Abdul-Lateef Haji-Ali

Contact Information

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Research Interests

Uncertainty Quantification, Stochastic Differential Equation, Numerical methods for SDEs and PDEs, 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, September 2005 to August 2010

Employment History

Maxwell Institute for Mathematical Sciences & School of Mathematical and Computer Sciences, Heriot-Watt University, Edinburgh, UK

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

Mathematical Institute, University of Oxford, UK

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

St. Anne's College, University of Oxford, UK

- College Association, January 2017 to January 2019.

Refereed Journal Publications

1. 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.
2. **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.**
3. 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. URL: https://doi.org/10.1007/s11222-022-10202-2.
4. 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.

5. 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.

6. 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.

7. 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.

8. **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.**

9. 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.

10. 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.

11. 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.

12. **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.**

13. **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.**

14. 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.

15. **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

16. A.-L. Haji-Ali, M. Pereyra, L. Shaw, and K. Zygalakis. *Bayesian computation with generative diffusion models by Multilevel Monte Carlo*. 2024. DOI: 10.48550/arxiv.2409.15511. arXiv: 2409.15511 [stat.CO]. URL: https://arxiv.org/abs/2409.15511.

17. A.-L. Haji-Ali and A. Stein. *An Antithetic Multilevel Monte Carlo-Milstein Scheme for Stochastic Partial Differential Equations.* 2023. DOI: 10.48550/arxiv.2307.14169. arXiv: 2307.14169 [math.NA].

18. 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].

19. 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/arxiv.2101.00886. arXiv: 2101.00886 [math.PR].

20. N. B. Rached, A.-L. Haji-Ali, M. Shyam, and R. Tempone. *Multilevel Importance Sampling for McKean-Vlasov Stochastic Differential Equation.* accepted. 2022. DOI: 10.48550/arxiv.2208.03225. arXiv: 2208.03225 [math.NA].

Awards

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

Selected Teaching Experience

- **PhD supervision** for three students, Maxwell Institute, Edinburgh.
- **Project supervision** for PhD and MSc students, Heriot-Watt University and University of Edinburgh.
- **Programme director**. “MSc in Financial Mathematics”, Heriot-Watt University joint with University of Edinburgh.
- **MSc course**. “Risk Theory”, Heriot-Watt University.
- **MSc course**. “Machine Learning for Risk and Insurance II”, Heriot-Watt University.
- **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.
- **Short course**. “`mimclib`: A Python library for MLMC and MIMC”, UQ School, King Abdullah University of Science and Technology, Thuwal, Saudi Arabia, May 2016.

Recent Research Visits

- UQ Chair, RWTH Aachen, December 2023.
- Issac Newton Institute, Cambridge, United Kingdom, June 2023.
- UQ Chair, RWTH Aachen, December 2022.
- Issac Newton Institute, Cambridge, United Kingdom, April 2022.
- University of Dundee, United Kingdom, May 2022.
- Issac Newton Institute, Cambridge, United Kingdom, April 2018.
- École Polytechnique Fédérale de Lausanne, Switzerland, July 2017.
- RWTH Aachen University, Germany, June 2017.

Technical Skills

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

Grants

- Project Grant, Defence Science and Technology Laboratory, Project: "DSTL: Maths for Defence – Recreating Time Series from Alan Deviation", 1 December 2022 to 20 March 2023. Cost to funder: £47,276.
- 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: £65,616
- Co-Investigator, Knowledge Transfer Partnership, Project: "Putting the Smart into Sensing and Imaging", 24 July 2023 to 23 July 2026.
- 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.
- 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.

Academic Citizenship

- Reviewer for German Science Foundation and UK Research and Innovation.
- Associate Editor for Springer's Statistics and Computing.
- Member of the Applied Probability Section Committee of the Royal Statistical Society.

Selected Outreach

Organization:

- Co-organized mini-symposium "Decision making under uncertainty" in BAMC, April 2022.
- Co-organized mini-symposium "Monte Carlo methods for discontinuous functions" in MCM 2021.
- Co-organized mini-symposium "Theory and Applications of Particle Systems" in MCM 2021.
- Co-organized SIAM UKIE annual meeting, January 2019.
- Co-organized mini-symposium: "Forward and inverse UQ with hierarchical models", MCQMC, Rennes, France, United Kingdom, July, 2018.
- Co-organized of mini-symposium: "Numerical Methods for PDEs in Uncertainty Quantification", SciCADE, University of Bath, United Kingdom, September, 2017.
- "Multilevel and multifidelity sampling methods in UQ for PDEs", Vienna, Austria, May 2022.
- "British Applied Mathematics Colloquium", Loughborough University, UK, April 2022.
- University of Dundee, School of Science and Engineering, UK, October 2021.
- "Applied Maths Seminar", University of Leicester, February 2021.

Recent Invited Talks:

- "Stochastic Numerics and Statistical Learning: Theory and Applications Workshop", King Abdullah University of Science and Technology, Saudi Arabia, May 2024.
- "The Linnaeus University Workshop on S(P)DEs, their numerics and applications", Linnaeus University, Växjö, Sweden, December 2023.
- "Workshop on Monte Carlo methods in Warsaw", Poland, December 2023.
- "ERA Seminar", Technische Universität München, Germany, December 2022.
- "Stochastic Numerics and Statistical Learning: Theory and Applications Workshop", KAUST, Saudi Arabia, May 2022.

Recent Talks:

- "SIAM Conference on Uncertainty Quantification", Trieste, Italy, February 2024.
- MCQMC, Linz, Austria, July 2022.
- MCM, Mannheim, Germany, August 2021.
- AvH RWTH UQ: hybrid seminar, February 2021.

- LMS/MAC-MIGS Workshop on Inverse Problems and Optimisation for PDEs, May 2020.
- One World Stochastic Numerics and Inverse Problems, May 2020.
- Multilevel and multifidelity sampling methods in UQ for PDEs, May 2020.