



# David Sinden

APPLIED MATHEMATICIAN — RESEARCH SOFTWARE ENGINEER

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## Professional Experience

### Fraunhofer Institute for Digital Medicine MEVIS

Bremen, Germany

SENIOR RESEARCH SCIENTIST – MODELLING & SIMULATION GROUP – PROF. TOBIAS PREUSSER

2019 - present

- Thermal ablation simulations for microwave and ultrasound therapies
- Pharmacokinetic modelling
- Ultrasound beamforming, transcranial imaging

### National Physical Laboratory

Teddington, UK

SENIOR RESEARCH SCIENTIST – ULTRASOUND & UNDERWATER ACOUSTICS GROUP – PROF. BAJRAM ZEIQIRI

2014 - 2019

- Piezo- and pyro-electric sensor modelling using multi-physics finite-element for device design and characterisation
- Development of computational tools for ultrasound field characterisation
- Measurement-based simulation for nonlinear propagation through complex media

### Institute of Cancer Research/The Royal Marsden Cancer NHS Foundation Trust

Sutton, UK

POST-DOCTORAL RESEARCH ASSOCIATE – THERAPEUTIC ULTRASOUND GROUP – PROF. GAIL TER HAAR

2011 - 2014

- Design and implementation of treatment planning software for large phased-array ultrasound transducer for transcatheter thermal ablation

### University College London

London, UK

POST-DOCTORAL RESEARCH ASSOCIATE – MECHANICAL ENGINEERING – PROF. NADER SAFARI | PROF ELEANOR STRIDE

2008 - 2011

- Modelling cavitation activity in tissue during high-intensity focus ultrasound therapy.

## Education

### PhD – University College London

DYNAMICAL SYSTEMS

2004 - 2008

- Thesis: "Integrability, Localisation and Bifurcation of an Elastic Conducting rod in a Uniform Magnetic Field"
- Supervisor: Prof. Gert van der Heijden

### MSc – University of Bath

MODERN APPLICATIONS OF MATHEMATICS

2003 - 2004

### BSc – Imperial College London

MATHS WITH APPLIED MATHEMATICS & THEORETICAL PHYSICS – 2.1

2000 - 2003

## Skills

SOFTWARE:	<div><div></div><div></div><div></div><div></div><div></div></div>	Python	10 Contributor to open source projects, open sourcing code in papers
	<div><div></div><div></div><div></div><div></div><div></div></div>	C++	8 Including STL, Boost, Eigen, VTK and ITK libraries
	<div><div></div><div></div><div></div><div></div><div></div></div>	Accelerators	4 OpenCL, numba/cupy, jax/XLA
	<div><div></div><div></div><div></div><div></div><div></div></div>	Matlab/Octave	20 Was used extensively in research
	<div><div></div><div></div><div></div><div></div><div></div></div>	Fortran	14 Experience from MSc, PhD, post-doc (BLAS, Lapack, auto07, numerical integration)
OS:	<div><div></div><div></div><div></div><div></div><div></div></div>	Linux	14 Ubuntu/WSL
PRESENTATION:	<div><div></div><div></div><div></div><div></div><div></div></div>	-	10 html/css (tailwind), $\LaTeX$ , BibTeX
METHODS:	<div><div></div><div></div><div></div><div></div><div></div></div>	Software development	8 Version control (git/svn), continuous integration, build systems (CMake, qmake), testing (googletests), documentation (doxygen, sphinx)

## Department of Mobility - Constructor University Bremen

Bremen, Germany

ADJUNCT LECTURER

2022, 2024, 2025

- Calculus and Linear Algebra for Graduate Students [MDE-MET-01]: introductory source for MSc students.
- Numerical Methods [JTMS-MAT-13]: second year course for engineering and mathematics students.
- Numerical Analysis [CA-S-MATH-804]: final year course for mathematics students.

## CIMPA Summer School - University of Havana

Havana, Cuba

GUEST LECTURER

June 2023

- Delivered short lecture course on “Examples and Principles of Mathematical Modelling in Medicine”, to around 50 applied mathematicians from South America and Africa.

## Department of Mechanical Engineering - University College London

London, UK

SEMINAR TEACHER

2011

- Modelling and Analysis in Engineering I [MECH1010]: first year course for engineering students.

## Department of Civil, Environmental & Geomatic Engineering - University College London

London, UK

SEMINAR TEACHER

2008, 2009

- Mathematics for Engineers II [Math6502]: Second maths for course for engineering students.

## Nazarbayev University

Astana, Kazakhstan

ADMINISTRATION | SEMINAR TEACHER

2011

For students on prestigious “Bolashak” scholarship and in establishing partner campus at Nazarbayev University

- Involved in construction of mathematics modules for 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 from the United States
- Ran tutorials and revision classes for students in mathematics and physics foundation classes
- Marking of tests and exam scripts

## PhD Industrial Supervisor

UNIVERSITY COLLEGE LONDON

2018–2019

- Morgan Roberts, Dept. Medical Physics (with Prof. Ben Cox) “Ultrasound Computed Tomography of the Breast”.
- Santeri Kaupinmäki, Dept. Medical Physics (with Prof. Simon Arridge) “Inverse Problems for Ultrasound Computed Tomography of the Breast”.

HERIOT-WATT UNIVERSITY

2017–2019

- Katherine Baker, Dept. Mathematics, (with Prof. Lehel Banjai) “Linear and Nonlinear Wave Equation Models with Power Law Attenuation”.

## MSc Secondary Supervisor

CONSTRUCTOR UNIVERSITY, BREMEN

2019-2021

- Sandeep Gyawali, Dept. Mathematics, (with Prof. Tobias Preusser). “Extending Composite Finite Element Method for PDE Problems with Geometric Uncertainties”.

## Undergraduate Supervision

NATIONAL PHYSICAL LABORATORY

2015

- Antoine Lucquiaud, École Normale Supérieure de Cachan, “Boundary Element Methods for Bubble Activity”.

UNIVERSITY COLLEGE LONDON

2012

- Jade Junqua, ENSEIRB-MATMECA and Bordeaux 1, “Investigating mode conversion and heating around the ribs due to high-intensity ultrasound”.

## Outreach

- Scientific consultant on documentary “The healing power of sound” (2014)
- NPL “Scientific Ambassador”: delivered talks at number of schools and colleges on careers in science as well as demonstrations of experiments relating to objective measurements (2016-2019).

# Affiliations, Awards & Achievements

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## Standardisation

- Member of IEC Technical Committee 87: Ultrasonics, Working Group 6 – High Power.  
Part of working group of internationally recognised experts writing the technical specification “TS 63900: Measurement-based Simulation in water and complex media”

## Scholarships

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


## Awards

- Challenge Award: Joint first place in IEEE IUS Challenge on Ultrasound Beamforming with Deep Learning (CUBDL) for “Improving image quality of single plane wave ultrasound via deep learning based channel compounding (2020)”
- Conference Award: Honourable mention for paper “Studying the effect of tissue properties on radiofrequency ablation by visual simulation ensemble analysis” VCBM 2022: Eurographics Workshop on Visual Computing for Biology and Medicine (2022)

## 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)

## Service

- Reviewer for a number of journals (Int. J. Hyperthermia · Ultrasonics · Ultrasound Med. & Biol. · Med. Phys. · Comp. Meth. Prog. Biomed. · J. Open Source Softw.), as well as funding agencies (ANR - France, FWF - Austria, Focused Ultrasound Foundation).
- Mentor to junior staff at NPL (2015–2019)
- Maintainer in open-source scientific code: **k-wave-python** , available via pypi  
<https://doi.org/10.5281/zenodo.10719461>

## Equality, Diversity & Inclusion

- Member of Fraunhofer MEVIS diversity and inclusion task force (2021-)
- Member of ICR's Athena Swan board (2012)

## Grants

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In descending chronological order:

2023	<b>Fraunhofer DISCOVER</b> CompTop: Computational Topology in Medical Imaging	€150,000
2023	<b>European Metrology Programme for Innovation and Research (EMPIR)</b> MAIBAI: Developing a Metrological Framework for Assessment of Image-based Artificial Intelligence Systems for Disease Detection	€180,000
2022	<b>Fraunhofer-Netzwerk: Simulation</b> Physics-Informed Neural Networks	€11,000
2019	<b>European Metrology Programme for Innovation and Research (EMPIR)</b> RaCHy: Radiotherapy Coupled with Hyperthermia – Adapting the Biological Equivalent Dose Concept	£180,000
2018	<b>Analysis for Innovators (A4I), with Deltex Medical Devices</b> Optimizing Oesophageal Doppler Transducers	£26,500
2018	<b>Industrial Challenge Strategy Fund, Wave 1, Metrology for Medical Imaging, with Huntleigh Diagnostics</b> Optimizing Fetal Doppler Transducers	£45,500
2016	<b>EPSRC Network+ Therapy Ultrasound Network for Drug Delivery &amp; Ablation Research (ThUNDDAR) feasibility study</b> Machine Learning for Cavitation Detection	£26,500
2014	<b>NPL Strategic Research Award</b> Mathematical Modelling of Histotripsy	£25,000
2012	<b>EPSRC/ICR Platform Grant</b> Vascular Remodelling	£25,000

[David Sinden](#), “Numerical modelling for simulation and planning of focused ultrasound treatments”

- 2024 In *Image-guided Focused Ultrasound Therapy: Physics and Clinical Applications*, Eds. F. Wu, G. ter Haar, and I. Rivens, Series in Medical Physics and Biomedical Engineering, (CRC Press, Baton Rouge, FL, 2024) ISBN 9781498711357 —

## Publications & Preprints

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In descending chronological order. Citation data from Google Scholar.

- Christina A. Neizert, Hoang N. C. Do, Miriam Zibell, [David Sinden](#), Christian Rieder, Jakob Albrecht,  
2025 Stefan M. Niehues, Kai S. Lehmann, and Franz G. M. Poch, “Optimizing microwave ablation planning with the ablation success ratio”. *Sci. Rep.* 15, 10450 —
- Pauline Coralie Guillemain, [David Sinden](#), Yacine M’Rad, Michael Schwenke, Jennifer Le Guevelou, Johan Uiterwijk, 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 *cites: 5*
- 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 *cites: 6*
- 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*, Eds. R. G. Raidou, B. Sommer, T. W. Kuhlen, M. Krone, T. Schultz, and H-Y. Wu (The Eurographics Association, 2022) ISBN 978-3-03868-177-9, ISSN 2070-5786 *cites: 2*
- Dongwoon Hyun, Alicen 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 *cites: 83*
- Santeri Kaupinmäki, Ben Cox, Simon Arridge, Christian Baker, [David Sinden](#), and Bajram Zeqiri, “Pyroelectric ultrasound sensor model: directional response”, *Meas. Sci. Technol.* 32, 035106 *cites: 4*
- 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”, *2020 IEEE International Ultrasonics Symposium (IUS)* pp. 1–4 *cites: 30*
- 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 *cites: 13*
- [David Sinden](#), Srinath Rajagopal, N. Christopher Chaggares, Guofeng Pang, and Oleg Ivanytskyy, “Reducing uncertainties for spatial averaging at high frequencies”, *2017 IEEE International Ultrasonics Symposium (IUS)* (IEEE, 2017) pp. 1–4 *cites: 1*
- 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 *cites: 42*
- [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 *cites: 13*
- [David Sinden](#), Eleanor Stride, and Nader Saffari, “Approximations for acoustically excited bubble cluster dynamics”, *J. Phys.: Conf. Ser.*, Vol. 353 (IOP Publishing, 2012) p. 012008 *cites: 3*
- [David Sinden](#) and Gert H. M. van der Heijden, “The buckling of magneto-strictive Cosserat rods”, in *Proc. 7<sup>th</sup> 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 —

- 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. 7<sup>th</sup> 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 *cites: 2*
- 2009 [David Sinden](#), Eleanor Stride, and Nader Saffari, “The effects of nonlinear wave propagation on the stability of inertial cavitation”, *J. Phys.: Conf. Ser.*, Vol. 195 (IOP Publishing, 2009) p. 012008 *cites: 3*
- 2009 [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 *cites: 10*
- 2008 [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 *cites: 10*

## Presentations

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In descending chronological order.

- 2025 Nonlinear dynamics of microbubbles in tissue, Dynamical Systems and Geometry Seminary, University of Bremen, 23 January 2025 [\[Abstract\]](#) [\[Presentation\]](#) *Invited*
- 2023 Integrability, localisation and bifurcation of an elastic conducting rod in a magnetic field, 7<sup>th</sup> Workshop on Dynamical Systems & Ergodic Theory in Northern Germany, 9 June 2023 [\[Abstract\]](#) [\[Presentation\]](#) *Invited*
- Artificial intelligence in therapeutic ultrasound, 22<sup>nd</sup> International Symposium on Therapeutic Ultrasound, Lyon, 17–20 April 2023 [\[Abstract\]](#) *Invited*
- 2022 Patient-specific modelling of microwave ablation, Society for Thermal Medicine 2022 Annual Meeting, 1–4 May 2022 [\[Abstract\]](#) [\[Presentation\]](#)
- 2020 Factors for validation of measurement-based simulation, ASA 179, ASA Acoustics Virtually Everywhere, 8 December 2020. [\[Abstract\]](#)[\[Presentation\]](#)
- 2018 Machine learning for cavitation detection, British Medical Ultrasound Symposium, 5 December 2018
- 2016 Acceleration techniques for acoustic holography, British Medical Ultrasound Symposium, 8 December 2016
- Computational challenges in high-intensity focused ultrasound, University of Strathclyde, 25 October 2016 *Invited*
- Absorption of ultrasound by tissue: fractional operators and integral equations Maxwell Institute for Applied Analysis, International Centre for Mathematical Sciences, Edinburgh, 7 October 2016 *Invited*
- Mathematical challenges of high-intensity focused ultrasound, Leslie Comrie Lecture, University of Greenwich, 11 April 2016 *Invited*
- Wave3D: A parallelised three-dimensional nonlinear acoustic wave propagation solver, Anglo-French Physical Acoustics Conference 15, London, 13–15 January 2016
- 2015 Computational challenges in high-intensity focused ultrasound treatment planning, University of Surrey, 15 December 2015 *Invited*
- 2014 Computational challenges in high-intensity focused ultrasound treatment planning, 14<sup>th</sup> International Symposium on Therapeutic Ultrasound, Las Vegas, Nevada, 2–4 April 2014
- 2013 Treatment planning of high-intensity focused ultrasound, Medical Modelling Group, University College London, 30 September 2013 *Invited*
- 2012 The challenges in boundary element modelling for high-intensity focused ultrasound treatment planning, Boundary Integral Equation Methods for High-Frequency Scattering, University of Reading, 25 May 2012 *Invited*
- The effects of nonlinear wave propagation on thermal ablation high-intensity focused ultrasound, Department of Electrical Engineering, Stanford University, California, 11 April 2012 *Invited*

- 2011 The buckling of magneto-strictive Cosserat rods, 7<sup>th</sup> European Mechanics Society European Nonlinear Oscillations Conference, Rome, Italy, 24–29 July 2011
- Localisation of a twisted conducting rod in a uniform magnetic field: the Hamiltonian-Hopf-Hopf bifurcation, 7<sup>th</sup> European Mechanics Society European Nonlinear Oscillations Conference, Rome, Italy, 24–29 July 2011
- Cavitation in tissue under high-intensity focused ultrasound, SIAM Conference on Applications of Dynamical Systems, Snowbird, Utah, 22–26 May 2011
- The effect of fluid compressibility on multi-bubble cavitation for high-intensity focused ultrasound, 161<sup>st</sup> Meeting of the Acoustical Society of America, Seattle, Washington, 23–27 May 2011
- Modelling cavitation in liver tissue under high-intensity focused ultrasound, British Applied Mathematics Colloquium, University of Birmingham, 11–13 April 2011
- Cavitation in models of wave propagation through tissue under high-intensity focused ultrasound, Anglo-French Physical Acoustics Conference 11, Fréjus, France, 19–21 January 2011
- 2010 The influence of liquid viscosity and compressibility on multi-bubble cavitation, UK Therapeutic Ultrasound Interest Group, University College London, 20 December 2010
- Multi-bubble interactions, and high-intensity focused ultrasound therapy, 10th International Symposium on Therapeutic Ultrasound, Tokyo, 9–12 June 2010
- On the stability of interacting bubbles, UK Therapeutic Ultrasound Interest Group, Institute of Cancer Research, 11 May 2010
- Cavitation in high-intensity focused ultrasound treatment, Medical Modelling Group, University College London, 4 May 2010
- Integrability, spatially complex localisation and bifurcation of an elastic conducting rod in a uniform magnetic field, London Dynamical Systems Workshop, Imperial College, 29 April 2010 *Invited*
- Phase synchronisation and the collective instability oscillating bubble clouds, 159<sup>th</sup> Meeting of the Acoustical Society of America, Baltimore, Maryland, 19–23 April 2010. *J. Acoust. Soc. Am.* 127(3), 1865–1865
- On multi-bubble interactions, Anglo-French Physical Acoustics Conference 10, Kendal, 18–22 January 2010
- 2009 On multi-bubble interactions, UK Therapeutic Ultrasound Interest Group, University College London, 11 November 2009
- The effects of viscoelasticity on the stability of inertial cavitation, 9<sup>th</sup> International Symposium on Therapeutic Ultrasound, Aix-en-Provence, 23–26 September 2009
- 2008 The effects of nonlinear wave propagation on inertial cavitation, UK Therapeutic Ultrasound Interest Group, University College London, 18 December 2008
- The effects of nonlinear wave propagation on inertial cavitation, Anglo-French Physical Acoustics Conference 9, Arcachon, 8–10 December 2008
- Integrability, spatially complex localisation and bifurcation of an elastic conducting rod in a uniform magnetic field, University of Surrey, 3 October 2008 *Invited*
- Spatially complex localisation of an elastic conducting rod in a uniform magnetic field, Bifurcations in Dynamical Systems with Applications, University of Bielefeld, 19–21 May 2008
- 2007 The integrability of a conducting elastic rod in a magnetic field, British Applied Mathematics Colloquium, Bristol University, 17–19 April 2007