

Matthew V. Galati

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Research Interests

Large-scale discrete-optimization; mathematical programming and polyhedral theory; decomposition methods for integer programming; optimization software development. Application areas include logistics, inventory management and financial portfolio optimization.

Education

Lehigh University – Bethlehem, PA

Ph.D. Candidate in Industrial and Systems Engineering (ISE).

- **Area of Research:** Operations Research and Applied Statistics
- **Expected Completion:** May 2005, **GPA:** 3.78/4.00
- **Thesis:** “Decomposition and Dynamic Cut Generation in Integer Programming”
- **Advisor:** Professor Ted Ralphs

Development of a theoretical and computational framework (DECOMP) for incorporating dynamic cut generation into traditional decomposition methods (Dantzig-Wolfe, Lagrangian Relaxation) for integer programming. Presentation of a new paradigm for separation called *Decompose and Cut*, which takes advantage of the fact that separation of a solution to a combinatorial relaxation is often much easier than separation of an arbitrary real vector. DECOMP provides a generic framework for doing separation using these ideas.

Masters of Science in Industrial and Systems Engineering. January 2000

- **Area of Research:** Operations Research and Applied Statistics
- **Thesis:** “Parallel Replacement Analysis and Utilization Scheduling Via Geometric Programming”
- **Advisor:** Professor Joseph Hartman

Modeled the decisions associated with scheduling the replacement and asset utilization of capital equipment. Previous work considers replacement decisions given a fixed utilization schedule. This work considers variable utilization simultaneously and provides a computational study using a geometric programming model.

Stetson University – Deland, FL

Bachelor of Science in Mathematics. Cum Laude. May 1998

- **Minors:** Computer Science, Business Administration
- **Overall GPA:** 3.68/4.00 **Major GPA:** 3.74/4.00
- **Senior Thesis:** “Surfing The Ring – An Exploration Into Ring Theory Using Mathematica”

Development of a computer package in Mathematica for teaching several topics in abstract algebra including ring theory, equivalence classes, binary operations and algebraic structures.

Research and Professional Experience

SAS Institute, Analytical Solutions – Cary, NC

Optimization Developer – Operations Research and Development (April 2004 – Present)

- Member of research and development team responsible for SAS/OR core optimization tools and business intelligence solutions. Current responsibilities include the development of a linear mixed integer programming solver.

IBM Corporation, Service Parts Solutions – Mechanicsburg, PA

Operations Research Analyst / Developer - Neighborhood Project (May 1999 – April 2004)

- Managed a research group on the modeling and implementation of *Neighborhood*, an inventory management tool for optimizing IBM’s parts’ supply chain. Collaborative research effort between IBM

Service Parts Solutions, IBM TJ Watson Research Lab and Lehigh University.

- Early design phase tasks completed:
 - development of a prototype geometric programming model using Matlab,
 - design of a linear mixed-integer programming (MIP) model using AMPL.
- Specific software development tasks completed:
 - production-level code (C++) for data transfer and model construction for large-scale MIP to interface to optimization libraries in OSL using PVM on a multi-processor RISC running AIX,
 - various shell scripts for validation and statistical analysis using: bash, Perl, Awk and Python.

Lehigh University, Industrial and Systems Engineering – Bethlehem, PA

Research Assistant (May 1998 – April 2004)

- Modeling and development of a decision support system for dynamic routing at Transcontinental Refrigerated Lines, Inc. Software development tasks completed (1999):
 - front-end GUI for dispatchers including mapping utilities (Visual Basic),
 - heuristic dynamic assignment algorithm for system optimization (C++).
- Development of an online teaching aid for undergraduate engineering students *The Business Game*. Software development tasks completed: game simulation (C++), client/server interface (HTML, PHP, JavaScript) and maintenance of web server (Apache). Current courses using the game: Production and Inventory Control and Integrated Business Engineering Honors Program Lab (1999 – Present).
- Creation of computational laboratory exercises for a new course: Algorithms in Systems Engineering. Additional duties included weekly lab administration, grading and student advising (2002).
- Teaching assistant and grader for graduate-level course: Advanced Mathematical Programming (2003).
- Established a new university-wide seminar series focused on various topics in optimization. Organized weekly sessions with speakers from several local universities and research labs (2002 – 2004).
- Organized and taught a series of labs on using the suite of optimization software tools from COIN-OR (Computational Infrastructure for Operations Research). Created and maintained a tutorial website based on the lab exercises (2002 – 2003).
- Member: Search Committee for the Dean of Engineering (2000), Thompson International Investment Portfolio (2001) and Manufacturing Logistics Institute (1998 - 2004).

École Polytechnique Fédéral de Lausanne, Mathématiques – Switzerland

Research Assistant – Galenica Pharmaceutical (January 2002 – June 2002)

- Modeled the logistics network at Galenica as a time and capacity constrained routing problem using a linear integer programming formulation. Implementation of a parallel branch cut and price algorithm (C++) using the suite of open-source optimization software tools from COIN-OR (Computational Interface for Operations Research).

Technical Skills

- In-depth knowledge of computing environments Win (98, 00, NT, XP), Unix (Linux, IRIX, AIX).
- Extensive software development in C and C++. Programming experience with Awk, Perl, Java, Visual Basic, Pascal, Fortran and Python. Web server administration (Apache/Linux); client/server design using HTML, PHP and JavaScript.
- Proficient with a wide range of commercial and public domain software for mathematical modeling (AMPL), numerical analysis (Mathematica, Maple, Matlab), optimization (CPLEX, OSL, COIN-OR, SAS/OR), version control systems (CVS, Microsoft SourceSafe), parallel computing (PVM, MPI), grid computing (Condor) and discrete event simulation (Arena).

Honors and Awards

- Lehigh Engineering Ingenuity Award for Graduate Research and Scholarship (2004)
- Industrial and Systems Engineering Department Award Graduate Student of the Year (2003)
- Integrated Graduate Education and Research Training Fellowship (IGERT). NSF doctoral fellowship in Global Manufacturing Logistics between Lehigh University and The Wharton School at the University of Pennsylvania (2000 – 2003)
- PC Rossin Engineering Fellowship (2000 – 2003)
- Lehigh University Research Assistantship (1998 – 2000, 2003)
- National Team COMAP/INFORMS Math Modeling Contest – 1998 Outstanding Meritorious
- Stetson University Academic Merit Scholarship (1994 – 1998)
- Mathematics Department Award Outstanding Achievement in Mathematics 1995, 1996, 1997, 1998
- Emmet S. Ashcraft Award Outstanding Math/Computer Science Major 1997
- Trans American Athletic Conference All-Academic Team 1996
- National Honors Societies: Phi Eta Sigma, Omicron Delta Kappa, Mortar Board (1994 – 1998)

Coursework

Graduate

- **Operations Research:** Advanced Operations Research, Mathematical Modeling in Manufacturing Logistics, Data Dependent Systems, Discrete Event Simulation, Replacement Analysis, Advanced Mathematical Programming, Applied Stochastic Processes, Production Engineering, Integer Programming, Nonlinear Programming, Networks and Graphs, Computation in Operations Research, Quantitative Models in Supply Chain Management, Readings in Mathematical Programming, Readings in Discrete Optimization, Stochastic Programming, Queuing Systems.
- **Finance:** Derivative Securities Markets, International Financial Markets and Investments
- **Computer Science:** Design and Analysis of Algorithms
- **Economics:** Game Theory

Related Undergraduate

- **Mathematics:** Calculus II-III, Linear Algebra I-II, Multivariate Calculus, Logic and Proof, Abstract Algebra I-II, Mathematical Modeling and Computer Simulation, Real Analysis I-II, Numerical Analysis, Probability, Differential Equations, Statistics, Topology, Operations Research, Physics, Chemistry
- **Computer Science:** Computer Science I-II, Discrete Structures, Data Structures, Computer Organization
- **Business/Finance:** Investments, Business Finance, Business Statistics, Financial Accounting, Managerial Accounting, Management, Marketing, Microeconomics, Macroeconomics

Refereed Publications

- T. Ralphs, M. Galati “Decomposition in Integer Programming” (book chapter in review).
- T. Ralphs, M. Galati, “Decomposition and Dynamic Cut Generation in Integer Programming” (journal article in review).
- J. Hartman, M. Galati, “A Revised Business Game for Use in Teaching Engineering Economy or Operations Management,” *American Society of Engineering Education (ASEE) Conference Proceedings*, Session 1339, 2000.
- A. Richardson, M. Galati, J. Fay, “Grade Inflation - A Systematic Approach to Fair Achievement,” *Journal of Undergraduate Mathematics and Its Applications*, V19, 315-322, 1998.

Other Publications

- J. Linderoth, M. Galati, “Knapsack Constrained Circuit Problem,” *Lehigh University – Technical Report* - in preparation.
- T. Ralphs, M. Galati, “Decomposition in Integer Programming,” *Lehigh University - Technical Report 04T-010*, October 2004.
- M. Galati “AAP_BP: A COIN/BCP Branch and Price Example” *Lehigh University - Technical Report*, November 2003.
- T. Ralphs, M. Galati, “Decomposition and Dynamic Cut Generation in Integer Programming,” *Lehigh University - Technical Report 03T-005*, July 2003.
- M. Galati, “Galexis Distribution Problem,” *École Polytechnique Fédérale de Lausanne - Technical Report RO2002.0508*, May 2002.
- G. Wilson, Y. Erke, C. Ma, M. Booth, E. Kelton, E. Kutanoglu, M. Galati, T. Hammaker, G. Pomper, “Neighborhood, The Next Generation Service Delivery Methodology,” *IBM Product Support Services and Logistics Systems - Technical Report*, October 1999.

Presentations

- M. Galati, T. Ralphs, “DECOMP: A Framework for Decomposition in Integer Programming”
 - *INFORMS Annual Conference* (invited), Denver, CO, October 2004.
 - *CORS/INFORMS Joint International Conference* (invited), Banff, Alberta, Canada, May 2004.
- M. Galati, T. Ralphs, “Decomposition and Dynamic Cut Generation in Integer Programming”
 - *The International Symposium on Mathematical Programming* (invited), The Technical University of Denmark, Copenhagen, Denmark, August 2003.
 - *Operations Research Days Joint Meeting – IBM Research and The Swiss Operations Research Society* (invited), École Polytechnique Fédérale de Lausanne, Switzerland, July 2003.
- T. Ralphs, M. Galati, “Decomposition and Dynamic Cut Generation in Integer Programming”
 - *INFORMS Annual Conference* (invited), Atlanta, GA, October 2003.
 - *Discussions on Mixed Integer Programming '03* (invited), Columbia University, June 2003.
- M. Galati, T. Ralphs, “Decomposition-based Methods for Large-scale Discrete Optimization,”
 - *INFORMS Annual Conference*, San Jose, CA, November 2002.
 - *ROSO Seminar Series École Polytechnique Fédérale de Lausanne* (invited), Switzerland, April 2002.
- M. Galati, “Logistics at Galenica Pharmaceutical,” *ISE Seminar Series, Lehigh University* (invited), Bethlehem, PA, September 2002.
- M. Galati, T. Ralphs, J. Hartman, “Valid Inequalities for the Cable Trench Problem,” *INFORMS Annual Conference*, Miami Beach, FL, November 2001.
- T. Ralphs, J. Hartman, M. Galati “Branch and Cut for Capacitated Network Routing,” *INFORMS Annual Conference*, Miami Beach, FL, November 2001.
- M. Galati, “An Introduction to Operations Research,” *Mathematics/Computer Science Department Colloquium Series* (invited), Stetson University, Deland, FL, October 2001.
- R. Storer, J. Hartman, M. Galati, S. Avci, “A Real-Time Dispatching Problem in the Trucking Industry,” *INFORMS Annual Conference* (invited), San Antonio, TX, November 2000.
- G. Wilson, S. Avci, M. Galati, F. Barahona, “Inventory Neighborhoods: A Time Sensitive Service Parts Stocking Approach,” *INFORMS Annual Conference* (invited), San Antonio, TX, November 2000.
- J. Hartman, M. Galati, “A Revised Business Game for Use in Teaching Engineering Economy or Operations Management,” *ASEE Annual Conference and Exposition*, St. Louis, MO, June 2000.

- M. Galati, J. Hartman, “Replacement Modeling Via Geometric Programming,” *IIE Annual Conference*, Cleveland, OH, May 2000.
- M. Galati, E. Friedman, “Predicting the Dow Jones Industrial Average,” *MAA Florida Section*, Tallahassee, FL, February 1997.

Professional Activities

- Publication Referee – *Annals of Operations Research*
- COR@L – Computational Optimization Research at Lehigh (2004 – Present)
- COIN-OR – Computational Infrastructure for Operations Research - Full member (2003 - Present)
- MPS - Mathematical Programming Society (2002 - Present)
- INFORMS – Institute for Operations Research and the Management Science (1998 - Present)
- INFORMS – Computing Society (2003 – Present)
- INFORMS – Optimization Society (2003 – Present)
- SIAM – Society of Industrial and Applied Mathematics (1998 - Present)
- MAA – Mathematical Association of America (1994 - Present)
- NAIC – National Association of Investors Corporation (1999 - Present)
- IAFE – The International Association of Financial Engineers (2000 – 2003)
- GARP – Global Association of Risk Professionals (2000 – 2003)
- IIE – Institute for Industrial Engineers (2000 – 2004)
- Society of Actuaries – Passed Preliminary Exam 1 (1999)
- Founder and president of *Investment Club 906* (1998 – Present)

References

Details Available Upon Request

- Trevor Kearney – SAS Institute – trevor.kearney@sas.com
- Mark Booth – IBM Service Parts Solutions – boothm@us.ibm.com
- Gardner Pomper – Network Now – gardner@networkknow.org
- Ted Ralphs – Lehigh University ISE – tkr2@lehigh.edu
- Jeff Linderoth – Lehigh University ISE – jtl3@lehigh.edu
- Robert Storer – Lehigh University ISE – rhs2@lehigh.edu
- Joseph Hartman – Lehigh University ISE – jch6@lehigh.edu
- George Wilson – Lehigh University ISE – grw3@lehigh.edu
- Selcuk Avci – MarketRx - savci@marketrx.com
- Erich Friedman – Stetson University Mathematics – efriedma@stetson.edu
- Margie Hale – Stetson University Mathematics – mhale@stetson.edu