Dr. Abdul-Lateef Haji-Ali

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Summary

Applied mathematician and computer scientist, working at the interface of uncertainty quantification, numerical analysis, and machine learning, with a with a strong record of publications and grant funding in stochastic algorithms, uncertainty quantification, and statistical analysis.

Research interests: Uncertainty Quantification, Numerical Analysis, Machine Learning, Stochastic Differential Equation, Numerical methods for SDEs and SPDEs, Multilevel Monte Carlo, Particle systems, Crowd modelling, Mean-field theory, Sparse Grids, Combination techniques, Multi-index techniques, Inverse problems.

Education

King Abdullah University of Science and Technology (KAUST), Saudi Arabia

PhD, Applied Mathematics, December 2012 to May 2016

Thesis Title: *Efficient Multilevel and Multi-index Sampling Methods in Stochastic Differential Equations*

MSc, Applied Mathematics, September 2010 to December 2012

Thesis Title: *Pedestrian Flow in the Mean-field Limit*

Arab International University, Damascus, Syria

BSc, Informatics Engineering (Major in Artificial Intelligence), September 2005 to August 2010

Employment History

Maxwell Institute for Mathematical Sciences and School of Mathematical and Computer Sciences, Heriot–Watt University, Edinburgh, United Kingdom

- Associate Professor, 01 August 2022, ongoing.
- Assistant Professor, 03 January 2019 to 31 July 2022.

Mathematical Institute, University of Oxford, United Kingdom

- Hooke Research Fellowship, 05 September 2016 to 31 December 2018.

St. Anne's College, University of Oxford, United Kingdom

- College Association, January 2017 to 31 December 2018.

Refereed Journal Publications

1. A.-L. Haji-Ali and A. Stein. "An Antithetic Multilevel Monte Carlo-Milstein Scheme for Stochastic Partial Differential Equations with non-commutative noise". In: *ESAIM: Mathematical Modelling and Numerical Analysis* 59.3 (2025), pp. 1437–1470. DOI: 10.1051/m2an/2025031.

2. L. Shaw, A.-L. Haji-Ali, M. Pereyra, and K. Zygalakis. "Bayesian computation with generative diffusion models by Multilevel Monte Carlo". In: *Philosophical Transactions A* (2025). DOI: 10.1098/rsta.2024.0333.

3. N. B. Rached, A.-L. Haji-Ali, M. Shyam, and R. Tempone. "Multilevel Importance Sampling for McKean-Vlasov Stochastic Differential Equation". In: *Statistics and Computing* 35.1 (Nov. 2024), p. 1. ISSN: 1573-1375. DOI: 10.1007/s11222-024-10508-3.

4. N. Ben Rached, A.-L. Haji-Ali, S. M. Subbiah Pillai, and R. Tempone. "Double-loop importance sampling for McKean–Vlasov stochastic differential equation". In: *Statistics and Computing* 34.6 (2024), pp. 1–25. DOI: 10.1007/s11222-024-10497-3.

5. **M. B. Giles and A.-L. Haji-Ali. "Multilevel Path Branching for Digital Options". In: *Annals of Applied Probability* 34.5 (2024), pp. 4836–4862. ISSN: 1050-5164. DOI: 10.1214/24-AAP2083.**

6. E. Ben Amar, N. Ben Rached, A.-L. Haji-Ali, and R. Tempone. "State-dependent importance sampling for estimating expectations of functionals of sums of independent random variables". In: *Statistics and Computing* 33.2 (Feb. 2023). ISSN: 0960-3174, 1573-1375. DOI: 10.1007/s11222-022-10202-2.

7. M. B. Giles and A.-L. Haji-Ali. "Subsampling and other considerations for efficient risk estimation in large portfolios". In: *Journal of Computational Finance* 26.1 (June 2022). ISSN: 1460-1559, 1755-2850. DOI: 10.21314/jcf.2022.019.

8. A.-L. Haji-Ali, J. Spence, and A. L. Teckentrup. "Adaptive Multilevel Monte Carlo for Probabilities". In: *SIAM Journal on Numerical Analysis* 60.4 (Aug. 2022), pp. 2125–2149. ISSN: 0036-1429, 1095-7170. DOI: 10.1137/21m1447064.

9. N. Ben Rached, A.-L. Haji-Ali, G. Rubino, and R. Tempone. "Efficient importance sampling for large sums of independent and identically distributed random variables". In: *Statistics and Computing* 31.6 (Oct. 2021). ISSN: 0960-3174, 1573-1375. DOI: 10.1007/s11222-021-10055-1.

10. A.-L. Haji-Ali, F. Nobile, R. Tempone, and S. Wolfers. "Multilevel weighted least squares polynomial approximation". In: *ESAIM: Mathematical Modelling and Numerical Analysis* 54.2 (Mar. 2020), pp. 649–677. ISSN: 0764-583X, 1290-3841. DOI: 10.1051/m2an/2019045.

11. **M. B. Giles and A.-L. Haji-Ali. "Multilevel Nested Simulation for Efficient Risk Estimation". In: *SIAM/ASA Journal on Uncertainty Quantification* 7.2 (Jan. 2019), pp. 497–525. ISSN: 2166-2525. DOI: 10.1137/18m1173186.**

12. A.-L. Haji-Ali, H. Harbrecht, M. Peters, and M. Siebenmorgen. "Novel results for the anisotropic sparse grid quadrature". In: *Journal of Complexity* 47 (Aug. 2018), pp. 62–85. ISSN: 0885-064X. DOI: 10.1016/j.jco.2018.02.003.

13. A.-L. Haji-Ali and R. Tempone. "Multilevel and Multi-index Monte Carlo methods for the McKean–Vlasov equation". In: *Statistics and Computing* 28.4 (Sept. 2017), pp. 923–935. ISSN: 0960-3174, 1573-1375. DOI: 10.1007/s11222-017-9771-5.

14. A.-L. Haji-Ali, F. Nobile, L. Tamellini, and R. Tempone. "Multi-Index Stochastic Collocation for random PDEs". In: *Computer Methods in Applied Mechanics and Engineering* 306 (July 2016), pp. 95–122. ISSN: 0045-7825. DOI: 10.1016/j.cma.2016.03.029.

15. **A.-L. Haji-Ali, F. Nobile, L. Tamellini, and R. Tempone. "Multi-index Stochastic Collocation Convergence Rates for Random PDEs with Parametric Regularity". In: *Foundations of Computational Mathematics* 16.6 (Aug. 2016), pp. 1555–1605. ISSN: 1615-3375, 1615-3383. DOI: 10.1007/s10208-016-9327-7.**

16. **A.-L. Haji-Ali, F. Nobile, and R. Tempone. "Multi-index Monte Carlo: When sparsity meets sampling". In: *Numerische Mathematik* 132.4 (June 2015), pp. 767–806. ISSN: 0029-599X, 0945-3245. DOI: 10.1007/s00211-015-0734-5.**

17. A.-L. Haji-Ali, F. Nobile, E. von Schwerin, and R. Tempone. "Optimization of mesh hierarchies in multilevel Monte Carlo samplers". In: *Stochastics and Partial Differential Equations Analysis and Computations* 4.1 (June 2015), pp. 76–112. ISSN: 2194-0401, 2194-041X. DOI: 10.1007/s40072-015-0049-7.

18. **N. Collier, A.-L. Haji-Ali, F. Nobile, E. von Schwerin, and R. Tempone. "A continuation multilevel Monte Carlo algorithm". In: *BIT Numerical Mathematics* 55.2 (Sept. 2014), pp. 399–432. ISSN: 0006-3835, 1572-9125. DOI: 10.1007/s10543-014-0511-3.**

Preprints

19. A.-L. Haji-Ali, H. Hoel, and A. Petersson. *The multi-index Monte Carlo method for semilinear stochastic partial differential equations*. 2025. DOI: 10.48550/arxiv.2502.00393. arXiv: 2502.00393 [math.NA].

20. N. B. Rached, A.-L. Haji-Ali, R. Tempone, and L. Wilkosz. *Forward Propagation of Low Discrepancy Through McKean-Vlasov Dynamics: From QMC to MLQMC*. 2024. DOI: 10.48550/arxiv.2409.09821. arXiv: 2409.09821 [math.NA].

21. M. B. Giles, A.-L. Haji-Ali, and J. Spence. *Efficient Risk Estimation for the Credit Valuation Adjustment*. 2023. DOI: 10.48550/arxiv.2301.05886. arXiv: 2301.05886 [q-fin.CP].

22. A.-L. Haji-Ali, H. Hoel, and R. Tempone. *Weak convergence analysis in the particle limit of the McKean–Vlasov equations using stochastic flows of particle systems*. 2023. DOI: 10.48550/arxipv.2101.00886. arXiv: 2101.00886 [math.PR].

23. N. B. Rached, A.-L. Haji-Ali, S. M. S. Pillai, and R. Tempone. *Multi-index Importance Sampling for McKean-Vlasov Stochastic Differential Equation*. 2023. DOI: 10.48550/arxiv.2307.05149. arXiv: 2307.05149 [math.NA].

Awards and Fellowships

- Alexander von Humboldt Fellowship for Experienced Researchers, April 2025.
- Second-place Leslie Fox Prize, June 2019.
- Fulford Non-stipendiary Junior Research Fellowship, Somerville College, University of Oxford, October 2017 to December 2019.
- Hooke Research Fellowship, Mathematical Institute, University of Oxford, September 2016 to December 2019.
- King Abdullah University of Science and Technology Fellowship 2010.
- Academic Excellence Award, King Abdullah University of Science and Technology 2010.

Grants

- Principal Investigator, Alexander von Humboldt Fellowship for Experienced Researchers, Project: "Advanced Sampling Techniques to Approximate Statistics of the McKean-Vlasov SDE", 1 July 2025 to 30 September 2027.
- Co-Investigator, Knowledge Transfer Partnership and Scottish Whisky Research Institute, Project: "Whisky Colour: correlating human perception and UV-vis spectroscopy", 1 January 2025 to 31 December 2026. Cost to funders: £147K.
- Principal Investigator, Project Grant, Defence Science and Technology Laboratory, Project: "DSTL: Maths for Defence – Recreating Time Series from Alan Deviation", 1 December 2023 to 20 March 2024. Cost to funder: £47K.

- Co-Investigator, Knowledge Transfer Partnership, Project: "Putting the Smart into Sensing and Imaging", 24 July 2023 to 23 July 2026. Cost to funder: £295K.
- Co-Investigator, Medical Research Council, Project: "Project: Reliable and Efficient Estimation of the Economic Value of medical Research (REEEVR)", 1 Apr 2022 - 30 Sep 2023, Cost to funder: £337K.
- Co-Investigator, Medical Research Council, Project: "What is the value of adaptive designs? Estimating expected value of sample information for adaptive trial designs", 1 Dec 2019 to 31 May 2022, Cost to funder: £408K.
- Principal Investigator, Royal Society of Edinburgh Research Grant, Project: "Accelerating the Monte Carlo Method for Detecting Orbital Collisions", 1 May 2019 to 30 April 2020. Cost to funder: £65K.

PhD Supervision

First supervisor:

- Jonathan Spence, 2019–2023, Thesis title: "*Hierarchical and adaptive methods for accurate and efficient risk estimation*", Maxwell Institute, Heriot-Watt University. Currently working in University of Edinburgh.
- Ian Powell, 2022-ongoing, Maxwell Institute, Heriot-Watt University.
- Songyi Zhou, 2025-ongling, Maxwell Institute, Heriot-Watt University.

Co-supervisor:

- Anastasia Istratuca, 2021-ongoing, Maxwell Institute, University of Edinburgh, First supervisor: Dr. Aretha Teckentrup.
- Nida Siddiqui, 2021-ongoing, First supervisor: Dr. Haslifah Hasim, Heriot–Watt University.
- Sara Helal, 2022-ongoing, Maxwell Institute, University of Edinburgh, First supervisor: Dr. Victor Elvira.
- Bernhard Heinzelreiter, 2023-ongoing, Maxwell Institute, University of Edinburgh, First supervisor: Prof. John Pearson.

Selected Teaching Experience

- **Designed and proposed MSc programme** "Mathematics of Sustainable Finance", Heriot–Watt University, 2024.
- **Project supervision** for PhD and MSc students, Heriot–Watt University and University of Edinburgh.
- **MSc course**. "Advanced Derivative Pricing", Heriot–Watt University, 2025–ongoing.
- **MSc course**. "Statistical Machine Learning", Heriot–Watt University, 2024.
- **MSc course**. "Risk Theory", Heriot–Watt University, 2021-2023.
- **MSc course**. "Machine Learning for Risk and Insurance II", Heriot–Watt University, 2021-2023.
- **Short course**. "Specialist 03: Monte Carlo simulations", InFoMM CDT, University of Oxford, March 2018.
- **Tutor** "Stochastic Differential Equations", Mathematical Institute, University of Oxford, October to November 2017 and 2018.
- **Tutor** "Differential Equations", St. Anne's College, University of Oxford, October to November 2017.
- **Tutor** "Constructive Maths", St. Anne's College, University of Oxford, May 2017.
- **Tutor** "Martingale Through Measure Theory", Mathematical Institute, University of Oxford, May 2017 and October to November 2018.
- **Tutor** "Differential Equations II", St. Anne's College, University of Oxford, January to July 2017 and 2018.
- **Tutor** "Numerical Analysis", St. Anne's College, University of Oxford, January to July 2017 and 2018.
- **Project supervisor** "Multilevel Hierarchical Markov Chain Monte Carlo", Centre for Doctoral Training in Mathematical Institute, University of Oxford, January

2017.

- **Short course**. "`mimclib`: A Python library for MLMC and MIMC", UQ School, King Abdullah University of Science and Technology, Thuwal, Saudi Arabia, May 2016.

Academic Leadership

- Academic Cohort Director of MAC-MIGS Centre for Doctoral Training, 2019-ongoing.
- Associate Editor for Springer's Statistics and Computing, 2023-ongoing.
- Heriot-Watt Coordinator for Centre of Statistics in University of Edinburgh, 2024-ongoing.
- Member of the Applied Probability Section Committee of the Royal Statistical Society, 2024-ongoing.
- Programme Director for Financial Mathematics MSc in School of Mathematical and Computer Science, Heriot-Watt University, 2022-2024.
- EDI officer for MAC-MIGS Centre for Doctoral Training, 2019-2021.
- Applied Computational Mathematics deputy group leader in School of Mathematical and Computer Sciences (MACS), 2024-ongoing.
- MINDS (Mathematics of Information and Data Science) group leader in MACS, 2022-2024.

Technical Skills

Proficient in C, C++, Python, TEX, UNIX shell scripting, GNU make, Lisp, MySQL, Matlab. Basic experience in C#, Javascript and Mathematica.

Research Visits

- Chair of Numerical Analysis and UQ, Heidelberg University, September 2024.
- Junior Research Group on Uncertainty Quantification, Karlsruhe Institute of Technology, September 2024.
- UQ Chair, RWTH Aachen, December 2023.
- Isaac Newton Institute, Cambridge, United Kingdom, June 2023.
- Heilbronn Focused Research Group, "UQ For SciML", Dundee, United Kingdom, May 2022.
- UQ Chair, RWTH Aachen, December 2022.
- Isaac Newton Institute, Cambridge, United Kingdom, April 2022.
- University of Dundee, United Kingdom, May 2022.
- Isaac Newton Institute, Cambridge, United Kingdom, April 2018.
- École Polytechnique Fédérale de Lausanne, Switzerland, July 2017.
- RWTH Aachen University, Germany, June 2017.
- École Polytechnique Fédérale de Lausanne, Switzerland, April 2016.
- École Polytechnique Fédérale de Lausanne, Switzerland, August 2015.
- University of Pavia, Pavia, Italy, July 2015.
- Königlich Technische Hochschule, Stockholm, Sweden, June 2015.
- University of Texas at Austin, USA, July 2014.
- Universidad de la República, Montevideo, Uruguay, December 2013.
- University of Texas at Austin, USA, June 2013.

Selected Outreach

Mini-symposia organization

- "Nested Expectations: models and estimators" in International Conference on Monte Carlo Methods and Applications (MCM), July 2025 (Upcoming).
- "Decision making under uncertainty" in British Applied Mathematics Colloquium, Loughborough University, April 2022.
- "Monte Carlo methods for discontinuous functions" in International Conference on Monte Carlo Methods and Applications (MCM), Mannheim, Germany, August 2021.
- "Theory and Applications of Particle Systems" in International Conference on

Monte Carlo Methods and Applications (MCM), Mannheim, Germany, August 2021.

Invited Talks in Conferences/Workshops

- **Plenary** talk. Stochastic Numerics and Inverse Problems in Sweden, Linnaeus University, Växjö, August 2025 (Upcoming).
- In mini-symposium. International Conference on Monte Carlo Methods and Applications, Chicago, USA, July 2025 (Upcoming).
- Uncertainty Quantification for Dynamical Modelling, Edinburgh, UK, July 2025 (Upcoming).
- In mini-symposium. The 30th Biennial Numerical Analysis Conference, University of Strathclyde, Glasgow, UK, June 2025 (Upcoming).
- CfS Annual Conference 2025, Edinburgh, UK, June 2025 (Upcoming).
- Stochastic Numerics and Statistical Learning: Theory and Applications Workshop 2025, King Abdullah University of Science and Technology, May 2025 (Upcoming).
- Stochastic Numerics and Statistical Learning: Theory and Applications Workshop, King Abdullah University of Science and Technology, May 2024.
- In mini-symposium. SIAM Conference on Uncertainty Quantification, Trieste, Italy, February 2024.
- Third workshop on Monte Carlo methods, December 2023.
- The Linnaeus University Workshop on S(P)DEs, their numerics and applications, December 2023.
- In mini-symposium. International Conference on Monte Carlo and Quasi-Monte Carlo Methods in Scientific Computing (MCQMC), July 2022.
- Stochastic Numerics and Statistical Learning: Theory and Applications Workshop, King Abdullah University of Science and Technology, May 2022.
- Multilevel and multifidelity sampling methods in UQ for PDEs, May 2022.
- In mini-symposium. British Applied Mathematics Colloquium, Online, April 2022.
- In mini-symposium. International Conference on Monte Carlo Methods and Applications (MCM), Mannheim, Germany, August 2021.
- In mini-symposium. International Conference on Monte Carlo Methods and Applications (MCM), Mannheim, Germany, August 2021.
- LMS/MAC-MIGS Workshop on Inverse Problems and Optimisation for PDEs, May 2020.
- Workshop on Multilevel and multifidelity sampling methods in UQ for PDEs, Online, May 2020.
- International Conference on Monte Carlo and Quasi-Monte Carlo Methods in Scientific Computing (MCQMC), Renne, France, July 2018.
- Reducing dimensions and cost for UQ in complex systems (UNQW03), Isaac Newton Institute, Cambridge, March 2018.
- Computational Uncertainty Quantification, BIRS, Banff, Canada, October 2017.
- LMS-EPSRC Symposium - Model Order Reduction, Durham, August 2017.
- International Conference on Monte Carlo Methods and Applications (MCM) 2017, Montreal, July 2017.
- UQ Summer School, WIAS Berlin, September 2016.
- SIAM Conference on Uncertainty Quantification, Lausanne, April 2016.
- SRI UQ, King Abdullah University of Science and Technology, January 2016.
- UQ15, WIAS Berlin, November 2015.
- SciCADE, Potsdam, September 2015.
- ICIAM, Beijing, August 2015.
- International Conference on Monte Carlo Methods and Applications (MCM), Johannes Kepler University, Linz, July 2015.
- FoCM, Universidad de la República in Montevideo, December 2014.
- SGA, Universität Stuttgart, September 2014.
- NASPDE, EPFL, September 2014.

- ENUMATH, EPFL, August 2013.

Invited Talks in Seminars

- Scientific Computing and Uncertainty Quantification, EPFL, June 2025 (Upcoming).
- Computational Mathematics and Applications Seminar, Mathematical Institute, Oxford, January 2025.
- Mathematical Physics and Harmonic Analysis Seminar, Texas A&M University, December 2024.
- Probability Seminar at the University of Leeds, University of Leeds, November 2024.
- Modern Applied and Computational Mathematics (MACM) Seminar, Karlsruhe Institute of Technology, September 2024.
- Engineering Risk Analysis Seminar, Technical University of Munich, December 2022.
- Dundee Mathematics Seminar, University of Dundee, School of Science and Engineering, October 2021.
- Applied Maths Seminar, University of Leicester, February 2021.
- AvH RWTH UQ: hybrid seminar, Online, February 2021.
- One World Stochastic Numerics and Inverse Problems, Online, May 2020.