# Shuvomoy Das Gupta

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| CITIZENSHIP | Canada |
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| RESEARCH INTERESTS | Optimization, Game Theory, Transportation |

**CURRENT POSITION**

**Rice University, Houston, TX, USA**                                               2025–Present
*Assistant Professor, Computational Applied Mathematics & Operations Research*

**ACADEMIC EXPERIENCE**

**Columbia University, New York, NY, USA**                                          2024–2025
*Postdoctoral Research Scientist, Department of Industrial Engineering and Operations Research*, HOSTS: Garud Iyengar & Christian Kroer
Worked on designing optimal algorithms for large-scale game solving.

**Massachusetts Institute of Technology, Cambridge, USA**                          2019 – 2024
*Graduate Research Assistant, MIT Operations Research Center*
Worked on computer-assisted algorithm design for large-scale optimization.

**INDUSTRY EXPERIENCE**

**Thales Canada Inc., Toronto, Canada**                                             2016–2018
*Researcher, Research & Technology Department*
Worked on real-time embedded optimization and sensor fusion algorithms in autonomous transportation systems.

**EDUCATION**

**Massachusetts Institute of Technology, Cambridge, USA**                          2019 – 2024
Ph.D. in Operations Research
THESIS: Advances in Computer-Assisted Design and Analysis of First-Order Optimization Methods and Related Problems
ADVISORS: Robert M. Freund & Bart P.G. Van Parys

**University of Toronto, Toronto, Canada**                                               2016
Master of Applied Science in Electrical and Computer Engineering
THESIS: Optimization Models for Energy-Efficient Railway Timetables
ADVISOR: Lacra Pavel

**GRANTS, AWARDS AND HONORS**

**AFOSR Grant: "Computer-Assisted Design of Provably Fastest Algorithms".
Co-PI. $600,000. (my share: $300,000)**                                          2025–2028

**Winner, INFORMS Computing Society Student Paper Award**                             2024

**Honorable Mention & Finalist, INFORMS George Nicholson Student Paper Competition**                                                                   2024

**Honorable Mention, MIT Operations Research Center Best Student Paper Award**                                                                        2024

**Computer-Assisted Design of Accelerated Composite Optimization Methods: OptISTA**
with Uijeong Jang and Ernest K. Ryu
Published in *Mathematical Programming, 2025*
PDF: https://arxiv.org/pdf/2305.15704.pdf

**Branch-and-Bound Performance Estimation Programming: A Unified Methodology for Constructing Optimal Optimization Methods**
with Bart P.G. Van Parys and Ernest K. Ryu
Published in *Mathematical Programming, 2024*
PDF: https://arxiv.org/pdf/2203.07305.pdf

**Nonlinear Conjugate Gradient Methods: Worst-Case Convergence Rates via Computer-Assisted Analyses**
with Robert M. Freund, Andy Sun, and Adrien Taylor
Published in in *Mathematical Programming, 2024*
PDF: https://arxiv.org/pdf/2301.01530.pdf

**Exterior-Point Optimization for Sparse and Low-Rank Optimization**
with Bartolomeo Stellato and Bart P.G. Van Parys
Published in *the Journal of Optimization Theory and Applications, 2024*
PDF: https://arxiv.org/pdf/2011.04552.pdf

**On Seeking Efficient Pareto Optimal Points in Multi-Player Minimum Cost Flow Problems with Application to Transportation Systems**
with Lacra Pavel
Published in *the Journal of Global Optimization, 2019*
PDF: https://arxiv.org/pdf/1805.11750.pdf

**A Two-Step Linear Programming Model for Energy-Efficient Timetables in Metro Railway Networks**
with Lacra Pavel and J. Kevin Tobin
Published in *Transportation Research Part B: Methodological, 2016*
PDF: https://arxiv.org/pdf/1506.08243.pdf

**An Optimization Model to Utilize Regenerative Braking Energy in a Railway Network**
with Lacra Pavel and J. Kevin Tobin
Published in *the Proceedings of American Control Conference, 2015*
PDF: https://tinyurl.com/ACCRegenOpt

**Spatial Branch-and-Bound for Computing Multiplayer Nash Equilibrium**
with Jakub Cerny and Christian Kroer
PDF: https://arxiv.org/pdf/2508.10204

**On the $O(1/T)$ Convergence of Alternating Gradient Descent–Ascent in Bilinear Games**
with Tianlong Nan, Garud Iyengar, and Christian Kroer
PDF: https://arxiv.org/pdf/2510.03855

**CMOR 467/567: Optimization for Energy Systems, Rice**          Fall 2025
*Instructor.* I have designed and launched this new course for advanced under-

graduate and graduate students.

**6.7220: Nonlinear Optimization, MIT**                              Spring 2023
*Teaching Assistant.* This is MIT's main doctoral course in optimization.
RATING: 6.9/7.0

**15.S60: Computing in Optimization and Statistics, MIT**    Winter 2022, 2023
*Instructor.* I taught the ORC's required three–hour module on advanced methods in computational optimization.
RATING: 6.9/7

**15.S08: Optimization of Energy Systems, MIT**                       Spring 2022
*Teaching Assistant.* This is a graduate course in power systems modeling and optimization.
RATING: 6.0/7.0

TALKS

*Computer-Assisted Design of Provably Fastest Algorithms*
Invited talk, New Jersey Institute of Technology, New York, NY         2025

*Nonlinear Conjugate Gradient Methods: Worst-case Convergence Rates via Computer-assisted Analyses*
ICCOPT, Los Angeles, CA                                                2025
INFORMS Annual Meeting, Seattle, WA                                    2024

*BnB-PEP: A Unified Methodology for Constructing Optimal Optimization Methods*
INFORMS Annual Meeting, Phoenix, AZ                                    2023
SIAM Conference on Optimization (OP23), Seattle, Washington            2023
UTORG Seminar, University of Toronto, Toronto, Canada                  2023
International Conference on Continuous Optimization, Bethlehem, PA     2022
MIT Data Science Lab Seminar                                          2022

*Design and Analysis of First-Order Methods via Nonconvex QCQP Frameworks*
One of just four invited "long talks" at the 1st Workshop on Performance Estimation, UCLouvain, Belgium                                          2023

*Energy-Optimal Timetable Design for Sustainable Metro Railway Networks*
INFORMS Annual Meeting, Phoenix, AZ                                    2023
33rd Annual POMS Conference, Orlando, FL                               2023
2023 MIT Energy Initiative Annual Research Conference                  2023

*Exterior-Point Optimization for Sparse and Low-Rank Optimization*
INFORMS Annual Meeting (virtual)                                       2020

*On Convergence of Heuristics Based on Douglas-Rachford Splitting and ADMM to Minimize Convex Functions over Nonconvex Sets*
56th Allerton Conference on Communication, Control, and Computing, Monticello, IL                                                            2018

*Multi-Player Minimum Cost Flow Problems with Nonconvex Costs and Integer Flows*
55th IEEE Conference on Decision and Control, Las Vegas, NV            2018

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| <span style="font-variant:small-caps">Service</span> | Reviewer for *Mathematical Programming, Transportation Research Part B: Methodological, IEEE Transactions on Control of Network Systems, American Control Conference, IEEE Transactions on Intelligent Transportation Systems, IEEE Transactions on Automatic Control* |

*Session Chair*, INFORMS Annual Meeting      2023

*Session Chair*, INFORMS Annual Meeting      2022

<span style="font-variant:small-caps">Software</span>

**[1] BnB-PEP**
Computes optimal first-order algorithms for different convex and nonconvex setups
LINK: `https://github.com/Shuvomoy/BnB-PEP-code`

**[2] NCG-PEP**
Computes worst-case convergence rates of nonlinear conjugate gradient methods
LINK: `https://github.com/Shuvomoy/NCG-PEP-code`

**[3] NExOS**
Implements the Nonconvex Exterior-point Optimization Solver (NExOS) algorithm for solving low-rank and sparse optimization problems
LINK: `https://github.com/Shuvomoy/NExOS.jl`

<span style="font-variant:small-caps">Languages</span>

**Fluent in**
English, Bengali, Hindi, Urdu
**Proficent in**
`Julia, C, C++, MATLAB, Mathematica`

<span style="font-variant:small-caps">Other</span>

I enjoy playing cricket, reading novels, cooking, and blogging at `https://shuvomoy.github.io/blogs/`.

<span style="font-variant:small-caps">Media Coverage</span>

**"Risky Giant Steps Can Solve Optimization Problems Faster"**    August, 2023
by Allison Parshall in *Quanta Magazine*
I was interviewed and quoted in the article along with my paper [1] being cited as the main inspiration for the discovery of long step gradient descent by Ben Grimmer. Also publicized in the *Nautilus Quarterly Magazine* and in the Chinese magazine *Heart of the Machine*.
URL: `https://www.quantamagazine.org/risky-giant-steps-can-solve-optimization-problems-faster-20230811/`