

# Shuvomoy Das Gupta

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CONTACT	 6100 Main St MS-134, Houston, TX 77005, USA  <a href="https://shuvomoy.github.io/">https://shuvomoy.github.io/</a>  sd158@rice.edu
CITIZENSHIP	Canada
RESEARCH INTERESTS	Optimization, Game Theory, Transportation
CURRENT POSITION	<b>Rice University, Houston, TX, USA</b> 2025–Present <i>Assistant Professor, Computational Applied Mathematics &amp; Operations Research</i>
ACADEMIC EXPERIENCE	<b>Columbia University, New York, NY, USA</b> 2024–2025 <i>Postdoctoral Research Scientist, Department of Industrial Engineering and Operations Research, HOSTS: Garud Iyengar &amp; Christian Kroer</i> Worked on designing optimal algorithms for large-scale game solving.  <b>Massachusetts Institute of Technology, Cambridge, USA</b> 2019 – 2024 <i>Graduate Research Assistant, MIT Operations Research Center</i> Worked on computer-assisted algorithm design for large-scale optimization.
INDUSTRY EXPERIENCE	<b>Thales Canada Inc., Toronto, Canada</b> 2016–2018 <i>Researcher, Research &amp; Technology Department</i> Worked on real-time embedded optimization and sensor fusion algorithms in autonomous transportation systems.
EDUCATION	<b>Massachusetts Institute of Technology, Cambridge, USA</b> 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  <b>University of Toronto, Toronto, Canada</b> 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	<b>AFOSR Grant: “Computer-Assisted Design of Provably Fastest Algorithms”.</b> Co-PI. \$600,000. (my share: \$300,000) 2025–2028  <b>Winner, INFORMS Computing Society Student Paper Award</b> 2024  <b>Honorable Mention &amp; Finalist, INFORMS George Nicholson Student Paper Competition</b> 2024  <b>Honorable Mention, MIT Operations Research Center Best Student Paper Award</b> 2024

SELECTED  
PUBLISHED  
PAPERS

**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 *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>

PAPERS  
UNDER  
REVIEW

**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 Bilin-  
ear Games**

with Tianlong Nan, Garud Iyengar, and Christian Kroer

PDF: <https://arxiv.org/pdf/2510.03855>

TEACHING

**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

*On the  $O(1/T)$  Convergence of Alternating Gradient Descent-Ascent in Bilinear Games*  
INFORMS Annual Meeting, Atlanta, GA 2025

*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 1<sup>st</sup> 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

SERVICE	<p>Reviewer for <i>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</i></p> <p>Session Chair, INFORMS Annual Meeting 2022, 2023, 2024</p>
SOFTWARE	<p>[1] <b>BnB-PEP</b> Computes optimal first-order algorithms for different convex and nonconvex setups LINK: <a href="https://github.com/Shuvomoy/BnB-PEP-code">https://github.com/Shuvomoy/BnB-PEP-code</a></p> <p>[2] <b>NCG-PEP</b> Computes worst-case convergence rates of nonlinear conjugate gradient methods LINK: <a href="https://github.com/Shuvomoy/NCG-PEP-code">https://github.com/Shuvomoy/NCG-PEP-code</a></p> <p>[3] <b>NExOS</b> Implements the Nonconvex Exterior-point Optimization Solver (NExOS) algorithm for solving low-rank and sparse optimization problems LINK: <a href="https://github.com/Shuvomoy/NExOS.jl">https://github.com/Shuvomoy/NExOS.jl</a></p>
LANGUAGES	<p><b>Fluent in</b> English, Bengali, Hindi, Urdu</p> <p><b>Proficient in</b> Julia, C, C++, MATLAB, Mathematica</p>
OTHER	<p>I enjoy playing cricket, reading novels, cooking, and blogging at <a href="https://shuvomoy.github.io/blogs/">https://shuvomoy.github.io/blogs/</a>.</p>
MEDIA COVERAGE	<p><b>“Risky Giant Steps Can Solve Optimization Problems Faster”</b> August, 2023 by Allison Parshall in <i>Quanta Magazine</i> 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 <i>Nautilus Quarterly Magazine</i> and in the Chinese magazine <i>Heart of the Machine</i>. URL: <a href="https://www.quantamagazine.org/risky-giant-steps-can-solve-optimization-problems-faster-20230811/">https://www.quantamagazine.org/risky-giant-steps-can-solve-optimization-problems-faster-20230811/</a></p>