SURESH BOLUSANI

https://sbolusani.github.io suresh.bolusani@gmail.com

PROFESSIONAL SUMMARY

Researcher and solver developer specializing in mixed-integer linear optimization (MILP), including multilevel and multistage settings, with a focus on translating optimization theory into algorithms implemented in open-source solvers such as SCIP, SYMPHONY, MibS, and MINOTAUR. My work emphasizes cold-starting vs warm-starting of optimization problems, decomposition methods, and computational benchmarking.

PROFESSIONAL EXPERIENCE

Researcher at Zuse Institute Berlin, Germany *2021 - 2025*
Mathematical Optimization Methods Group, AIS2T Department

System Administrator at Lehigh University, U.S.A. *2015 - 2021*
COR@L Lab, Department of Industrial and Systems Engineering

Web Administrator at IIT Bombay, India *2013 - 2014*
Department of Industrial and Systems Engineering

Assistant Manager at NMDC Ltd., India *2009 - 2012*
Department of Industrial Engineering

RESEARCH EXPERIENCE

Mixed-Integer Linear Optimization: Theory and Software Development *2021 - 2025*
Researcher, Zuse Institute Berlin

- Research on solving MILPs from scratch and via warm starting (reoptimization).
- Implemented cutting planes and primal heuristics within the branch-and-cut framework of SCIP - an open-source optimization solver for MILPs and mixed-integer nonlinear optimization problems (MINLPs).
- Developed a benchmarking library for warm starting of MILPs.

Parametric Valid Inequalities in Discrete Optimization *2014 - Present*
Ph.D. Research, Lehigh University, Advisor: Dr. Ted Ralphs

- Research on parametric valid inequalities (PVIs) based on duality and the value functions of multilevel/multistage mixed-integer linear optimization problems (MMILPs).
- Designed an abstract framework for generalizing Benders' technique for reformulation that encompasses MMILPs.
- Developed a generalized Benders' decomposition algorithm employing PVIs for mixed-integer bilevel linear optimization problems (MIBLPs).
- Developed a new open-source solver in C++ for the above algorithm and problem classes.
- Implemented new warm-starting techniques utilizing PVIs for MILPs in SYMPHONY - an open-source MILP solver.

Warm Starting Deterministic Security Constrained Unit Commitment *2016 - 2017*
Internship Project, Argonne National Laboratory, Supervisor: Dr. Feng Qiu

- Unified major MILP formulations for unit commitment problems, added security constraints, and evaluated their performance on MATPOWER and RTS bus systems using AMPL and CPLEX.
- Improved warm-starting techniques in SYMPHONY using MILP duality theory to expedite the security-constrained unit commitment problem solving.

Practical Branching Techniques for Convex Mixed-Integer Nonlinear Optimization *2013 - 2014*
Master Thesis, IIT Bombay, Advisor: Dr. Ashutosh Mahajan

- Developed four new branching techniques for the branch-and-bound algorithm for solving convex MINLPs, implemented and evaluated these techniques in MINOTAUR (an open-source MINLP solver.)

Automated Timetabling System at IIT Bombay *2012 - 2013*
Consulting Project, IIT Bombay, Coordinator: Dr. Jayendran Venkateswaran

- Designed and implemented an automated timetabling system to generate a centralized timetable of all courses at IIT Bombay (around 700 courses per semester), as per the institute time slot pattern, in classrooms across the campus.
- Used AMPL for modeling, CPLEX and Gurobi solvers for solving the integer optimization formulation, and Python programming for managing input data and results.

Computer Aided Process Planning of Sheet Metal Parts *2008 - 2009*
Bachelor Thesis, IIT Roorkee, Advisor: Dr. N. K. Mehta

- Developed a heuristic for stock layout planning & an algorithm for operation sequencing of rectangular sheet metal parts.
- Achieved more than 90% utilization of sheet metal via the developed heuristic for sheet metal parts, which is an improvement of 3-7% over the then best heuristics.
- Used C++ for coding and OpenGL for visualizing the results.

SKILL SET

Programming Languages	C, C++, Python, Bash scripting, MATLAB
Optimization Solvers	SCIP, SYMPHONY, MibS, MINOTAUR, CHiPPS Framework, CPLEX, Gurobi
Modeling and Analytical Tools	AMPL, Apache Spark, R, Spreadsheet
Computational/ Utility Tools	Scilab, Mathematica, LaTeX, AnyLogic

EDUCATION

Ph.D., Industrial and Systems Engineering, Lehigh University, USA *Ongoing*
Master of Technology, Industrial Engineering and Operations Research, IIT Bombay, India *2014*
Bachelor of Technology, Production and Industrial Engineering, IIT Roorkee, India *2009*

PUBLICATIONS

S. Bolusani, G. Mexi, M. Besançon, and M. Turner. A Multi-Reference Relaxation Enforced Neighborhood Search Heuristic in SCIP. In L. Glomb, editor, *Operations Research Proceedings 2024*, pages 421–427, Cham, 2025. Springer Nature Switzerland. ISBN 978-3-031-92575-7. doi: 10.1007/978-3-031-92575-7_60.

G. Mexi, M. Besançon, S. Bolusani, A. Chmiela, A. Hoen, and A. Gleixner. Scylla: A Matrix-Free Fix-Propagate-and-Project Heuristic for Mixed-Integer Optimization. In G. Voigt, M. Fliedner, K. Haase, W. Brüggemann, K. Hoberg, and J. Meissner, editors, *Operations Research Proceedings 2023*, pages 65–72, Cham, 2025. Springer Nature Switzerland. ISBN 978-3-031-58405-3. doi: 10.1007/978-3-031-58405-3_9.

S. Bolusani, M. Besançon, A. Gleixner, T. Berthold, C. D'Ambrosio, G. Muñoz, J. Paat, and D. Thomopulos. The MIP Workshop 2023 Computational Competition on Reoptimization. *Mathematical Programming Computation*, 16(2): 255–266, 2024a. doi: 10.1007/s12532-024-00256-w.

S. Bolusani, M. Besançon, K. Bestuzheva, A. Chmiela, J. Dionísio, T. Donkiewicz, J. van Doornmalen, L. Eifler, M. Ghannam, A. Gleixner, C. Graczyk, K. Halbig, I. Hedtke, A. Hoen, C. Hojny, R. van der Hulst, D. Kamp, T. Koch, K. Kofler, J. Lentz, J. Manns, G. Mexi, E. Mühmer, M. E. Pfetsch, F. Schlösser, F. Serrano, Y. Shinano, M. Turner, S. Vigerske, D. Weninger, and L. Xu. The SCIP Optimization Suite 9.0. ZIB Report 24-02-29, Zuse Institute Berlin, February 2024b.

S. Bolusani and T. K. Ralphs. A Framework for Generalized Benders' Decomposition and Its Application to Multilevel Optimization. *Mathematical Programming*, 196(1):389–426, 2022. doi: 10.1007/s10107-021-01763-7.

S. Bolusani, S. Coniglio, T. K. Ralphs, and S. Tahernejad. A Unified Framework for Multistage Mixed Integer Linear Optimization. In S. Dempe and A. Zemkoho, editors, *Bilevel Optimization: Advances and Next Challenges*, chapter 18, pages 513–560. Springer International Publishing, Cham, 2020. ISBN 978-3-030-52119-6. doi: 10.1007/978-3-030-52119-6_18.

CONFERENCE AND WORKSHOP PRESENTATIONS

S. Bolusani, G. Mexi, M. Besançon, M. Turner *OR Conference, 2024*
The Relax-and-Cut Framework in the SCIP Optimization Solver

S. Bolusani *EURO Conference, 2024*
Recent Advances in the SCIP Optimization Solver

S. Bolusani, M. Besançon, M. Turner *INFORMS Optimization Society Conference, 2024*
Efficient Relax-and-Cut Separation in a Branch-and-Cut Solver

G. Mexi, M. Besançon, S. Bolusani, A. Chmiela, A. Hoen, A. Gleixner *OR Conference, 2023*
Scylla: A Matrix-free Fix-Propagate-and-Project Heuristic for Mixed-Integer Optimization

S. Bolusani *SIAM Conference on Optimization, 2023*
Recent Developments in SCIP

S. Bolusani *MIP Workshop, 2023*
MIPcc23: The MIP Workshop 2023 Computational Competition

T. Ralphs, S. Bolusani *INFORMS Annual Meeting, 2020*
A Framework for Generalized Benders' Decomposition and Its Application to Multilevel Optimization

S. Bolusani, T. Ralphs *MIP Workshop, 2020*
Generalized Benders' Decomposition for Multilevel/Multistage Optimization

T. Ralphs, S. Bolusani *INFORMS Annual Meeting, 2019*
Parametric Valid Inequalities and the Solution of Multistage Optimization Problems

T. Ralphs, S. Bolusani, S. Tahernejad *International Conference on Stochastic Programming, 2019*
Multistage/Multilevel Discrete Optimization

S. Bolusani, F. Qiu, T. Ralphs, A. Botterud, K. Kim *INFORMS Annual Meeting, 2018*
Warm Starting For Security Constrained Deterministic Unit Commitment

S. Bolusani, T. Ralphs *MOPTA, 2018; IWOBIP, 2018; INFORMS Annual Meeting, 2017*
Generalized Benders' Algorithm for Mixed-Integer Bilevel Linear Optimization

S. Bolusani, T. Ralphs *NemFest17 Workshop, 2017*
Dual Functions and Warm Starting of Mixed-Integer Linear Optimization Problems

S. Bolusani, T. Ralphs, A. Mahajan, M. Güzelsoy *INFORMS Optimization Society Conference, 2016*
Bilevel Optimization and the SYMPHONY MILP Solver (Tutorial, Part II)

S. Bolusani, T. Ralphs *INFORMS Annual Meeting, 2015*
Solving Bilevel Linear Optimization Problems in Parallel

TEACHING AND MENTORING EXPERIENCE

AIS2T Department, Zuse Institute Berlin

Master's Internship Supervisor
- Performance testing of pricers through hot starting with objective perturbations in the SoPlex solver *2023*

ISE Department, Lehigh University

Adjunct Lecturer
- ISE 426 - Optimization Models and Applications *Summer 2020*

Teaching Assistant
- ISE 467/367 - Mining of Massive Datasets *Fall 2020, 2019, 2018*
- ISE 172 - Algorithms in Systems Engineering *Spring 2020, 2019*
- ISE 406 - Introduction to Mathematical Optimization *Fall 2015*
- ISE 324 - Industrial Automation and Robotics *Spring 2015*
- ISE 372 - Systems Engineering Design *Fall 2014*
- ISE 224 - Information Systems Analysis and Design *Fall 2014*

IEOR Department, IIT Bombay

Teaching Assistant
- ISE 507 - Modeling and Computation Lab *Autumn 2013*

HONORS AND AWARDS

- Gottshall Fellowship, Rossin Doctoral Fellowship, Dean's Doctoral Assistantship, Lehigh University
- Mentorship Appreciation Award, Lehigh University *2020*
- Van Hoesen Family Best Publication Award, ISE Department, Lehigh University *2020*
- Ph.D. Student of the Year, ISE Department, Lehigh University *2015 - 2016*

EXTRACURRICULAR ACTIVITIES

Leadership Positions
- President of Lehigh INFORMS Student Chapter, Lehigh University *2016 - 2017*
- Vice-President of Lehigh INFORMS Student Chapter, Lehigh University *2015 - 2016*
- Joint Secretary (Library & Publications) at IEOR, IIT Bombay *2013 - 2014*

Trainings Recieved

- Research Leadership, Program Development, and Proposal Preparation, Lehigh University *2018*
- Teacher Development Program, Levels 1 and 2 Certifications, Lehigh University *2017*
- Symposium on Teaching and Learning, Lehigh University *2016*

Volunteering Activities

- MIP Computational Competition Organizing Committee, MIP Workshop *2023, 2024*
- OutreachISE Program, ISE Department, Lehigh University *Spring 2021*
- ISE Student Council, ISE Department, Lehigh University *2017 - 2018*
- Annual STEM-CON, Glen Ellyn, Illinois *2017*
- Family Codefest, Da Vinci Science Center, Allentown, Pennsylvania *2016*
- Workshop on C++, OpenMP & MPI, ISE Department, Lehigh University *2016*

LANGUAGES

- English: Fluent
- Telugu: Mothertongue
- Hindi: Fluent