# Yufei Zhang


CONTACT INFORMATION

**Office:** 803, Weeks Building, South Kensington Campus
**Mail:** Department of Mathematics, 180 Queen's Gate, South Kensington Campus, Imperial College London, London, SW7 2AZ
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**Website:** https://yufei-zhang.github.io


RESEARCH INTERESTS

My research interests lie at the intersection of machine learning, stochastic control and games, and mathematical finance.

ACADEMIC APPOINTMENTS

**Imperial College London**, United Kingdom

Senior Lecturer at Department of Mathematics — Sep. 2023-present

**London School of Economics**, United Kingdom

Assistant Professor at Department of Statistics — Sep. 2021-Aug. 2023

EDUCATION

**University of Oxford**, United Kingdom

D.Phil., Mathematics — Oct. 2017-June 2021

- Adviser: Professor Christoph Reisinger

**The Chinese University of Hong Kong**, Hong Kong

M.Phil., Mathematics — Aug. 2015-July 2017

M.Sc., Mathematics — Aug. 2013-June 2015

B.B.A., Insurance, Financial and Actuarial Analysis — Aug. 2008-June 2013

- Minor in Mathematics

REFEREED JOURNAL PUBLICATIONS

[1] Christoph Reisinger, Wolfgang Stockinger, and Yufei Zhang, *A fast iterative PDE-based algorithm for feedback controls of nonsmooth mean-field control problems*, SIAM Journal on Scientific Computing, forthcoming, arXiv:2108.06740, 2024.

[2] Lukasz Szpruch, Tanut Treetanthiploet, and Yufei Zhang, *Exploration-exploitation trade-off for continuous-time episodic reinforcement learning with linear-convex models*, The Annals of Applied Probability, forthcoming, arXiv:2112.10264, 2024.

[3] Michael Giegrich, Christoph Reisinger, and Yufei Zhang, *Convergence of policy gradient methods for finite-horizon exploratory linear-quadratic control problems*, SIAM Journal on Control and Optimization, 62 (2024), pp. 1060-1092 [Preprint version.]

[4] Lukasz Szpruch, Tanut Treetanthiploet, and Yufei Zhang, *Optimal scheduling of entropy regulariser for continuous-time linear-quadratic reinforcement learning*, SIAM Journal on Control and Optimization, 62 (2024), pp. 135-166 [Preprint version.]

[5] Christoph Reisinger, Wolfgang Stockinger, and Yufei Zhang, *Linear convergence of a policy gradient method for some finite horizon continuous time control problems*, SIAM Journal on Control and Optimization, 61 (2023), pp. 3526-3558 [Preprint version.]

[6] Christoph Reisinger, Wolfgang Stockinger, and Yufei Zhang, *A posteriori error estimates for fully coupled McKean-Vlasov forward-backward SDEs*, IMA Journal of Numerical Analysis, online first, 2023 [Preprint version.]

[7] Xin Guo, Anran Hu and Yufei Zhang, *Reinforcement learning for linear-convex models with jumps via stability analysis of feedback controls*, SIAM Journal on Control and Optimization, 61 (2023), pp. 755-787. [Preprint version.]

[8] Matteo Basei, Xin Guo, Anran Hu and Yufei Zhang, *Logarithmic regret for episodic continuous-time linear-quadratic reinforcement learning over a finite-time horizon*, Journal of Machine Learning Research, 23 (2022), pp. 1–34. [Preprint version.]

[9] Christoph Reisinger and Yufei Zhang, *Regularity and stability of feedback relaxed controls*, SIAM Journal on Control and Optimization, 59 (2021), pp. 3118–3151. [Preprint version.]

[10] Kazufumi Ito, Christoph Reisinger, and Yufei Zhang, *A neural network based policy iteration algorithm with global $H^2$-superlinear convergence for stochastic games on domains*, Foundations of Computational Mathematics, 21 (2021), pp. 331–374. [Preprint version.]

[11] Christoph Reisinger and Yufei Zhang, *A penalty scheme and policy iteration for nonlocal HJB variational inequalities with monotone drivers*, Computers and Mathematics with Applications, 93 (2021), pp. 199-213. [Preprint version.]

[12] Roxana Dumitrescu, Christoph Reisinger, and Yufei Zhang, *Approximation schemes for mixed optimal stopping and control problems with nonlinear expectations and jumps*, Applied Mathematics & Optimization, 83 (2021), pp. 1387-1429.

[13] Christoph Reisinger and Yufei Zhang, *Rectified deep neural networks overcome the curse of dimensionality for nonsmooth value functions in zero-sum games of nonlinear stiff systems*, Analysis and Applications, 18 (2020), pp. 951-999. [Preprint version.]

[14] Christoph Reisinger and Yufei Zhang, *Error estimates of penalty schemes for quasi-variational inequalities arising from impulse control problems*, SIAM Journal on Control and Optimization, 58 (2020), pp. 243–276. [Preprint version.]

[15] Christoph Reisinger and Yufei Zhang, *A penalty scheme for monotone systems with interconnected obstacles: convergence and error estimates*, SIAM Journal of Numerical Analysis, 57 (2019), pp. 1625–1648. [Preprint version.]

REFEREED CONFERENCE PUBLICATIONS

[1] Xinshi Chen, Yufei Zhang, Christoph Reisinger, and Le Song, *Understanding deep architectures with reasoning layer*, Advances in Neural Information Processing Systems (NeurIPS 2020), 33 (2020), pp. 1240–1252. [Preprint version.]

PREPRINTS

[1] Deven Sethi and David Šiška and Yufei Zhang, *Entropy annealing for policy mirror descent in continuous time and space*, arXiv:2405.20250, 2024.

[2] Tanut Treetanthiploet, Łukasz Szpruch, and Yufei Zhang, *$\epsilon$-policy gradient for online pricing* , arXiv:2405.03624, 2024.

[3] Xin Guo, Xinyu Li, and Yufei Zhang, *An $\alpha$-potential game framework for $N$-player games*, arXiv:2403.16962, 2024.

[4] Bekzhan Kerimkulov, David Šiška, Łukasz Szpruch, and Yufei Zhang, *Mirror descent for stochastic control problems with measure-valued controls*, arXiv:2401.01198, 2024.

[5] Bekzhan Kerimkulov, James-Michael Leahy, David Šiška, Łukasz Szpruch, and Yufei Zhang, *A Fisher-Rao gradient flow for entropy-regularised Markov decision processes in Polish spaces*, Submitted, arXiv:2310.02951, 2023.

[6] Xin Guo and Yufei Zhang, *Towards an analytical framework for potential games*, Submitted, arXiv:2310.0225, 2023.

[7] Eyal Neuman, Wolfgang Stockinger, and Yufei Zhang, *An offline learning approach to propagator models*, Submitted, arXiv:2309.02994, 2023.

[8] Tanut Treetanthiploet, Yufei Zhang, Lukasz Szpruch, Isaac Bowers-Barnard, Henrietta Ridley, James Hickey, and Chris Pearce, *Insurance pricing on price comparison websites via reinforcement learning*, Submitted, arXiv:2308.06935, 2023.

[9] Eyal Neuman and Yufei Zhang, *Statistical learning with sublinear regret of propagator models*, Submitted, arXiv:2301.05157, 2023.

[10] Christoph Reisinger, Wolfgang Stockinger, and Yufei Zhang, *Path regularity of coupled McKean-Vlasov FBSDEs*, preprint, arXiv:2011.06664, 2020.

[11] Christoph Reisinger, Wolfgang Stockinger, and Yufei Zhang, *Optimal regularity of extended mean field controls and their piecewise constant approximation*, preprint, arXiv:2009.08175v2, 2020.

AWARDS

- The Mathematical Institute DPhil Thesis Prize 2021, *University of Oxford*.
- G-Research PhD Prize in Maths and Data Science, *G-Research*, 2020.
- Academic Support Grands, *The Queen's College, University of Oxford*, 2017.
- Departmental Studentship, *Mathematical Institute, University of Oxford*, 2017–2021.
- Postgraduate Studentship, *The Chinese University of Hong Kong*, 2015–2017.
- Honours at Entrance, *The Chinese University of Hong Kong*, 2008–2013.

GRANTS

[1] CNRS-Imperial "Abraham de Moivre" International Lab in Mathematics Short-Term Exchange Grant, £1,400, 2024.

[2] Co-Investigator, "Reinforcement Learning for Insurance Pricing" in partnership with The Alan Turing Institute, £39,000, November 1, 2022 to April 28, 2023.

INVITED TALKS

[1] *16th International Conference of the ERCIM WG on Computational and Methodological Statistics*, Berlin, Dec. 16-18, 2023.

[2] *7th London-Paris Bachelier Workshop on Mathematical Finance*, London, Sept. 18-19, 2023.

[3] *The Second HKSIAM Biennial Meeting*, Hong Kong, Aug. 28-Sept. 1, 2023.

[4] *Recent Advances on Quantitative Finance*, Hong Kong, Aug. 27-30, 2023

[5] *10th International Congress on Industrial and Applied Mathematics*, Tokyo, Aug. 20-25, 2023.

[6] *11th Advanced Mathematical Methods for Finance Conference*, Bielefeld, June 26-30, 2023.

[7] *Stochastic Analysis and Math Finance Seminar*, Berlin, June 22, 2023.

[8] *Berlin Probability colloquium*, Berlin, June 21, 2023.

[9] *North British Probability Seminar*, The University of Edinburgh, June 14, 2023.

[10] *Data Science Seminar*, The University of Essex, May 11, 2023.

[11] *2nd Workshop on Machine Learning for PDEs*, Imperial College London, Apr. 3-4, 2023.

[12] *Probability Seminar*, The University of Bath, Jan. 9, 2023.

[13] *World Online Seminars on Machine Learning in Finance*, Virtual, Nov. 22, 2022.

[14] *Machine Learning and Optimal Control*, Royal Statistical Society, Virtual, Oct. 19, 2022.

[15] *Finance and Stochastic Seminar*, The University of Sydney, Oct. 11, 2022.

[16] *London-Paris Bachelier Workshop on Mathematical Finance*, Paris, France, Sept. 15-16, 2022.

[17] *Machine learning for PDEs*, London, UK, Sept. 6-8, 2022.

[18] *The 9th International Colloquium on BSDEs and Mean Field Systems*, Annecy, France, June 26–July 1, 2022.

[19] *Machine Learning and Mean-Field Games Workshop*, The Institute for Mathematical and Statistical Innovation, Chicago, May 23–27, 2022.

[20] *Maxwell Institute Probability Seminar*, Heriot-Watt University and University of Edinburgh, Mar. 24, 2022.

[21] *Finance and Stochastic Seminar*, Imperial College London, Mar. 23, 2022.

[22] *Financial/Actuarial Mathematics Seminar*, University of Michigan, Virtual, Mar. 16, 2022.

[23] *SIAG/FME virtual seminar*, Virtual, Mar. 10, 2022.

[24] *15th German Probability and Statistics Days*, Virtual, Sept. 27-Oct. 1, 2021.

[25] *2nd Fudan-Warwick Workshop on Financial Mathematics and Stochastic Analysis*, University of Warwick, UK, July 30–31, 2019.

[26] *3rd International Conference on Computational Finance*, A Coruña, Spain, July 8–12, 2019.

[27] *International Workshop on PDE-Constrained Optimization, Optimal Controls and Applications*, Sanya, China, Dec. 10–14, 2018.

[28] *10th Oxford-Berlin Young Researchers Meeting on Applied Stochastic Analysis*, Oxford, United Kingdom, Nov. 29–Dec. 1, 2018.

[29] *14th Viennese Conference on Optimal Control and Dynamic Games*, Vienna, Austria, July 3–6, 2018.

OTHER TALKS

[1] *8th Workshop on High-Dimensional Approximation*, ETH Zurich, Switzerland, Sept. 9–13, 2019.

[2] *12th European Summer School in Financial Mathematics*, Padova, Italy, Sept. 2–6, 2019.

[3] *SIAM Financial Mathematics and Engineering (FM19)*, Toronto, Ontario, Canada, June 4–7, 2019.

[4] *Scientific Computation using Machine-Learning Algorithms*, Nottingham, United Kingdom, Apr. 25–26, 2019.

[5] *Oxford–ETH Workshop in Mathematical & Computational Finance*, Oxford, United Kingdom, Mar. 14–15, 2019.

[6] *Robust Techniques in Quantitative Finance*, Oxford, United Kingdom, Sept. 3–7, 2018.

[7] *11th European Summer School in Financial Mathematics*, Paris, France, Aug. 27–31, 2018.

[8] *The Fourth Young Researchers Meeting on BSDEs, Nonlinear Expectations and Mathematical Finance*, Shanghai, China, Apr. 23–27, 2018.

## Professional Service

**Referee Service**

- *Automatica*
- *Advances in Computational Mathematics*
- *Advances in Continuous and Discrete Models: Theory and Applications*
- *Applied Mathematical Finance*
- *Applied Mathematics and Optimization*
- *Discrete and Continuous Dynamical Systems Series B*
- *Finance and Stochastics*
- *Journal of Computational Finance*
- *Journal of Mathematical Analysis and Applications*
- *Journal of Machine Learning*
- *Journal of Optimization Theory and Applications*
- *Market Microstructure and Liquidity*
- *SIAM Journal on Control and Optimization*
- *SIAM Journal on Financial Mathematics*
- *SIAM Journal on Financial Mathematics*
- *Stochastic Processes and Their Applications*
- *Advances in Neural Information Processing Systems (NeurIPS 2021)*
- *Conference on Mathematical and Scientific Machine Learning (MSML 2020)*

**Committee Service**

- Treasurer, University of Oxford SIAM Student Chapter, 2018-20.
- Mathematrix, University of Oxford, 2020-21.

## Teaching Experience

**London School of Economics**, United Kingdom

- Lecturer
  - Stochastic Process — Fall 2021, 2022
  - Stochastic Simulation — Spring 2023
  - Computational Methods in Finance and Insurance — Spring 2022, 2023

**University of Oxford**, United Kingdom

- Tutor
  - Analysis II — Spring 2021
  - Fixed Income — Spring 2021
  - Financial Derivatives — Fall 2020
  - Introduction to Probability — Fall 2020
  - Advanced Numerical Methods — Spring 2020
  - Numerical Methods — Fall 2019
- Teaching Assistant
  - Analysis I — Fall 2020
  - Calibration — Spring 2019
  - Continuous Optimization — Spring 2019
  - Numerical Methods: Finite Differences — Fall 2018, Spring 2018, Spring 2019
  - Numerical Methods: Monte Carlo — Spring 2018

**The Chinese University of Hong Kong**, Hong Kong

- Teaching Assistant
  - Mathematical Analysis II — Spring 2016, Spring 2017
  - Numerical Methods for Differential Equations — Spring 2016
  - Mathematical Analysis I — Fall 2015, Fall 2016

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| PROFESSIONAL MEMBERSHIPS | • Institute of Mathematics and its Applications, Associate Member<br>• Society for Industrial and Applied Mathematics, Member |

*Last updated on May 31, 2024*