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David Sinden

Applied Mathematician/Software Engineer — Curriculum Vitæ

David Sinden is a senior research scientist at the Fraunhofer for Digital Medicine MEVIS. He is an applied mathematician working primarily on numerical simulations of the propagation of ultrasound in biomedical applications. He is the lead author of six papers, and has published a book chapter on treatment planning for therapeutic ultrasound. He is a member of the British Standards Institute and leads a new work item for IEC Technical Committee 87 Working Group 6 on measurement-based simulation for high pressure fields in water and other media.

Professional Experience

2019– **Senior Research Scientist**, *Fraunhofer Institute for Digital Medicine MEVIS*, Bremen

Modelling and Simulation/Image-guided therapies group

Detailed achievements:

- Achievement 1
- Achievement 2 (with sub-achievements)
  - Sub-achievement (a);
  - Sub-achievement (b), with sub-sub-achievements (don't do this!);
    - Sub-sub-achievement i;
    - Sub-sub-achievement ii;
    - Sub-sub-achievement iii;
  - Sub-achievement (c);
- Achievement 3
- Achievement 4

2014–2019 **Senior Research Scientist**, *Acoustics, National Physical Laboratory*, Teddington

Measurement capabilities for therapeutic ultrasound

Acoustic Holograpy

Hydrophones

2011–2014 **Post Doctoral Research Associate**, *Therapeutic Ultrasound, Institute for Cancer Research*, Sutton

Description line 1

Description line 2

Description line 3

2008–2011 **Post Doctoral Research Associate**, *Mechanical Engineering, University College London*, London

Description line 1

Description line 2

Description line 3

Education

2004–2008 **PhD**, *Nonlinear Dynamics*
University College London
Integrability, Localisation and Bifurcation of an Elastic Rod in a Uniform Magnetic Field
Supervisor: Prof. G. H. M. van der Heijden

2003–2004 **MSc**, *Modern Applications of Mathematics*, University of Bath

2000–2003 **BSc**, *Mathematics with Applied Mathematics and Theoretical Physics*, Imperial College London

Master thesis

title *Title*

supervisors Supervisors

description Short thesis abstract

Languages

Language 1	Skill level	*Comment*
Language 2	Skill level	*Comment*
Language 3	Skill level	*Comment*
Language 4	Skill level	*Comment*

Computer skills

category 1	XXX, YYY, ZZZ	category 4	XXX, YYY, ZZZ
category 2	XXX, YYY, ZZZ	category 5	XXX, YYY, ZZZ
category 3	XXX, YYY, ZZZ	category 6	XXX, YYY, ZZZ

Key Technical Skills

Language:	■■■□□	Python	2	*I'm so experienced in Python and have realised a million projects. At least.*
	■■□□□	C++	14	*So much sheet music! Man, I'm the best!*
	■■■□□	Fortran	14	*Clearly I rock at LaTeX*
OS:	■■■□□	Linux	2	*I only use Archlinux btw*
Methods	■■■■□	SCRUM	8	*SCRUM master for 5 years*

Affiliations, Awards & Achievements

Standardisation Member of IEC Technical Committee 87: Ultrasonics, Working Group 6 – High Power. "Measurement-based Simulation" of ten internationally recognised experts in writing of technical specification

Scholarships M.Sc. funded by an EPSRC scholarship (2003–4), EPSRC funding was awarded for Ph.D. (2004–7) and post-doctoral work (2008–2011, 2011–2013, 2014)

Professional Affiliations	Member of the Society for Industrial and Applied Mathematics member (2004–present), associate member of the Institute of Mathematics (2016–present), and member of the Institute of Physics (2008–present)
Challenge Award	Joint first place in IUS Challenge on Ultrasound Beamforming with Deep Learning (CUBDL)
Conference Award	

Teaching & Administration Experience

Supervision: MSc Secondary supervisor, Sandeep Gyawali, Dept Mathematics, Jacobs University, Bremen, (with Prof. Tobias Preusser) "Extending Composite Finite Element Method for PDE Problems with Geometric Uncertainties" 2019-2021

PhD Industrial-Supervisor, Morgan Roberts, Medical Physics, University College London, (with Dr. Ben Cox) "Ultrasound Computed Tomography of the Breast" 2018–2019

PhD Industrial-Supervisor, Santeri Kaupinmäki, University College London, (with Prof. Simon Arridge) "Inverse Problems for Ultrasound Computed Tomography of the Breast" 2018–2019

PhD Industrial-Supervisor, Katie Baxter, Mathematics, Heriot-Watt University, (with Dr. Lehel Banjai) "Fast Methods for Convolution Quadrature Integration" 2017–2019

Summer student Antoine Lucquiaud, École Normale Supérieure de Cachan, "Boundary Element Methods for Bubble Activity" 2015

Summer student Jade Junqua, Enseirb-Matmeca and Bordeaux 1, investigating mode conversion and heating around the ribs due to high-intensity ultrasound. 2012

Administration: Involved in administration and running of Centre for Preparatory Studies, Nazarbayez University, Astana, Kazakhstan for students on prestigious Bolashak scholarship and in establishing partner campus at Nazarbayez University

- Involved in construction of modules of new courses in mechanical and civil engineering degrees, design of syllabus and preparation of course notes
  ⇒ Project management skills, including liaising with host organisation and participating partner institutions in the United States
- Ran tutorials and revision classes for students in mathematics and physics classes
- Marking of tests and exam scripts

2011

Lecturing: Numerical Analysis, Jacobs University $3/4^{\text{th}}$ undergraduate course, 2022.

Two years lecturing experience teaching general mathematical methods (linear algebra and techniques and applications of integration) to first year Mechanical Engineering undergraduate students at University College London

- Lecturing and production of lecture notes for twenty hours worth of material
  ⇒ Communicating complex material in a clear and accessible manner
- Production of exam and tutorial questions and solutions, marking exam scripts
  ⇒ Attention to detail, precision
- Organisation of tutorial sessions, supervision of post-graduate students who run the tutorials, room bookings
  ⇒ Organisation and leadership skills

2009–11

Teaching: Seven years teaching experience, including general mathematical methods to first and second year Civil and Mechanical Engineering undergraduate students at University College London, first year Mathematics students at the University of Bath and M.Sc. students in Mathematics Department in dynamical systems at University College London

- Running problem-based tutorials
  ⇒ Understanding students' difficulties in understanding course, identifying the strengths and weaknesses of alternative solutions, conclusions or approaches.
- Assisting course directors in teaching-related duties

2004–11

Grants

- European Metrology Programme for Innovation and Research (EMPIR): MAIBAI – Developing a Metrological Framework for Assessment of Image-based Artificial Intelligence Systems for Disease Detection €180,000 (2023-2026)
- Fraunhofer-Netzwerk Simulation: Physics-Informed Neural Networks €5,000 (2023)
- European Metrology Programme for Innovation and Research (EMPIR): Radiotherapy Coupled with Hyperthermia – Adapting the Biological Equivalent Dose Concept, £180,000 (2019-21)
- Focused Ultrasound Foundation invited participant in workshop *Pancreatic cancer workshop* fees, expenses, accommodation and flights to Washington D.C., £2,000 (2019)
- Analysis for Innovators, with Deltex Medical Devices: Optimizing Oesophageal Doppler Transducers, £26,500 (2018)
- Industrial Challenge Strategy Fund, Wave 1, Metrology for Medical Imaging, with Huntleigh Diagnostics: Optimizing Fetal Doppler Transducers £45,500 (2018-19)
- EPSRC Network+ "Thunddar" feasibility study: Machine learning for cavitation detection £26,500 (2016)
- NPL Strategic Research Award: Mathematical modelling of histotripsy £25,000 (2015)
- EPSRC/ICR platform grant: Vascular remodelling, £25,000 (2014)
- American Institute of Mathematics invited participant in workshop *Nonlinear solvers for high-intensity focused ultrasound* fees, expenses, accommodation and flights to Paolo Alto, California £2,000 (2012)
- Institute of Mathematics and its Applications Small Grant £300 (2011)
- UCL Graduate School Conference Fund £250 (2010)
- UCL Study Assistance Scheme £350 (2008)

Outreach

- Scientific consultant on documentary "The healing power of sound" (2012)
- NPL Scientific Ambassador: Talks at number of schools and colleges on careers in science as well as demonstrations of experiments relating to objective measurements (2016-2019)

References

Available upon request.

Publications

[1] Pauline Coralie Guillemin, David Sinden, Yacine M'Rad, Michael Schwenke, Jennifer Le Guevelou, Johan Uiterwijk, Orane Orane Lorton, Max Scheffler, Pierre-Alexandre Poletti, Jürgen Jenne, Thomas Zilli, and Rares Salomir, "A novel concept of transperineal focused ultrasound transducer for prostate cancer local deep hyperthermia treatments," *Cancers* **15**, 163 (2022)

[2] Christina A. Neizert, Hoang N. C. Do, Miriam Zibell, Christian Rieder, David Sinden, Stefan M. Niehues, Janis L. Vahldiek, Kai S. Lehmann, and Franz G. M. Poch, "Three-dimensional assessment of vascular cooling effects on hepatic microwave ablation in a standardized ex vivo model," *Sci. Rep.* **12**, 17061 (2022)

[3] Karl Heimes, Marina Evers, Tim Gerrits, Sandeep Gyawali, David Sinden, Tobias Preusser, and Lars Linsen, "Studying the Effect of Tissue Properties on Radiofrequency Ablation by Visual Simulation Ensemble Analysis," in *Eurographics Workshop on Visual Computing for Biology and Medicine*, edited by Renata G. Raidou, Björn Sommer, Torsten W. Kuhlen, Michael Krone, Thomas Schultz, and Hsiang-Yun Wu (The Eurographics Association, 2022) ISBN 978-3-03868-177-9, ISSN 2070-5786

[4] Dongwoon Hyun, Alycen Wiacek, Sobhan Goudarzi, Sven Rothlübbers, Amir Asif, Klaus Eickel, Yonina C. Eldar, Jiaqi Huang, Massimo Mischi, Hassan Rivaz, David Sinden, Ruud J. G. van Sloun, Hannah Strohm, and Muyinatu A. Lediju Bell, "Deep learning for ultrasound image formation: CUBDL evaluation framework and open datasets," *IEEE Trans. Ultrason. Ferroelectr. Freq. Control* **68**, 3466–3483 (2021)

[5] Sven Rothlübbers, Hannah Strohm, Klaus Eickel, Jürgen Jenne, Vincent Kuhlen, David Sinden, and Matthias Günther, "Improving image quality of single plane wave ultrasound via deep learning based channel compounding," in *2020 IEEE International Ultrasonics Symposium (IUS)* (2020) pp. 1–4

[6] Nadia A. S. Smith, David Sinden, Spencer A. Thomas, Marina Romanchikova, Jessica E Talbott, and Michael Adeogun, "Building confidence in digital health through metrology," *Br. J. Radiol.* **93**, 20190574 (2020)

[7] Santeri Kaupinmäki, Ben Cox, Simon Arridge, Christian Baker, David Sinden, and Bajram Zeqiri, "Pyroelectric ultrasound sensor model: directional response," *Meas. Sci. Technol.* **32**, 035106 (2020)

[8] Ki Joo Pahk, Pierre Gélat, David Sinden, Dipok Kumar Dhar, and Nader Saffari, "Numerical and experimental study of mechanisms involved in boiling histotripsy," *Ultrasound Med. Biol.* **43**, 2848–2861 (2017)

[9] David Sinden, Srinath Rajagopal, N. Christopher Chaggares, Guofeng Pang, and Oleg Ivanytskyy, "Reducing uncertainties for spatial averaging at high frequencies," in *2017 IEEE International Ultrasonics Symposium (IUS)* (IEEE, 2017) pp. 1–4

[10] David Sinden and Gail ter Haar, "Dosimetry implications for correct ultrasound dose deposition: uncertainties in descriptors, planning and treatment delivery," *Trans. Cancer Res.* **3**, 459–471 (2014)

[11] David Sinden, Eleanor Stride, and Nader Saffari, "Approximations for acoustically excited bubble cluster dynamics," in *J. Phys.: Conf. Ser.*, Vol. 353 (IOP Publishing, 2012) p. 012008

[12] Gert H. M. van der Heijden and David Sinden, "Localisation of a twisted conducting rod in a uniform magnetic field: the Hamiltonian-Hopf-Hopf bifurcation," in *Proc. 7th European Nonlinear Dynamics Conference (ENOC 2011)*, edited by D. Bernardini, G. Rega, and F. Romeo (European Mechanics Society, 2011) p. 4, ISBN 978-88-906234-2-4

[13] David Sinden and Gert H. M. van der Heijden, "The buckling of magneto-strictive Cosserat rods," in *Proc. 7th European Nonlinear Dynamics Conference (ENOC 2011)*, edited by D. Bernardini, G. Rega, and F. Romeo (European Mechanics Society, 2011) p. 4, ISBN 978-88-906234-2-4

[14] David Sinden, Eleanor Stride, and Nader Saffari, "The effects of nonlinear wave propagation on the stability of inertial cavitation," in *J. Phys.: Conf. Ser.*, Vol. 195 (IOP Publishing, 2009) p. 012008

[15] David Sinden and Gert H. M. van der Heijden, "Spatial chaos of an extensible conducting rod in a uniform magnetic field," *J. Phys. A: Math. Theor* **42**, 375207 (2009)

[16] David Sinden and Gert H. M. van der Heijden, "Integrability of a conducting elastic rod in a magnetic field," *J. Phys. A: Math. Theor* **41**, 045207 (2008)