Songlan (Nick) NIE

4100 Greenbriar Dr,
Apt 232,
Houston, TX, 77098

+1 (346) 308 4737
songlan.nie@hotmail.com
https://www.linkedin.com/in/songlan-nick-nie/

SUMMARY

I am a third-year PhD student in Computational Applied Mathematics at Rice University with experience developing numerical algorithms for PDEs and integral equations. My work spans spectral element, finite element, finite volume, discontinuous Galerkin, and Newton-type methods, with implementations in Julia, MATLAB, and Python. I enjoy turning mathematical algorithms into efficient, reliable software solutions for scientific and engineering applications.

EDUCATION

Rice University   **Aug. 2023-Present**
PhD in Computational Applied Mathematics and Operations Research (CMOR)   *GPA: 3.95/4.0*
TA: CMOR 304 Differential Equations in Sci & Engi. Grader: CMOR 524 Advanced Numerical Analysis, CMOR 500 Analysis
Courses taken: CMOR 524 Advanced Numerical Analysis, CMOR 527 Discontinuous Galerkin Method, CMOR 505 Partial Differential Equations, CMOR 501 Applied Functional Analysis, CMOR 520 Computational Science

University of Oxford, Hertford College   **Oct. 2019-Jun. 2023**
MMath in Mathematics and Statistics
Undergraduate Score: 72/100. Ranking: 9/47. GPA: 3.80/4.0. Master Score: 77/100. Ranking: 5/37. GPA: 3.89/4.0
Courses taken: C6.4 FEM for PDEs, C6.2 Continuous Optimization, SC4 Advanced Machine Learning, SC1 Stochastic Models in Genetics, B6.1 Numerical Solution of PDEs, B5.5 Further Math Biology, SB1 Applied & Comp Stats

INTERNSHIPS

TGS-NOPEC Geophysical Company: Geophysics Research Intern   **May 2025-Aug. 2025**
- Developed a robust workflow for simulating 3D viscoelastic wave propagation with irregular topography using spectral element methods (SEM)
- Implemented and customized the open-source package SPECFEM3D for advanced seismic modeling
- Validated modeling accuracy against finite difference simulations, dispersion curve inversion, and the SEG Foothills dataset
- Accelerated simulations by adapting the GPU version of SPECFEM3D on TGS systems, achieving ~50x speedup over CPU

MarQuest Energy Usage Data Processing Internship: Data Analyst   **Dec. 2019**
- Taught myself coding (collectd, regular expressions) and imported 3-month energy usage data of IT infrastructure to the Splunk system
- Created panels to show the trend of energy usage and resolve a high energy usage anomaly
- Suggested a server shutdown scheme to save energy and reduce pollution by up to 10%

PROJECTS

Newton's method for nonlinear elasticity   **Jun. 2023-Aug. 2023**
Advisor: Dr. Francis Aznaran (University of Notre Dame), Dr. Charles Parker (University of Oxford)
- Derived the Newton linearization of St Venant–Kirchhoff (SVK) hyperelasticity model
- Investigated different types of globalizations of Newton's method, such as backtracking line search and critical point line search
- Implemented a high order finite element method to discretize the linearized equations using Firedrake in Python, producing optimal rate of convergence

Analytical lower bound for union probability   **Nov. 2022-Apr. 2023**
Advisor: Dr Jun Yang (University of Copenhagen)
- Completed a literature review of the derivation of the lower bounds for the probability of at least m-out-of-n events using linear programming (LP)
- Derived a particular relaxation of LP used in the Yang-Alajaji-Takahara (YAT) bound and strengthened the bounds by applying the additional constraints on the joint probability of n events

- Derived a novel analytical lower bound for 3-out-of-n events with three constraints

Finite volume method for gradient flow problems   **Jun. 2022-Aug. 2022**

Advisor: Dr. Rafael Bailo (Eindhoven University of Technology)
- Simplified the CuO_2 crystal growth model to a one-dimensional PDE with an L^2 gradient flow structure
- Developed an implicit-explicit convex-splitting numerical scheme that exhibits the conservation of mass and the dissipation of free energy
- Simulated and visualized the numerical solutions of the PDE using Julia that correctly matches the coarsening behavior of crystal growth

Oxford Computational Mathematics Project   **Feb. 2020-Mar. 2020**
- Converted an image to matrices and performed singular value decomposition (SVD) using MATLAB
- Optimized the code that generated a sequence of low-rank approximations from the SVD to produce compressed images, reducing the runtime from one minute to five seconds

ACTIVITIES

Rice SIAM Chapter: Treasurer   **Aug. 2024-Aug. 2025**
- Advised and prepared budgets for activities, including annual BBQ events and departmental items, totaling $1500
- Maintained documentations on incomes and expenditures and applied for SIAM Chapter funding

Oxford University Chinese Society: Treasurer   **Mar. 2020-Mar. 2021**
- Advised and prepared budgets for new activities, including the Orientation Camp, with a total budget of £25,000
- Maintained accurate records of incomes and expenditures for over 100 transactions
- Assisted on-site with all activities organized such as the Singing Competition and drama performance

AWARDS

Hertford College Scholarships   **2021-2023**
- Awarded for 1st class performance in the 2nd-year final exam

Undergraduate Prize   **Oct. 2022**
- Awarded for 1st class performance in the undergraduate final exam

Hertford College Summer Research Studentships   **May 2022**
- Awarded to only six students out of the 419 undergraduate college students

CONFERENCES

Rice RTG Annual Workshop: Poster session   **Oct. 2025**
- Title: Integral equation methods for time-dependent problems

Rice RTG Ranch Retreat: Presenter   **Apr. 2024**
- Title: Newton's method in infinite dimensions and Galerkin approximations

SKILLS

IT Skills
- Programming: Julia, MATLAB, Python, R, SQL
- Scientific Libraries: Firedrake, SPECFEM3D, Inti.jl
- Developer Tools: Version Control (Git)
- Productivity Software: Microsoft Office Suite (Word, Excel, PowerPoint)

REFEREES

Dr. Thomas Anderson   *Department of Computational Applied Mathematics and Operations Research, Rice University,* *thomas.anderson@rice.edu*

Dr. Keegan Kirk   *Mathematical Sciences Department, George Mason University, kkirk6@gmu.edu*

Dr. Jun Yang   Department of Mathematical Sciences, University of Copenhagen, *jy@math.ku.dk*