ABHISHEK SINGH, PH.D.

Postdoctoral Researcher — Multi-objective Optimization, Vector Optimization & Numerical Algorithms

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Date of Birth: 20 July 1989 · Marital Status: Married · Nationality: Indian

RESEARCH PROFILE

I work on convergent numerical methods for multi-objective and vector optimization, extending quasi-Newton, trust-region, and conjugate gradient algorithms from the single-objective to the vector-valued setting. My doctoral research built inexact Newton and BFGS-type frameworks for generalized Nash equilibrium problems (GNEPs), proving global and superlinear convergence for nonsmooth reformulations of multi-player games — results that transfer directly to large-scale competitive and multi-agent systems. My current research extends this line of work to unconstrained and constrained multi-objective optimization, with an emphasis on methods that are both theoretically rigorous and scalable to the large, nonconvex problems arising in engineering design, resource allocation, and multi-agent decision-making.

RESEARCH INTERESTS

- Multi-objective and vector optimization (Pareto stationarity, scalarization, nondominated solutions)
- Numerical optimization algorithms (adaptive trust-region, nonmonotone line-search, quasi-Newton/BFGS, nonlinear conjugate gradient, inexact Newton methods)
- Generalized Nash equilibrium problems (GNEPs)
- Nonconvex and constrained optimization

ACADEMIC APPOINTMENTS

Postdoctoral Researcher *Oct 2024 – Oct 2026*

National Center for Applied Mathematics, Chongqing Normal University, China

- Design, analyze, and numerically validate nonmonotone adaptive trust-region and quasi-Newton methods for unconstrained multi-objective optimization, proving global convergence under standard smoothness assumptions.
- Derived nonmonotone trust-region and conjugate gradient theory to vector-valued objectives, submitted (under review) to Computational Optimization and Applications, Journal of Optimization Theory and Applications, and Journal of Global Optimization.
- Implement and benchmark all algorithms in MATLAB against state-of-the-art solvers on standard multi-objective test suites, providing the convergence-rate comparisons reported in the submitted manuscripts.

Visiting Research Intern *Jan – Mar 2023*

National Sun Yat-sen University, Kaohsiung, Taiwan

- Conducted collaborative research in vector optimization theory under Prof. Jen-Chih Yao during a three-month visiting fellowship, contributing analysis later formalized into a joint publication in Optimization (2025).

EDUCATION

Ph.D. in Mathematics (Optimization / Applied Mathematics) *2016 – 2023*

Indian Institute of Technology (BHU), Varanasi, India — Advisor: Dr. Debdas Ghosh

Thesis: "Optimization Methods to Solve Generalized Nash Equilibrium Problems." Developed and analyzed the global convergence of inexact Newton, BFGS, and trust-region methods for computing Nash equilibria in finite-player games with continuous cost functions.

M.Sc., Mathematical Sciences *2011 – 2013*

VBS Purvanchal University, Jaunpur, India

B.Sc., Mathematics & Physics *2008 – 2011*
VBS Purvanchal University, Jaunpur, India

PUBLICATIONS

Peer-Reviewed Journal Articles

1. Peng, J.W., Ren, J., **Singh, A.***, & Kobis, E. (2026). A trust-region algorithm with a T_k-based nonmonotone strategy for unconstrained multi-objective optimization. *Journal of Nonlinear and Variational Analysis*, (Accepted for publication, August 2026), [SCIE, Q2, IF 1.5, Chinese Academy of Sciences: T-1]
2. Kumar, K., **Singh, A.**, Upadhayay, A., & Ghosh, D.* (2026). Improved nonmonotone quasi-Newton method for multiobjective optimization problems. *Journal of Nonlinear and Convex Analysis*, 27(1), 119–142. [SCIE, Q2, IF 1.5]
3. Peng, J.W., Zhong, D.H., & **Singh, A.*** (2025). A novel modified Liu–Storey nonlinear conjugate gradient method for solving vector optimization problems. *Optimization*, 1–30. DOI: 10.1080/02331934.2025.2516452 [SCIE, Q1, IF 1.8]
4. **Singh, A.**, Ghosh, D.*, & Ansari, Q.H. (2024). Inexact Newton method for solving generalized Nash equilibrium problems. *Journal of Optimization Theory and Applications*, 201, 1333–1363. DOI: 10.1007/s10957-024-02411-8 [SCIE, Q1]
5. **Singh, A.**, Kumar, K., & Ghosh, D.* (2024). Improved nonmonotone adaptive trust-region method to solve generalized Nash equilibrium problems. *Journal of Nonlinear and Convex Analysis*, 25(1), 11–29. [SCIE, Q2, IF 1.5]
6. **Singh, A.**, & Ghosh, D.* (2024). A globally convergent improved BFGS method for generalized Nash equilibrium problems. *SeMA Journal*, 81, 235–261. DOI: 10.1007/s40324-023-00323-7 [ESCI, Q2]
7. Ghosh, D.*, **Singh, A.**, Shukla, K.K., & Manchanda, K. (2019). Extended Karush–Kuhn–Tucker condition for constrained interval optimization problems and its application in support vector machines. *Information Sciences*, 504, 276–292. DOI: 10.1016/j.ins.2019.07.017 [SCIE, Q1, IF 6.8, Chinese Academy of Sciences: T-2]

Manuscripts Under Review

1. Peng, J.W., **Singh, A.***, Ghosh, D., & Yao, J.C. Improved nonmonotone adaptive trust-region method for unconstrained multi-objective optimization problems. Submitted to *Journal of Global Optimization* (Springer), Oct 2025.
2. Peng, J.W., **Singh, A.***, Ghosh, D., & Kobis, E. Spectral-adaptive trust-region method for unconstrained multi-objective optimization problems. Submitted to *Optimization*, Feb 2026.
3. Peng, J.W., Liao, S., **Singh, A.***, & Yao, J.C. A modified hybrid conjugate gradient algorithm for vector optimization. Submitted to *Positivity* (Springer), Jul 2026.

**Corresponding author*

SCIE / SCI journal articles	6
ESCI / Scopus articles	**1**
Highest impact factor	**6.8**
Google Scholar citations	**99**
Manuscripts under review	4

AWARDS & HONORS

- CSIR-JRF (Junior Research Fellowship), Mathematical Sciences — All India Rank 22, 2016
- GATE (Graduate Aptitude Test in Engineering), Mathematical Sciences — All India Rank 624, 2015

ACADEMIC SERVICE

Managing Editor, Applicable Nonlinear Analysis 2024 – Present

Managing Editor, Optimization Eruditorum 2024 – Present

CONFERENCES & WORKSHOPS

Conference Presentations

- International Conference on Optimization and Variational Analysis (ICOVA-2025), Chongqing Normal University, China
- ICCOPT-2019, Weierstrass Institute for Applied Analysis and Stochastics (WIAS), Berlin, Germany
- ICMC-2018, Indian Institute of Technology, Varanasi, India

Workshops

- ICCOPT 2019 Summer School, WIAS, Berlin, Germany
- ICWAO-2017, Aligarh Muslim University, India

TEACHING EXPERIENCE

Teaching Assistant / Tutor (Ph.D.) *Indian Institute of Technology, Varanasi, India*
Engineering Mathematics-II · Operations Research · Numerical Analysis *2017 – 2020*

TECHNICAL SKILLS

- **Programming:** MATLAB (advanced, algorithm implementation and benchmarking), Python (NumPy, SciPy)
- **Scientific Writing:** LaTeX
- **Methods:** BFGS and quasi-Newton schemes, trust-region methods, nonlinear conjugate gradient methods, inexact Newton methods, nonmonotone line-search strategies

REFERENCES

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Professor, Center for General Education, China Medical University, Taiwan
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