. & Tanizawa, T., 19 Feb 2019, In : Physical Review E. 99, 2, 6 p., 022128.

#### **Consistency in echo-state networks**

Lymburn, T. M., Khor, A. J., Stemler, T., Correa, D., Small, M. & Jungling, T., 11 Feb 2019, In : Chaos: an interdisciplinary journal of nonlinear science. 29, 2, p. 1-9 9 p., 023118.

#### **An investigation of the impact of pv penetration and BESS capacity on islanded microgrids-a small-signal based analytical approach**

Chau, T. K., Shenglong Yu, S., Fernando, T., lu, H. H. C. & Small, M., 1 Feb 2019, *Proceedings - 2019 IEEE International Conference on Industrial Technology, ICIT 2019*. IEEE, Institute of Electrical and Electronics Engineers, p. 1679-1684 6 p. 8754912. (Proceedings of the IEEE International Conference on Industrial Technology; vol. 2019-February).

#### **Comparing capability of scenario hazard identification methods by the PIC (Plant-People-Procedure Interaction Contribution) network metric**

Seligmann, B. J., Zhao, J., Marmara, S. G., Corbett, T. C., Small, M., Hassall, M. & Boadle, J. T., 1 Feb 2019, In : Safety Science. 112, p. 116-129 14 p.

#### **The use of the perimeter-area method to calculate the fractal dimension of aggregates**

Florio, B. J., Fawell, P. D. & Small, M., 1 Feb 2019, In : Powder Technology. 343, p. 551-559 9 p.

#### **Review mechanism promotes knowledge transmission in complex networks**

Wang, H., Wang, J., Small, M. & Moore, J. M., 1 Jan 2019, In : Applied Mathematics and Computation. 340, p. 113-125 13 p.

#### **From Flocs to Flocks**

Algar, S. D., Stemler, T. & Small, M., 2019, *MATHEMATICAL MODELING APPROACH FROM NONLINEAR DYNAMICS TO COMPLEX SYSTEMS*. Macau, EEN. (ed.). Springer International Publishing AG, p. 157-175 19 p. (Nonlinear Systems and Complexity; vol. 22).

#### **Constructing directed networks from multivariate time series using linear modelling technique**

Tanizawa, T., Nakamura, T., Taya, F. & Small, M., 15 Dec 2018, In : Physica A: Statistical Mechanics and its Applications. 512, p. 437-455 19 p.

**Detecting determinism in time series with complex networks constructed using a compression algorithm**  
Correa, D. C., Walker, D. M. & Small, M., 15 Dec 2018, In : International Journal of Bifurcation and Chaos. 28, 13, 1850165.

**Cooperative output regulation problem of multi-agent systems with stochastic packet dropout and time-varying communication delay**  
Liu, Z., Yan, W., Li, H. & Small, M., Nov 2018, In : Journal of the Franklin Institute.

**Time series network induced subgraph distance as a metonym for dynamical invariants**  
Walker, D. M., Stemler, T. & Small, M., Nov 2018, In : EPL. 124, 4, 7 p., 40001.

**Knowledge transmission model with differing initial transmission and retransmission process**  
Wang, H., Wang, J. & Small, M., 1 Oct 2018, In : Physica A: Statistical Mechanics and its Applications. 507, p. 478-488 11 p.

**Estimating dynamical dimensions from noisy observations**  
Moore, J. M. & Small, M., 1 Sep 2018, In : Information Sciences. 462, p. 55-75 21 p.

**Epidemic spreading on metapopulation networks including migration and demographics**  
Gong, Y. & Small, M., 1 Aug 2018, In : Chaos. 28, 8, 083102.

**Is Bach's brain a Markov chain? Recurrence quantification to assess Markov order for short, symbolic, musical compositions**  
Moore, J. M., Corrêa, D. C. & Small, M., 1 Aug 2018, In : Chaos. 28, 8, 085715.

**Predicting search time when hunting for multiple moving targets: A recursive harmonic law**  
Weng, T., Zhang, J., Small, M., Yang, H. & Hui, P., 1 Aug 2018, In : Chaos. 28, 8, 083109.

**Transmission Dynamics of an SIS Model with Age Structure on Heterogeneous Networks**  
Chen, S., Small, M., Tao, Y. & Fu, X., 1 Aug 2018, In : Bulletin of Mathematical Biology. 80, 8, p. 2049-2087 39 p.

**A Load-Forecasting-Based Adaptive Parameter Optimization Strategy of STATCOM Using ANNs for Enhancement of LFOD in Power Systems**  
Chau, T. K., Yu, S. S., Fernando, T., Ho-Ching Lu, H. & Small, M., Jun 2018, In : IEEE Transactions on Industrial Informatics. 14, 6, p. 2463-2472

**Complex networks untangle competitive advantage in Australian football**  
Braham, C. & Small, M., 1 May 2018, In : Chaos. 28, 5, 053105.

**Detection of core-periphery structure in networks based on 3-tuple motifs**  
Ma, C., Xiang, B. B., Chen, H. S., Small, M. & Zhang, H. F., 1 May 2018, In : Chaos. 28, 5, 053121.

**Fault prediction and modelling in transport networks**  
Ballantyne, A., Lawrance, N., Small, M., Hodkiewicz, M. & Burton, D., 26 Apr 2018, *2018 IEEE International Symposium on Circuits and Systems, ISCAS 2018 - Proceedings*. New York: IEEE, Institute of Electrical and Electronics Engineers, Vol. 2018-May. 8351658

**Ordinal Network Measures - Quantifying Determinism in Data**  
Small, M., McCullough, M. & Sakellariou, K., 26 Apr 2018, *2018 IEEE International Symposium on Circuits and Systems, ISCAS 2018 - Proceedings*. IEEE, Institute of Electrical and Electronics Engineers, Vol. 2018-May. 8351743

**From local uncertainty to global predictions: Making predictions on fractal basins**

Levi, A., Sabuco, J., Small, M. & Sanjuán, M. A. F., 1 Apr 2018, In : PLoS One. 13, 4, e0194926.

**Universal principles governing multiple random searchers on complex networks: The logarithmic growth pattern and the harmonic law**

Weng, T., Zhang, J., Small, M., Harandizadeh, B. & Hui, P., 30 Mar 2018, In : Physical Review E. 97, 3, 032320.

**A Novel Control Strategy of DFIG Wind Turbines in Complex Power Systems for Enhancement of Primary Frequency Response and LFOD**

Chau, T. K., Yu, S. S., Fernando, T., Lu, H. H. C. & Small, M., Mar 2018, In : IEEE Transactions on Power Systems. 33, 2, p. 1811-1823

**An exploration and simulation of epidemic spread and its control in multiplex networks**

Sun, M., Small, M., Lee, S. S. & Fu, X., 1 Jan 2018, In : SIAM Journal on Applied Mathematics. 78, 3, p. 1602-1631 30 p.

**Brain anomaly networks uncover heterogeneous functional reorganization patterns after stroke**

Zou, Y., Zhao, Z., Yin, D., Fan, M., Small, M., Liu, Z., Hilgetag, C. C. & Kurths, J., 1 Jan 2018, In : NeuroImage: Clinical. 20, p. 523-530 8 p.

**On system behaviour using complex networks of a compression algorithm**

Walker, D. M., Correa, D. C. & Small, M., 1 Jan 2018, In : Chaos. 28, 1, 013101.

**Bipartite centrality diffusion: Mining higher-order network structures via motif-vertex interactions**

Li, P., Chen, K., Ge, Y., Zhang, K. & Small, M., 1 Oct 2017, In : EPL. 120, 2, 28003.

**Multitarget search on complex networks: A logarithmic growth of global mean random cover time**

Weng, T., Zhang, J., Small, M., Yang, J., Bijarbooneh, F. H. & Hui, P., 1 Sep 2017, In : Chaos. 27, 9, 093103.

**Constructing ordinal partition transition networks from multivariate time series**

Zhang, J., Zhou, J., Tang, M., Guo, H., Small, M. & Zou, Y., 10 Aug 2017, In : Scientific Reports. 7, 13 p., 7795.

**Hunting for a moving target on a complex network**

Weng, T., Zhang, J., Small, M. & Hui, P., 1 Aug 2017, In : EPL. 119, 4, 48006.

**Mathematical methods in medicine: Neuroscience, cardiology and pathology**

Amigó, J. M. & Small, M., 28 Jun 2017, In : Philosophical Transactions of the Royal Society A: Mathematical, Physical and Engineering Sciences. 375, 2096, 20170016.

**Multiscale ordinal network analysis of human cardiac dynamics**

McCullough, M., Small, M., Lu, H. H. C. & Stemler, T., 28 Jun 2017, In : Philosophical Transactions of the Royal Society A: Mathematical, Physical and Engineering Sciences. 375, 2096, 20160292.

**Tracking a single pigeon using a shadowing filter algorithm**

Zaitouny, A., Stemler, T. & Small, M., Jun 2017, In : Ecology and Evolution. 7, 12, p. 4419-4431 13 p.

**Fitness networks for real world systems via modified preferential attachment**

Shang, K., Small, M. & Yan, W. S., 15 May 2017, In : Physica A: Statistical Mechanics and its Applications. 474, p. 49-60 12 p.

**Multiple random walks on complex networks: A harmonic law predicts search time**

Weng, T., Zhang, J., Small, M. & Hui, P., 3 May 2017, In : Physics Review E. 95, 5, 052103.

### **Using geodesic space density gradients for network community detection**

Mahmood, A., Small, M., Al-Maadeed, S. A. & Rajpoot, N., 1 Apr 2017, In : IEEE Transactions on Knowledge and Data Engineering. 29, 4, p. 921-935 15 p., 7756297.

### **Dynamic versus static biomarkers in cancer immune checkpoint blockade: unravelling complexity**

Lesterhuis, W. J., Bosco, A., Millward, M. J., Small, M., Nowak, A. K. & Lake, R. A., Apr 2017, In : Nature Reviews Drug Discovery. 16, 4, p. 264-272

### **Link direction for link prediction**

Shang, K. K., Small, M. & Yan, W. S., 1 Mar 2017, In : Physica A: Statistical Mechanics and its Applications. 469, p. 767-776 10 p.

### **Regenerating time series from ordinal networks**

McCullough, M., Sakellariou, K., Stemler, T. & Small, M., Mar 2017, In : Chaos. 27, 3, 11 p., 035814.

### **Memory and betweenness preference in temporal networks induced from time series**

Weng, T., Zhang, J., Small, M., Zheng, R. & Hui, P., 3 Feb 2017, In : Scientific Reports. 7, 41951.

### **Preferential imitation can invalidate targeted subsidy policies on seasonal-influenza diseases**

Zhang, H. F., Shu, P. P., Wang, Z., Tang, M. & Small, M., 1 Feb 2017, In : Applied Mathematics and Computation. 294, p. 332-342 11 p.

### **Modelling and tracking the flight dynamics of flocking pigeons based on real GPS data (small flock)**

Zaitouny, A., Stemler, T. & Small, M., 24 Jan 2017, In : Ecological Modelling. 344, p. 62-72 11 p.

### **Comparing classical and quantum PageRanks**

Loke, T., Tang, J. W., Rodriguez, J., Small, M. & Wang, J. B., 1 Jan 2017, In : Quantum Information Processing. 16, 1, 25.

### **The role of direct links for link prediction in evolving networks**

Shang, K., Small, M., Xu, X. K. & Yan, W. S., 1 Jan 2017, In : EPL. 117, 2, 28002.

### **A general stochastic model for studying time evolution of transition networks**

Zhan, C., Tse, C. K. & Small, M., 15 Dec 2016, In : Physica A: Statistical Mechanics and its Applications. 464, p. 198-210 13 p.

### **Complex network analysis of time series**

Gao, Z. K., Small, M. & Kurths, J., 1 Dec 2016, In : EPL. 116, 5, 50001.

### **Counting forbidden patterns in irregularly sampled time series. I. The effects of under-sampling, random depletion, and timing jitter**

McCullough, M., Sakellariou, K., Stemler, T. & Small, M., 1 Dec 2016, In : Chaos. 26, 12, 123103.

### **Counting forbidden patterns in irregularly sampled time series. ii. reliability in the presence of highly irregular sampling**

Sakellariou, K., McCullough, M., Stemler, T. & Small, M., 1 Dec 2016, In : Chaos. 26, 12, 123104.

### **Prevention of infectious diseases by public vaccination and individual protection**

Peng, X. L., Xu, X. J., Small, M., Fu, X. & Jin, Z., 1 Dec 2016, In : Journal of Mathematical Biology. 73, 6-7, p. 1561-1594 34 p.

### **Navigation by anomalous random walks on complex networks**

Weng, T., Zhang, J., Khajehnejad, M., Small, M., Zheng, R. & Hui, P., 23 Nov 2016, In : Scientific Reports. 6, 37547.

**A surrogate technique for investigating deterministic dynamics in discrete human movement**

Taylor, P. G., Small, M., Lee, K. Y., Landeo, R., O'Meara, D. M. & Millett, E. L., 1 Oct 2016, In : *Motor Control*. 20, 4, p. 459-470 12 p.

**Dissipative propagation of pressure waves along the slip-lines of yielding material**

Moore, J., Karrech, A., Small, M., Veveakis, E. & Regenauer-Lieb, K., 1 Oct 2016, In : *International Journal of Engineering Science*. 107, p. 149-168 20 p.

**Impact of asymptomatic infection on coupled disease-behavior dynamics in complex networks**

Zhang, H. F., Xie, J. R., Chen, H. S., Liu, C. & Small, M., 1 Jun 2016, In : *EPL*. 114, 3

**Examining k-nearest neighbour networks: Superfamily phenomena and inversion**

Khor, A. & Small, M., 4 Apr 2016, In : *Chaos*. 26, 4, p. 043101-1-043101-13 043101.

**Constructing networks from a dynamical system perspective for multivariate nonlinear time series**

Nakamura, T., Tanizawa, T. & Small, M., 28 Mar 2016, In : *Physical Review E - Statistical, Nonlinear, and Soft Matter Physics*. 93, 3, 032323.

**Subspace based Network Community Detection using sparse linear coding**

Mahmood, A. & Small, M., Mar 2016, In : *IEEE Transactions on Knowledge and Data Engineering*. 28, 3, p. 801-812 12 p.

**A general model for studying time evolution of transition networks**

Zhan, C., Tse, C. K. & Small, M., 2016, *Complex Systems and Networks: Dynamics, Controls and Applications*. J. L. Z. Y. G. C. W. Y. (ed.). Springer, Vol. 73. p. 373-393 21 p. (Understanding Complex Systems).

**Advances in Time Series Analysis and Its Applications**

Gao, Z. K., Small, M., Donner, R., Meng, D. & Ghaffari, H. O., 2016, In : *Mathematical Problems in Engineering*. 2016

**Evolving networks - Using past structure to predict the future**

Shang, K., Yan, W. S. & Small, M., 2016, In : *Physica A: Statistical Mechanics and its Applications*. 455, p. 120-135

**Subspace based network community detection using sparse linear coding**

Mahmood, A. & Small, M., 2016, *2016 IEEE 32nd International Conference on Data Engineering (ICDE)*. IEEE, Institute of Electrical and Electronics Engineers, p. 1502-1503 2 p.

**Lévy Walk Navigation in Complex Networks: A Distinct Relation between Optimal Transport Exponent and Network Dimension**

Weng, T., Small, M., Zhang, J. & Hui, P., 25 Nov 2015, In : *Scientific Reports*. 5, p. 1-9 9 p., 17309.

**Growing local likelihood network: Emergence of communities**

Chen, S. & Small, M., 9 Nov 2015, In : *EPL*. 112, 2, p. 28003-p1 - 28003-p6 6 p.

**Exactly scale-free scale-free networks**

Zhang, L., Small, M. & Judd, K., 1 Sep 2015, In : *Physica A: Statistical Mechanics and its Applications*. 433, p. 182-197

**Practical synchronization on complex dynamical networks via optimal pinning control**

Li, K., Sun, W., Small, M. & Fu, X., 27 Jul 2015, In : *Physical Review E - Statistical, Nonlinear, and Soft Matter Physics*. 92, 1, p. 010903-1 - 010903-5

**Improvements to local projective noise reduction through higher order and multiscale refinements**

Moore, J. M., Small, M. & Karrech, A., 15 Jun 2015, In : *Chaos*. 25, 6, p. 063114-1 - 063114-10



**A new piecewise linear Chen system of fractional-order: Numerical approximation of stable attractors**  
Danca, M. F., Aziz-Alaoui, M. A. & Small, M., Jun 2015, In : Chinese Physics B. 24, 6, p. 060507-1 - 060507-9

**Time lagged ordinal partition networks for capturing dynamics of continuous dynamical systems**  
McCullough, M., Small, M., Stemler, T. & Lu, H. C., May 2015, In : Chaos. 25, 5, p. 053101 12.

**Growing optimal scale-free networks via likelihood**  
Small, M., Li, Y., Stemler, T. & Judd, K., 7 Apr 2015, In : Physical Review E - Statistical, Nonlinear, and Soft Matter Physics. 91, 4, 11 p., 042801.

**Dynamics of self-excited thermoacoustic instability in a combustion system: Pseudo-periodic and high-dimensional nature**  
Okuno, Y., Small, M. & Gotoda, H., Apr 2015, In : Chaos. 25, 4, 043107.

**Modelling real disease dynamics with behaviourally adaptive complex networks: Comment on "Coupled disease-behavior dynamics on complex networks: A review" by Z. Wang et al.**  
Small, M., 1 Jan 2015, In : Physics of Life Reviews. 15, p. 49-50 2 p.

**Testing for linear and nonlinear Gaussian processes in nonstationary time series**  
Rios, R. A., Small, M. & De Mello, R. F. D., Jan 2015, In : International Journal of Bifurcation and Chaos. 25, 1, p. 1550013-1-1550013-15 19 p., 1550013.

**Dynamical systems induced on networks constructed from time series**  
Hou, L., Small, M. & Lao, S., 2015, In : Entropy. 17, 9, p. 6433-6446

**Effects of edge directions on the structural controllability of complex networks**  
Xiao, Y., Lao, S., Hou, L., Small, M. & Bai, L., 2015, In : PLoS One. 10, 8, p. e0135282

**Enhancing complex network controllability by minimum link direction reversal**  
Hou, L., Lao, S., Small, M. & Xiao, Y., 2015, In : Physics Letters, Section A: General, Atomic and Solid State Physics. 379, 20-21, p. 1321-1325

**Epidemic threshold determined by the first moments of network with alternating degree distributions**  
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Small, M. & Tse, C. K., 2005, In : *PHYSICA A-STATISTICAL MECHANICS AND ITS APPLICATIONS*. 351, p. 499-511

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

Zhao, Y. & Small, M., 2005, In : *International Journal of Neural Systems*. 15, 4, p. 277-286

**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

**Scale-free user-network approach to telephone network traffic analysis**

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

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Small, M. & Tse, C. K., 2005, In : *International Journal of Bifurcation and Chaos*. 15, 5, p. 1745-1755

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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

**Testing for nonlinearity in time series without the Fourier transform**

Nakamura, T., Luo, X. & Small, M., 2005, In : *Physical Review E - Statistical, Nonlinear, and Soft Matter Physics*. 72, p. 055201-1 to 055201-4

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

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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**

Small, M. & Tse, C. K., 2002, In : *Physical Review E - Statistical, Nonlinear, and Soft Matter Physics*. 66, p. 066701-1 to 066701-12

**Modeling continuous processes from data**

Small, M., Judd, K. & Mees, A., 2002, In : *Physical Review E*. 65, 11 p., 046704.

**Uncovering non-linear structure in human ECG recordings**

Small, M., Yu, D., Simonotto, J., Harrison, R. G., Grubb, N. & Fox, K. A. A., 2002, In : *Chaos, Solitons and Fractals*. 13, p. 1755-1762

**Surrogate test for pseudoperiodic time series data**

Small, M., Yu, D. & Harrison, R. G., 2001, In : *Physical Review Letters*. 87, 18, p. 188101-1 to 188101-4

**Temporal evolution of nonlinear dynamics in ventricular arrhythmia**

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**Testing time series for nonlinearity**

Small, M., Judd, K. & Mees, A. I., 2001, In : *Statistics and Computing*. 11, p. 257-268

**Variation in the Dominant Period During Ventricular Fibrillation**

Small, M., Yu, D. & Harrison, R. G., 2001, In : *IEEE Transactions on Biomedical Engineering*. 48, 9, p. 1056-1061

**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.

#### **Evolution of ventricular fibrillation revealed by first return plots**

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**

Yu, D., Small, M., Harrison, R. G. & Diks, C., 2000, In : Physical Review E - Statistical, Nonlinear, and Soft Matter Physics. 61, 4, p. 3750-3756

#### **Measuring temporal complexity of ventricular fibrillation**

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**

Judd, K. & Small, M., 2000, In : Physica D. 136, p. 31-44

#### **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**

Small, M., 1 Oct 1999, In : Bulletin of the Australian Mathematical Society. 60, 2, p. 345-347 3 p.

#### **Detecting periodicity in experimental data using linear modeling technique**

Small, M. & Judd, K., 1999, In : Physical Review E - Statistical, Nonlinear, and Soft Matter Physics. 59, 2, p. 359-376

#### **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**

**Raise The Bar (UWA)**

Michael Small (Speaker)  
29 Oct 2019

**OZ Minerals Explorer Challenge**

Michael Small (Speaker)  
11 Jun 2019 → 12 Jun 2019

**AngloAmerican FutureSmart Mining Open Forum: Non-stop Operations**

Michael Small (Consultant)  
19 Nov 2018 → 21 Nov 2018

**Geoscientists to Data Scientist**

Michael Small (Consultant)  
2018 → ...

**IEEE TRANSACTIONS ON CIRCUITS AND SYSTEMS (Journal)**

Michael Small (Editor)  
2016 → 2020

**Chaos: an interdisciplinary journal of nonlinear science (Journal)**

Michael Small (Editor)  
2015 → ...

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

Michael Small (Editor)  
2012 → ...

## **Prizes/awards**

**Adjunct Professor**

Small, Michael (Recipient), 2019

**Australian Research Council Future Fellowship**

Small, Michael (Recipient), 2012

**Fellow Australian Mathematics Society**

Small, Michael (Recipient), 2015

**Outstanding Referee**

Small, Michael (Recipient), 2016

**Grants (InfoEd projects)****ARC Training Centre for Transforming Maintenance through Data Science**

Rohl, A., Small, M., Hodkiewicz, M., Loxton, R., O'Halloran, K., Tan, T., Calo, V., Reynolds, M., Liu, W., While, R., French, T., Cripps, E. & Cardell-Oliver, R.

Australian Research Council

1/01/19 → 31/12/23

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

Small, M.

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., Heuer, S., Roessner, U., Small, M., Gupta, R. & Kuchel, H.

Australian Research Council

1/01/14 → 31/12/17

**Development of a Vulnerability Index to Predict Adolescent Suicide.**

Page, A., Small, M., Lawrence, D. & Hooke, G.

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., Milroy, H., Milroy, J., Calma, T., Wright, M., Gee, G., Ewen, S., Hood, S., Walker, R. & Small, M.

Medical Research Future Fund MRFF

1/01/19 → 31/05/24

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

Thompson, S., Small, M., Correa, D. & Duncan, J.

National Geographic Society

1/08/20 → 31/07/21

**Mathematical modelling of multiphase transport and aggregation in turbulent flows**

Small, M. & Fawell, P.

CSIRO

12/12/19 → 11/12/21

**Navigating tipping points in complex dynamical systems**

Small, M., Lesterhuis, W., Bosco, A. & Zaitouny, A.

Australian Research Council

1/01/18 → 31/12/20

**Parameters for Roundabout Modelling**

Sun, C., Stemler, T., Small, M. & Polpo, A.

WA Main Roads

1/05/20 → 30/04/21

**Quantifying complexity and measuring structure within complex systems**

Small, M.

Australian Research Council

1/01/14 → 31/12/16

**Subsurface Big Data Visualisation and Analysis: Oil/Gas Reservoirs**

Small, M., Portes dos Santos, L. & Correa, D.  
Woodside R2D3  
20/12/18 → 19/12/19

**TSuNAMI: Time Series Network Animal Modelling**

Walker, D., Small, M., Correa, D. & Blache, D.  
Australian Research Council  
1/01/20 → 31/12/22

**Teaching units (UWA)**

**MATH1002: Mathematical Methods 2**

Michael Small  
23/02/15 → 27/06/15

**MATH3021: Nonlinear Dynamics and Chaos**

Michael Small  
27/02/12 → 30/06/18

**MATH4021: Dynamical Systems**

Michael Small  
25/02/19 → ...

**SHPC4001: Principles of Scientific Computing**

Michael Small  
23/02/15 → 22/06/18