Artur L. Gower

Curiculum Vitae

Contact Information

Mechanical Engineering
The University of Sheffield
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Research Interests

Wave propagation, random media, solid mechanics, and supervised machine learning.

Programming

Julia, Mathematica, C, C++, Matlab, Bash, and TEX (LATEX, BIBTEX, TikZ).

Academic History

The University of Sheffield, UK
Lecturer in Dynamics, Mechanical Engineering **01/2019 – present**

University of Manchester, UK
Research associate, Applied Mathematics **10/2015 – 12/2018**

- *Ultrasonic propagation in complex media* - EPSRC (EP/M026205/1)
- Responsible for mathematical modelling and numerical implementation. Strong ties with experiments (EP/M026310/1) and simulations (EP/M026302/1)

NUI Galway, Ireland
Ph.D. Applied Mathematics **09/2011 – 09/2015**

- Thesis title: *Incremental elastic surface waves and static wrinkles*
- Supervisor: Prof. Michel Destrade

University of Campinas, Brazil (QS 2nd best university in Latin America)
M.Sc. Applied Mathematics, Grade 96% **03/2009 – 05/2011**
Computational geophysics group

- Thesis: *Nonlinear Elasticity with Radial Symmetry*
- Emphasis in wave scattering and propagation in Geophysics.

B.Sc. Applied Mathematics, Grade 83% **03/2005 – 12/2008**

- Emphasis on Mechanics with a minor in Computer Science

Teaching experience

Qualification
Teaching and learning course - (5 ECTS) NUI Galway **2013**

University of Manchester
Supervision

- Informal Ph.D supervisor, Erik Garcia Neefjes, working on thermo-visco-elastic waves. Erik is on track to complete his PhD on time. **09/2017 – present**
- Final year undergraduate on *Acoustic Scattering from Cylinders*. Janni Harju compared multiple scattering theory with numerical software. **2018**
- Summer intern *Modelling the Bladder using Non-Linear Elasticity*. Imagining the bladder as a rubber material, Farid Breffni Hounat found the optimal material to sustain varied internal fluid pressure. **2017**
- Summer intern *Using elastic waves to measure initial stress*. Sara Ilhac related bulk wave speeds with directions of tension. **2016**

Tutorials **09/2015 – 06/2018**

- Led problem solving classes on calculus, linear algebra, complex analysis for B.Sc. mathematics and B.Sc. engineering 1st to 2nd year students.
- Marked and provided constructive feedback on weekly assignments.

NUI Galway

Tutorials and lectures **09/2014 – 06/2015**

- Taught tutorials, and occasional lectures, on Fluid Mechanics and Nonlinear Elasticity to final year B.Sc. mathematics students.
- Marked and provided constructive feedback on weekly assignments.

Tutorials **09/2011 – 06/2014**

- Led problem solving classes on vector calculus, mathematical modelling, linear algebra, mathematical methods for B.Sc. mathematics and engineering.
- Marked exams and gave in class feedback.

Drop-in centre **03/2012 – 11/2014**

- Taught at the centre for the Support for Undergraduate Mathematics.

University of Campinas

Lectures **02/2010 – 07/2010**

- Lectured on Linear Algebra to B.Sc. engineering 1st year students.
- Prepared lectures, wrote and graded exams.

Pas Facamp (Charity) **07/2009 – 09/2009**

- Taught basic finance to the local community.

Funding

EPSRC, Postdoctoral Fellowship (unsuccessful, rank 7/35) **2018**
Title: Predicting the properties of particulate materials from backscattered waves
Principal Investigator: Artur L. Gower
Funding Value: N/A

Irish Research Council, PhD fellowship **09/2013 - 09/2015**
Title: Nonlinear modelling of soft matter
Principal Investigators: Artur L. Gower and Michel Destrade
Funding Value: €46k

Hardiman Scholarship, PhD fellowship **09/2011 - 09/2013**
Title: Skin deep: the mechanics of skin
Principal Investigators: Artur L. Gower and Michel Destrade
Funding Value: €42k

Brazilian National Council for Scientific and Technological Development, M.Sc. fellowship (rank 1/45) **02/2009 - 03/2011**
Title: Nonlinear elastodynamics with radial symmetry
Principal Investigator: Artur L. Gower
Funding Value: R$29k (≈ 5.5k)

Sao Paulo Research Foundation Undergraduate Research Scholarship
Title: Acoustic diffraction with Kirchhoff modelling **03/2007 - 02/2008**
Principal Investigator: Artur L. Gower and Lucio T. Santos
Funding Value: R$6k (≈ 1.1k)
Title: Introduction to discrete chaotic dynamics **03/2006 - 02/2007**
Principal Investigator: Artur L. Gower and Lucio T. Santos
Funding Value: R$6k (≈ 1.1k)

Recent Software

[S3] A.L. Gower and J. Deakin. A Julia library for simulating, processing, and plotting multiple scattering of waves. MultipleScattering.jl, GitHub, MIT License.

[S2] A.L. Gower. A Julia library to calculate the effective wave reflection and transmission in material random materials. EffectiveWaves.jl, GitHub, MIT License.

[S1] A.L. Gower. A Mathematica package that uses the concept of entropy maximisation to calculate the influence on a GO board. EntropyGO, GitHub, MIT License.

Submitted

[16] V.J. Pinfield, D.M. Forrester, A.L. Gower, W.J. Parnell, I.D. Abrahams, "Thermoviscoacoustic scattering by a spherical particle: comparison of analytical and finite element models", *submitted*, (2020)

Refereed Journal Papers

Total citations: 216, according to my **Google Scholar**.

[15] A.L. Gower, W.J. Parnell, I.D. Abrahams, "Multiple Waves Propagate in Random Particulate Materials", *SIAM Journal on Applied Mathematics* (preprint), 79.6 (2019)

[14] A.L. Gower, I.D. Abrahams, W.J. Parnell, "A proof that multiple waves propagate in ensemble-averaged particulate materials", *Proceedings of the Royal Society A* (preprint), 475.2229 (2019)

[13] A.L. Gower, R.M. Gower, J. Deakin, W.J. Parnell, I.D. Abrahams, "Characterising particulate random media from near-surface backscattering: A machine learning approach to predict particle size and concentration", *Europhysics Letters*, (2018) 122 (5)

[12] A.L. Gower, M.J.A. Smith, W.J. Parnell, I.D. Abrahams, "Reflection from a multi-species material and its transmitted effective wavenumber", *Proceedings of the Royal Society A* (preprint), 474.2212 (2018)

[11] A. Agosti, A.L. Gower, P. Ciarletta, "The constitutive relations of initially stressed incompressible Mooney-Rivlin materials", *Mechanics Research Communications*, 93, (2018)

[10] A.L. Gower, T. Shearer, P. Ciarletta, "A new restriction for initially stressed elastic solids", *Quarterly Journal of Mechanics and Applied Mathematics*, 70(2017)

[9] M. Carfagna, M. Destrade, A.L. Gower, A. Grillo, "Oblique wrinkles", *Philosophical Transactions of the Royal Society A*, Invited contribution to the themed issue on *Patterning through instabilities in complex media*, 375(2017)

[8] P. Ciarletta, M. Destrade, A.L. Gower, M. Taffetani, "Morphology of residually stressed tubular tissues: beyond the elastic multiplicative decomposition", *Journal of the Mechanics and Physics of Solids*, 90 (2016)

[7] P. Ciarletta, M. Destrade, A.L. Gower, "On residual stresses and homeostasis: an elastic theory of functional adaptation in living matter", *Scientific Reports*, 6 (2016)

[6] R.M. Gower, A.L. Gower, "High order reverse automatic differentiation with emphasis on the third order", *Mathematical Programming SERIES A*, 155 (2016)

[5] A.L. Gower, P. Ciarletta, M. Destrade, "Initial stress symmetry and its application in elasticity", *Proceedings of the Royal Society A*, 471 (2015)

[4] A.L. Gower, "Connecting the material parameters of soft fibre-reinforced solids with the formation of surface wrinkles", *Journal of Engineering Mathematics*, Special Issue on Fibre-Reinforced Materials, 95 (2015)

[3] D.R. Nolan, A.L. Gower, M. Destrade, R.W. Ogden, J.P. McGarry, "A robust anisotropic hyperelastic formulation for the modelling of soft tissue", *Journal of the Mechanical Behavior of Biomedical Materials*, 39 (2014)

[2] A.L. Gower, M. Destrade, R.W. Ogden, "Counter-intuitive results in acousto-elasticity", *Wave Motion*, Special Issue in Honour of V.I. Alshits, 50 (2013)

[1] P. Ciarletta, M. Destrade, A.L. Gower, "Shear instability in skin tissue", *Quarterly Journal of Mechanics and Applied Mathematics*, 66 (2013)

Technical Reports

[6a] A.L. Gower, Chapter: "Generating feasible solutions: part 1", In: Automatic Optimised Design of Umbilicals (ESGI 100), *MIIS Eprints Archive*, 710 (2016)

[3a] A.L. Gower, Chapter: "Elimination of errors from track line detection", In: Train Positioning Using Video Odometry (ESGI 116), *MIIS Eprints Archive*, 672 (2014)

[1b] A.L. Gower, C. Brett, J. Herterich, K. Katterbauer, A. Melnik, J. Thompson, "Modelling of abrasive waterjet etching" (OCCAM 4th Modelling Camp), (2012)

[1a] A.L. Gower, "Detecting Geometric Faults from Measured Data" (ESGI 85), *MIIS Eprints Archive*, 659 (2012)

Academic Services

Reviewer:

Proceedings of the Royal Society A |*International Journal of Non-Linear Mechanics* |*IMA Journal of Applied Mathematics* |*SIAM Journal of Applied Mathematics* | *ZAMP* (Journal of Applied Mathematics and Physics) |*Journal of the Acoustical Society of America* |*Acta Acustica United with Acustica*

Outreach

- 24hr Inspire for Life. A talk on "Sensing the world with sound". These science talks raise money for cancer charities. **03/2020**
- Pint of Science - Sheffield. A talk about science to the general public. **05/2019**
- The New Scientist Live. A science festival that attracts over 30,000 visitors. I demonstrated acoustic levitation and other phenomena over a weekend. **09/2018**
- Science Showdown! *How can we measure the invisible: the mathematics of jiggly waves*. A talk promoting maths to a wider audience in Manchester. **03/2017**
- Science Experience Workshop: on open days we gave potential students a hands on science experience. I ran a stand on maths/physics puzzles. **2011 - 2014**
- Maths Enrichment: Teach two morning sessions preparing students for the Irish and international mathematics Olympiad. **2014**
- School Presentation for the School of Science: Two school visits to engage with students about studying science at university. **2011**

Leadership

- Early Career Group - UK Acoustics Network (*Coordinator*) **9/02/2018–present**
  Two summer schools to train early career acousticians (6–9/08/2018, 5–9/08/2019), and a workshop on academic-industrial collaboration (8–9/04/2019).
- Constitutive Behaviour of Soft Tissues (*Co-organiser*) **31/08–2/09 2016**
  A workshop to establish the state-of-the-art in constitutive behaviour of soft tissue
- Joint Symposium: Irish Mechanics Society and Irish Society for Scientific Engineering & Computation (*Co-organiser*) **8–9/11/2014**
  An annual international mechanics conferences
- Irish Applied Maths Research Students' Meeting (*Co-organiser*) **11/10/2014**
  Organized by the SIAM student chapter, this was the first meeting of postgraduates working in applied mathematics across Ireland.
- Stokes Modelling Workshop (*Co-organiser*) **23–26/06/2014**
  A modelling workshop to solve problems brought by industry, in the same style as the European Study Groups with Industry.

Recent Talks

Below are recent invited talks from workshops/conferences/seminars.

- UCL Applied Maths Seminar, "Multiple waves propagate in complex media", London, UK **03/2020**
- Cardiff - Applied and Computational Mathematics Seminar, "Waves in Particulate Materials", Cardiff, UK **02/2020**
- International Congress on Industrial and Applied Mathematics (ICIAM2019), talk in symposium "Waves in multiple-scattering media", Valencia, Spain **06/2019**
- Strathclyde Applied Mathematics Seminar, "Waves in Particulate Materials: Beyond Low Frequencies", Glasgow, UK **05/2019**

- Wave Chaos Seminar, "Waves in complex random media", Wave Modelling Research Group, Nottingham, UK **10/2018**
- I. David Abrahams 30th workshop, "Waves in random particulate materials", Isaac Newton Institute for Mathematical Sciences (INI), Cambridge, UK **09/2018**
- Research seminar, "Using machine learning to characterise complex materials", Malvern Panalytical Ltd, Malvern, UK **08/2018**
- Bremen Workshop on Light Scattering 2018, "Characterising particulate random media from near-surface backscattering, Bremem, Germany **03/2018**
- Meeting of the Acoustical Society of America, 141 (5), 3810-3810, "Characterizing composites with acoustic backscattering: Combining data driven and analytical methods", Boston, USA **06/2017**
- New mathematics for a safer world: wave propagation in heterogeneous materials, "Characterising random composites with acoustic backscattering", International Centre for Mathematical Sciences (ICMS), Edinburgh, UK **06/2017**
- Constitutive behaviour of soft tissues, "Constitutive modelling of initially stressed elastic solids", Manchester, UK **09/2016**