StephenLynch

Professor and NTF

Loughborough, UK

(+44 1509) 225854

s.lynch@lboro.ac.uk

Homepage: https://www.lboro.ac.uk/departments/compsci/staff/stephen-lynch/

Skills & Strengths

Dynamical Systems and Programming/Modelling

- Ranked 23rd in the world for Dynamical Systems
- Author of Python, Mathematica, MATLAB and Maple books
- World Leader in programming for assessment, learning, research and teaching

Widening Participation

- Schools Liaison
- Levelling Up
- Engagement and Enjoyment in Maths Education (EEME)
- In2Science

Teaching and Research

- Research Informed Teaching
- Highly Interdisciplinary Research

Consultancy

- Python for A-Level Maths and Beyond
- Python for Scientific Computing and TensorFlow for Artificial Intelligence

Patents

- Binary Oscillator Computing
- An Assay for Neuronal Degradation

Social Media Links

- LinkedIn
- ScholarGPS
- Twitter @DrStephenLynch
- Facebook
- ResearchGate
- Google Scholar
- Academia

National Teaching Fellow

Chair of the IMA Branches

Member of the IMA Council

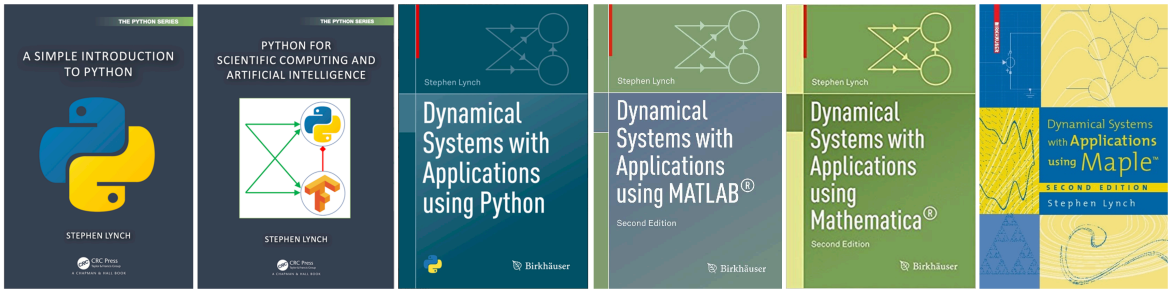
STEM Ambassador

Public Engagement Champion

Speaker for Schools

Fellow of the IMA

Senior Fellow of the HEA



EDUCATION

1985-1988 **PhD | Bifurcation of limit cycles of Liénard systems, UCW Aberystwyth**
1982-1985 **BSc(Hons) Pure Mathematics | UCW Aberystwyth**

EXPERIENCE

2024-now **Loughborough University | Professor of Digital Skills**
1991-2024 **Manchester Metropolitan University | Reader**
2007-2012 **Open University | Concurrently an Associate Lecturer**
1988-1991 **Southampton University | Temporary Lecturer in Mathematics**

PROFESSIONAL MEMBERSHIP

2022-now **Advance HE | National Teaching Fellow (NTF)**
2016-now **Higher Education Academy | Senior Fellow**
2015-now **The Institute of Mathematics and its Applications (IMA) | Fellow**
2007-now **National Centre for the Excellence in Teaching Maths | Member**
1991-2014 **The London Mathematics Society (LMS) | Member**

RESPONSIBILITIES

2025-now **IMA Council Member**
2025-now **Chair of the Branches of the IMA**
2024-now **Organizing Committee Member of the Biannual IMA AI/ML Congress**
2020-2021 **Interim Deputy Head of Department**
2020-2024 **Chair of the North-West Branch of the IMA**
2005-now **Programme Leader on Mathematics Courses | on and off**
2001-2004 **Foundation Maths Tutor**
2000-now **Schools Liaison Co-ordinator | I have visited over 100 schools/colleges**

REFEREE FOR THE ORGANISATIONS

2000-now **Springer International Publishing and CRC Press**
2005-now **Mathematical Reviews**
1994-now **The LMS and the Institute of Physics (IoP)**

Languages

English ●●●●●●
Spanish ●●●○○○

Interests

Playing Spanish Classical Guitar
Badminton, Football, Swimming, Table Tennis
Reading Fantasy Novels

PUBLICATIONS

Books

1. Lynch S (2025) Dynamical Systems with Applications using MATLAB, 3rd Ed., Springer International Publishing, in press.
2. Lynch S (2024) A Simple Introduction to Python, CRC Press, ISBN 9781032750293.
3. Lynch S (2023) Python for Scientific Computing and Artificial Intelligence, CRC Press. ISBN 9781032258713.
4. Lynch S (2018) Dynamical Systems with Applications using Python, Springer International Publishing. ISBN 3319781448.
5. Lynch S (2017) Dynamical Systems with Applications using Mathematica, Springer International Publishing. ISBN 3319614843.
6. Lynch S (2014) Dynamical Systems with Applications using MATLAB® 2nd Ed., Springer International Publishing. ISBN 3319068199.
7. Lynch S (2010) Dynamical Systems with Applications using Maple® 2nd Ed., Springer International Publishing. ISBN 0-8176-4389-3.
8. Lynch S (2007) Dynamical Systems with Applications using Mathematica®, Birkhäuser, Boston. ISBN 0-8176-4482-2.
9. Lynch S (2004) Dynamical Systems with Applications using MATLAB®, Birkhäuser, Boston. ISBN 0-8176-4321-4.
10. Lynch S (2001) Dynamical Systems with Applications using Maple®, Birkhäuser, Boston. ISBN 0-8176-4150-5.

Patents

1. Lynch S, Slevin MA & Borresen J (2016) Assay utilizing cellular binary half-adder system. US Patent 9,274,096.
2. Lynch S & Borresen J (2012) Binary Half Adder using Oscillators, International Publication Number, WO 2012/001372 A1, 1-5.

Book Chapters

1. Lynch S & Borresen J (2015) Oscillations, feedback, and bifurcations in mathematical models of angiogenesis and haematopoiesis, in Handbook of Techniques in Vascular Biology, Slevin M, McDowell G, Cao Y, Kitajewski J (Eds.), Springer, New York 373-390. ISBN 9789401797153.
2. Lynch S (2011) MATLAB® Programming for Engineers and Scientists, Applications of Nonlinear Dynamics and Chaos in Engineering, Santo Banerjee, Mala Mitra, Lamberto Rondoni (Eds.), Springer 3-35.
3. Lynch S & Steele AL (2011) Nonlinear Optical Fibre Resonators with Applications in Electrical Engineering and Computing, Applications of Nonlinear Dynamics and Chaos in Engineering, Santo Banerjee, Mala Mitra, Lamberto Rondoni (Eds.), Springer 65-84. ISBN 3642219217.
4. Lynch S (2005) Symbolic computation of Lyapunov quantities and the second part of Hilbert's sixteenth problem, Differential Equations with Symbolic Computation, Wang, Dongming; Zheng, Zhiming (Eds.), Trends in Mathematics, Birkhäuser/Springer, 1-26. ISBN: 3-7643-7368-7.

Conference Proceedings

1. Nyamapfene A, Lynch S, Burova I & Oliveira de Andrade M (2022) MATLAB and Python open book assessments: Lessons from two UK institutions, IEEE EDUCON 2022, Tunisia, DOI: 10.1109/EDUCON52537.2022.9766577, 2022-2027.
2. Nyamapfene A, & Lynch S (2016) Systematic integration of MATLAB into undergraduate mathematics teaching: Preliminary lessons from two UK institutions, IEEE EDUCON 2016, Abu Dhabi, DOI:10.1109/EDUCON.2016.7474699. 1145-1148.
3. Lynch S, Borresen J, & Latham K (2013) Josephson junction binary oscillator computing, Proceedings of the IEEE International Superconductive Electronics Conference, Cambridge, Massachusetts. DOI:10.1109/ISEC.2013.6604275.
4. Steele AL & Lynch S (2004) Chaos synchronization of a passive fibre resonator using the auxiliary system and applications to chaos masking, Nonlinear Guided Waves and Their Applications (Topical Meeting) on CD-ROM (The Optical Society of America, Washington, DC, 2004), CANADA MC15.

Journal Publications

1. Whitehead KA, Brown M, Caballero L, Lynch S, Edge M, Hill C, Verran J and Allen NS (2025) The use of nano-titania photocatalysis and metal doping to deter fungal growth on outdoor and indoor paint surfaces using UV and fluorescent light. Micro **5**, (submitted).
2. Lynch S (2025) A mathematician from a poor socio-economic background, Mathematics Today, IMA, **61**(1), (in press).
3. Wilson-Nieuwenhuis J, Taylor J, Gomes LC, Lynch S, Whitehead D and Whitehead KA (2024) Non-chlorine detergent formulations as an alternative for unpasteurised milk removal from stainless steel surfaces. J. of Food Engineering **373** 112031.
4. Whitehead KA, Lynch S, Amin M, Deisenroth T, Liauw CM and Verran J (2023) Properties of cationic and ionic surfaces on the perpendicular and lateral binding forces and attachment, adhesion and retention of *Aspergillus niger* conidia. Nanomaterials **13**(22) 2932.
5. Bearon R and Lynch S (2022) Microswimmers and Computing at Leicester British Science Festival, Mathematics Today, IMA, **58**(6), 184.

6. Evans A, Slate AJ, Tobin M, Lynch S, Wilson-Nieuwenhuis J, Verran J, Kelly P and Whitehead KA (2022) Multifractal analysis to determine the effect of surface topography on the distribution, density, dispersion, and clustering of differently organised coccal shaped bacteria. Antibiotics **11**(5) 11050551.
7. Muthana MSA, Muthana A, Rafiq A,Khakimov A, Albelaly S, Elgendy, Hammoudeh M, Lynch S and Elboseny M (2022) Deep reinforcement learning based transmission policy enforcement and multi-hop routing in QoS aware LoRa IoT networks. Computer Communications **183**(1), 33-50.
8. Whitehead KA, El Mohtadi M, Lynch S, Liauw CM, Amin M, Deisenroth T, Preuss A and Verran J (2021) Diverse surface properties reveal that substratum roughness affects fungal spore binding. iScience **24**(4), 102333.
9. Mihalcea BM and Lynch S (2021) Investigations on dynamical stability in 3D quadrupole ion traps. Applied Sciences **11**(7) 2938.
10. Lynch S (2020) Programming in the mathematics curriculum at Manchester Metropolitan University, MSOR Connections, **18**(2), 5-12.
11. Slate AJ, Whitehead KA, Lynch S, Foster CW and Banks CE (2020) Electrochemical decoration of additively manufactured graphene macro electrodes with MoO2 nanowire: An approach to demonstrate the surface morphology, J. of Physical Chemistry C, **124**(28) 15377-15385.
12. Amin M, Rowley-Neale S, Shalamanova L, Lynch S, Wilson-Nieuwenhuis El Mohtadi M, Banks CE and Whitehead K (2020) Molybdenum disulphide surfaces to reduce staphylococcus aureus and pseudomonas aeruginosa biofilm formation, ACS Appl. Mater. Interfaces **12**(18), 21057-21069.
13. Lynch S, Borresen J, Roach P, Kotter M and Slevin MA (2020) Mathematical modelling of neuronal logic, memory, and clocking circuits. International Journal of Bifurcation and Chaos, **30** 2050003, 1-16.
14. Moreira JMR, Gomes LC, Whitehead KA, Lynch S & Mergulhao FJ (2017) Effect of surface conditioning with cellular extracts on Escherichia coli adhesion and initial biofilm formation, Food and Bioproducts Processing, **104**, 1-12.
15. Ramos J, Lynch S, Jones DA & Degens H (2017) Hysteresis in muscle, Int. J. Bifurcation and Chaos (Feature Article), **27** 1730003, 1-16.
16. Tetlow L, Lynch S & Whitehead K (2017) The effect of surface properties on bacterial retention: a study utilising stainless steel and TiN/25.65 at.%Ag substrata, Food and Bioproducts Processing **102**, 332-339.
17. Sharaby Y, Lynch S, & Hassan S (2016) Critical slowing down in an optical bistable model with a Kerr-nonlinear blackbody reservoir, Optik **127**(21), 10195-10200.
18. Sharaby YA, Lynch S, & Hassan SS (2016) Inhomogeneous and transverse field effects on time delayed optical bistability inside and outside the rotating wave approximation, Journal of Nonlinear Optical Physics and Materials, **25**(2), 1650021.
19. Lynch S., Alharbey RA, Hassan SS, & Batarfi HA (2015) Delayed-dynamical bistability within and without rotating wave approximation, Journal of Nonlinear Optical Physics and Materials, **24**(3), 1550037.
20. Lynch S (2014) Brain Inspired Computing, Mathematics Today, IMA, **50**(5), 262-264.
21. Wickens D, Lynch S, Kelly P, West G, Whitehead K, and Verran J (2014) Quantifying the pattern of microbial cell dispersion, density and clustering on surfaces of differing chemistries and topographies using multifractal analysis, Journal of Microbiological Methods**, 104** 101-108.
22. Sharaby YA, Lynch S, Hassan SS & Joshi A (2014) Bistable dynamics beyond rotating wave approximation, Journal of Nonlinear Optical Physics and Materials, **23**(2) 1-19.
23. Alherbey RA, Nejad LAM, Lynch S & Hassan SS (2014) Critical slowing down in biological bistable models, International Journal of Pure and Applied Mathematics, **93**(4), 581-602.
24. Borresen J and Lynch S (2012) Threshold Oscillator Logic, PLoS ONE 7(11): e48498. doi:10.1371/journal.pone.0048498.
25. Wickens DJ, Lynch S, Kelly PJ, Verran J, West, G., Whitehead, KA (2012) Zirconium nitride- silver nanocomposites in the design of antimicrobial, fixation pin surface coatings, Int. J. of Artificial Organs, Nov 8:0. doi: 10.5301/ijao.5000156.
26. Borresen J & Lynch S (2009) Neuronal Computers, Nonlinear Anal. Theory, Meth. & Appl., **71**, 23722376.
27. Jiang J, Han M, Yu P & Lynch S (2007) Limit cycles in two types of symmetric Liénard systems, Int. J. of Bifurcation and Chaos, **17**(6), 2169-2174.
28. Mills SL, Lees GC, Liauw CM, Rothon RN & Lynch S (2005) Prediction of physical properties following the dispersion assessment of flame retardant filler/polymer composites based on the multifractal analysis of SEM images, J. Macromolecular Sci. B- Physics, **44**(6), 1137-1151.
29. Lynch S & Bandar Z (2005) Bistable neuromodules, Nonlinear Anal. Theory, Meth. & Appl., **63**(5-7), 669-677.
30. Lynch S (2005) Analysis of a blood cell population model, Int. J. of Bifurcation and Chaos, **15**(7), 2311-2316.
31. Mills SL, Lees G, Liauw C & Lynch S (2004) An improved method for the dispersion assessment of flame retardent filler/polymer systems based on the multifractal analysis of SEM images, Macromolecular Materials and Engineering, **289**(10), 864-871.
32. Mills SL, Lees G, Liauw C & Lynch S (2002) Dispersion assessment of flame retardent filler/polymer systems using a combination of X-ray mapping and multifractal analysis, Polymer Testing, **21(**8), 941-948.
33. Borreson J & Lynch S (2002) Further investigation of hysteresis in Chua's circuit, Int. J. of Bifurcation and Chaos, **12(**1), 129-134.
34. Lynch S (2001) Mutistability, bistability and chaos control, Nonlinear Anal. Theory, Meth. & Appl., **47**(7), 4501-4512 (2001).

35. Lynch S. & Steele AL (2000) Controlling chaos in nonlinear bistable optical resonators, Chaos, Solitons & Fractals, **11(**5**)**, 721-728.
36. Christopher CJ & Lynch S (1999) Small-amplitude limit cycles of Liénard equations with either quadratic or cubic damping or restoring terms, Nonlinearity, **12(4)**, 1099-1112.
37. Lynch S & Christopher CJ (1999) Limit cycles in highly non-linear differential equations, Journal of Sound and Vibration, **224(**3**)**, 505-517.
38. Lynch S (1999) Generalized cubic Liénard equations, Applied Math. Lett., **12(**2**)**, 1-6.
39. Lynch S, Steele AL & Hoad JE (1998) Stability analysis of nonlinear optical resonators, Chaos, Solitons & Fractals, **9(**6**)**, 935-946.
40. Lynch S (1998) Generalized quadratic Liénard equations, Applied Math. Lett., **11(**3**)**, 7-10.
41. Lynch S (1997) Liénard systems and the second part of Hilbert's sixteenth problem, Nonl. Anal. Theory, Meth. and Appl., **30(**3**)**, 1395-1403.
42. Ogusu K, Steele AL, Hoad JE & Lynch S (1997) Corrections to and comments on ``Dynamic behaviour of reflection optical bistability in a nonlinear fibre ring resonator'', IEEE J. Quantum Electron., **33(**11**)**, 2128-2129.
43. Steele AL, Lynch S & Hoad JE (1997) Analysis of optical instabilities and bistability in a nonlinear optical fibre loop mirror with feedback, Optics Comm., **137(**1-3**)**, 136-142.
44. Lynch S (1995) Limit cycles of generalized Liénard equations, Applied Math. Lett., **8(**6**)**, 15-17.
45. Lynch S (1994) Small-amplitude limit cycles of the generalized mixed Rayleigh-Liénard oscillator, Journal of Sound and Vibration, **178(**5**)**, 615-620.
46. Lynch S (1994) More results on the bifurcation of limit cycles for systems of Liénard type, J. Egypt. Math. Soc., **2**, 75-87.
47. Lynch S (1990) Small-amplitude limit cycles of Liénard equations, Calcolo, **127**, Nos. 1-2, 1-32.
48. Lloyd NG & Lynch S (1988), Small-amplitude limit cycles of certain Liénard systems, Proc. Roy. Soc. Lond. Ser. A, **418**, 199-208.

BBC Radio 4

17/12/2012: BBC Radio 4 Interview on Material World related to our invention:

http://www.bbc.co.uk/programmes/b01p7ddm

Grants

2022: £2K Levelling Up Mathematics, Tony Hill (Founder and WP at MMU).
2015: £20K MMU Equipment grant to purchase MEA Lite for work with Paul Roach.
2014: £5K Interdisciplinary Research Grant MMU.
2011: £50K EPSRC PhD Studentship (co-investigator).
2000-present: £50K complimentary licences for Maple, MATLAB, and Mathematica.

PhD Students

2014-2017: J Ramos, Hysteresis in muscle.
2011-2014: D Wickens, Multifractal analysis in microbiology.
2002-2007: SL Mills, Multifractal analysis in polymer science.

News Articles

1. National Teaching Fellow: https://www.advance-he.ac.uk/ntfs/dr-stephen-lynch

2. Lynch S, Wilber J (2015) Manchester Metropolitan University students vote Math best overall course following adoption of MATLAB. MathWorks User Story - Reprinted in Societe Europeenne Pour La Formation des Ingenieurs (SEFI) Annual Report, 23-24.

https://www.sefi.be/publication/annual-report-2014-2015/

Book URLs

Python book (2024): https://github.com/proflynch/A-Simple-Introduction-to-Python

Python book (2023): https://github.com/proflynch/CRC-Press/

Python Book (2018): https://drstephenlynch.github.io/webpages/DSAP_Jupyter_Notebook.html

MATLAB files: http://www.mathworks.com/matlabcentral/fileexchange/authors/6536

Maple: http://www.doc.mmu.ac.uk/STAFF/S.Lynch/cover1.html

Mathematica: https://library.wolfram.com/infocenter/Books/9563/

Consultancy

IMA Workshops: Python for A-Level Maths and Beyond:

https://ima.org.uk/18974/online-workshop-python-for-a-level-mathematics-and-beyond-autumn-2022/

IMA Workshop: Python for Scientific Computation and TensorFlow for Artificial Intelligence:

https://ima.org.uk/18235/online-workshop-5-days-python-for-a-level-mathematics-and-beyond

International

I run workshops in China, Malaysia, Saudi Arabia, Singapore, and the USA.