Federico Battista

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Contact Information

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Research Interests

Discrete optimization with contributions spanning theory, methodology, and computation toward more effective solution approaches for complex mixed-integer linear problems and the development of open-source tools for the community.

Combinatorial optimization, particularly the design of strong relaxations for graph problems, such as, the maximum clique/independent set and graph coloring.

Academic Experience

Lehigh University, Dept. of Industrial and Systems Engineering, Bethlehem, PA, USA

Postdoctoral Researcher under Ted Ralphs — *February 2023 – Present*

Education

Università di Roma Sapienza Dept. of Computer, Control, and Management Engineering, Rome, Italy

Ph.D in Operations Research — *November 2019 – January 2023*
Thesis: On Semidefinite Lift-and-Project of Combinatorial Optimization Problems
Advisors: Marianna De Santis, Fabrizio Rossi, Stefano Smriglio

Alpen-Adria-Universität Institut für Mathematik, Klagenfurt, Austria

Visiting Ph.D student under Angelika Wiegele — *February 2022 – July 2022*

Università degli Studi dell'Aquila Dept. of Inf. Eng., Computer Science and Mathematics, L'Aquila, Italy

Master's degree in Computer Science, *Magna Cum Laude* — *July 2019*
Bachelor's degree in Computer Science, *Magna Cum Laude* — *October 2017*

Refereed Publications

[1] F. **Battista** and M. De Santis. *Dealing with Inequality Constraints in Large-Scale Semidefinite Relaxations for Graph Coloring and Maximum Clique Problems*. In: *4OR. A Quarterly Journal of Operations Research* (2024), pp. 1–31. DOI: 10.1007/s10288-024-00569-5.

[2] F. **Battista**. *On Semidefinite Lift-and-Project of Combinatorial Optimization Problems*. PhD thesis. Università di Roma Sapienza, 2023. HDL: 11573/1668673. URL: https://hdl.handle.net/11573/1668673.

Working Papers

[3] F. **Battista** and T. K. Ralphs. *Improving Directions in Mixed Integer Bilevel Linear Optimization*. arXiv preprint. COR@L Laboratory, Lehigh University, 2025. URL: https://doi.org/10.48550/arXiv.2511.03566.

[4] F. **Battista**, F. Rossi, and S. Smriglio. *Application of the Lovász-Schrijver Operator to Compact Stable Set Integer Programs*. arXiv preprint. Università di Roma Sapienza, 2025. URL: https://doi.org/10.48550/arXiv.2407.19290. *Accepted to Mathematical Programming Computation (2025+)*.

[5] S. Fallah, F. **Battista**, and T. K. Ralphs. *A Branch-and-Bound Algorithm for Multiobjective Mixed Integer Linear Optimization*. Working paper. COR@L Laboratory, Lehigh University, 2025. *Submitted*.

Software

[6] F. **Battista**, F. Rossi, and S. Smriglio. *SDP_lift_and_project* (2025). URL: `https://github.com/febattista/SDP_lift_and_project`. *Maintainer*.

[7] F. **Battista** and M. De Santis. *ADAL-ineq* (2024). URL: `https://github.com/febattista/ADAL-ineq`. *Maintainer*.

[8] S. DeNegre, T. Ralphs, and S. Tahernejad. *MibS Version 1.2* (2024). URL: `https://github.com/coin-or/MibS`. *Contributor*.

[9] T. Ralphs, M. Güzelsoy, and A. Mahajan. *SYMPHONY Version 5.7* (2023). URL: `https://github.com/coin-or/SYMPHONY/`. *Contributor*.

Students

Doctoral Students Mentorship

- Shannon Kelley, Lehigh University, ISE, Advisor: Ted Ralphs — *2023 – Present*
- Samira Fallah, Lehigh University, ISE, Advisor: Ted Ralphs — *2023 – Present*
- Hesam Shaelaie, Lehigh University, ISE, Advisor: Ted Ralphs — *2023 – Present*
- Suresh Bolusani, Lehigh University, ISE, Advisor: Ted Ralphs — *2023 – Present*

Teaching Experience

Teaching Assistant

- ISE 418 Integer Programming, Ph.D. course, Lehigh University — *2024*
- Operations Research Laboratory, B.Sc. course, Università Roma Sapienza — *2020*
- Advanced Calculus, B.Sc. course, Università Roma Sapienza — *2020*

Talks

[1] F. **Battista**, T. K. Ralphs, and S. Fallah. *The Restricted Value Function of MILPs and Its Construction with SYMPHONY*. In: *18th INFORMS Computing Society (ICS) Conference* (2025).

[2] F. **Battista** and T. K. Ralphs. *A Branch-and-Cut Algorithm for Mixed-Integer Bilevel Linear Optimization Based on Improving Directions*. In: *International Symposium on Mathematical Programming* (2024).

[3] F. **Battista** and T. K. Ralphs. *Exploiting Dual Functions in Mixed Integer Bilevel Linear Programs*. In: *INFORMS Annual Meeting* (2023).

[4] F. **Battista**, F. Rossi, and S. Smriglio. *Application of the Lovász-Schrijver Operator to Representative Formilation for Graph Coloring Problem*. In: *International Symposium on Combinatorial Optimization* (2022).

[5] F. **Battista** et al. *On Semidefinite Lift-and-Project Relaxations for Combinatorial Optimization Problems*. In: *University of Pavia* (2022).

[6] F. **Battista** and M. De Santis. *Dealing with Inequalities in Large Scale Semidefinite Programs*. In: *International Conference on Optimization and Decision Science* (2021).

Service

Editorial Board (Associate Editor)

- Operations Research (Area: Data, Software, and Computation) — *2025 – Present*