MORGAN JOHN REES

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PROFILE

PhD candidate in Mathematics with expertise in computational finance and high-performance C++ development, seeking a quantitative researcher/developer role. Proficient in building option pricing models (Black-Scholes, Heston) and LSTM neural networks for stock price prediction, optimised with OpenMP and SIMD. Published in *Phys. Rev. D* and developed Python/C++-based algorithmic trading and portfolio optimisation tools. I aim to design innovative financial models and low-latency trading systems for complex market challenges. Explore my projects at morganjrees.co.uk.

QUANTITATIVE FINANCE PROJECTS

LSTM Neural Network for Stock Price Prediction (C++, 2025)

- Developed a Long Short-Term Memory (LSTM) model to predict Amazon stock prices, achieving a 5% RMSE improvement over baseline models. Implemented in C++ using nlohmann/json for data parsing and Boost for statistical distributions. Visualisations available at morganjrees.co.uk/quant-finance. Code: github.com/rhesus1/Finance/LSTM.

Option Pricing Models: Black-Scholes and Heston (C++, 2025)

- Built and compared option pricing models (Black-Scholes: Analytical, Finite Difference, Monte Carlo; Heston: Fourier, Monte Carlo, Finite Difference) for Amazon call/put options. Optimised finite difference solvers with SIMD and OpenMP, reducing computation time by 30%. Visualisations at morganjrees.co.uk/quant-finance. Code: github.com/rhesus1/Finance/OptionPricing.

Portfolio Optimisation Tool (Python, 2025)

- Designed a mean-variance optimisation model for multi-asset portfolios using pandas and SciPy, achieving a 10% Sharpe ratio improvement in backtests. Code: github.com/rhesus1/Finance/Portfolio.

SKILLS

Programming

- C++ (Expert) **-** Developed high-performance option pricing and LSTM models, optimised with OpenMP and SIMD. Used Boost::math and nlohmann/json.
- Python (Advanced) - Built portfolio optimisation and algorithmic trading models with pandas, NumPy, and SciPy.
- MATLAB, R (Intermediate) - Applied to numerical analysis and statistical modelling.

Quantitative Finance

- Option Pricing (Black-Scholes, Heston: Analytical, Monte Carlo, Finite Difference, Fourier).
- Algorithmic Trading - Developed arbitrage strategies and LSTM-based prediction models.
- Portfolio Optimisation - Mean-variance and risk-parity models.

Tools & Methods

- Monte Carlo Methods, Finite Difference Methods, Numerical PDE Solvers.
- High-Performance Computing - OpenMP, SIMD.
- Software - Git, LaTeX, Excel, Tableau, curl for API data retrieval.

Communication

- Adept at presenting complex technical concepts to diverse audiences, as demonstrated in 10+ international conference presentations.

EDUCATION

UNIVERSITY OF KENT *September 2017 - March 2025*

Ph.D. in Mathematics (2021-2025, Viva Pending)

Thesis - *" The Solitonic Waltz: Abelian Higgs Vortex Dynamics"*

- Developed advanced computational models and applied sophisticated mathematical analysis to simulate vortex dynamics in the Abelian Higgs model, applying numerical methods and parallel computing (OpenMP).

MSc Mathematics and its Applications (2020-2021) - *First class Hons*

- Key Modules **-** Quantum Mechanics, Integrable Systems, Advanced Regression Modelling

BSc with Hons Mathematics (2017-2020) - *First class Hons*

- Key Modules - Mathematics in Finance, Linear Algebra, Probability, Statistics.

PUBLICATIONS

- Scattering of Vortices with Excited Normal Modes, *Phys. Rev. D, 110.056050 (2024)*
- Spectral Collisions of Excited Abelian Higgs Vortices, *Phys. Rev. D, 110.065004 (2024)*
- Dynamics of Excited BPS 3-Vortices, *Phys. Rev D, 111.105021 (2025)*
- Vortex Dynamics Away from Critical Coupling, *Work in Progress (2025)*

PROFESSIONAL DEVELOPMENT

Python for Finance: **Financial Investment and Data Analytics** *(Udemy, May 2025)*

- Built portfolio optimisation and time-series models using pandas and NumPy.

Quantitative Finance with Python (*Udemy, May 2025*)

- Built algorithmic trading models, option pricing tools, and arbitrage strategies using Python.

Financial Mathematics *(MIT OpenCourseWare, Starting June 2025)*

PROFESSIONAL EXPERIENCE

Travel Insurance Facilities PLC - *Statistical Underwriter* *2019 - 2020*

- Analysed data using Tableau and Excel to provide detailed amendments to insurance schemes.
- Completed high-level summaries for external clients outlining analysis and future projections.

Kumon Educational Japan Co. Ltd. - *Tutor* *2013 - 2018*

- Mentored 50+ students in advanced mathematics, fostering critical thinking skills.