

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 (ABD) in Industrial and Systems Engineering (ISE).

- **Area of Research:** Operations Research and Applied Statistics
- **Expected Completion:** November 2007, **GPA:** 3.78/4.00
- **Thesis:** “Decomposition 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, Advanced Analytics – Cary, NC

Optimization Interface Lead – Operations Research R&D (March 2007 – Present)

- Lead architect and manager of *Optimization Interface Team* which develops and supports advanced uses of SAS/OR products by various user communities including: customers, the analytical consulting division, SAS solutions developers and internal SAS products.
- Responsible for architectural and implementation issues related to the integration of SAS/OR products in various frameworks and clients (including distributed systems and grid environments).
- In charge of ensuring that future product roadmaps and user expectations are in line with development plans and priorities determined with Development and Product Management.
- Responsible for the generation and presentation of educational materials for advanced uses of SAS/OR.
- Founder and organizer of three distinct seminar streams:
 - OR R&D: this series is dedicated to cutting edge research techniques,
 - OR Virtual Team (OR Track): focused on consulting engagements and customer deployment,
 - OR Virtual Team (Tech Track): focused on educational materials and best practices.
- Continued responsibility as member of development team for SAS/OR optimization tools, specifically:
 - linear mixed integer programming (OPTMILP),
 - graph theory, network flow and combinatorial optimizers (OPTGRAPH),
 - pack-fit optimization solution for retail industry.

SAS Institute, Advanced Analytics – Cary, NC

Optimization Developer – Operations Research R&D (April 2004 – January 2007)

- Member of research and development team responsible for SAS/OR core optimization tools and business intelligence solutions.
- Responsibilities include:
 - the development of a general linear mixed integer programming solver (OPTMILP), specializing in cutting plane technologies, and polyhedral theory,
 - development and architecture of a new suite of algorithms (OPTGRAPH) for solving graph theory, network flow and combinatorial optimization problems,
 - optimization specialist working directly with analytical consulting division on various projects including those in the retail and government logistics sector,
 - application-specific solutions development including projects in retail sector (pack-fit solution).
- Administrative duties include:
 - LP/MILP progress meeting chair,
 - distributed (cluster) hardware and software steering and management,
 - OPTMILP testing, benchmarking, and performance analysis,
 - web services (cvs/svn repository, wiki) administration.

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 SAS, 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), code profiling (Valgrind, Quantify, Purify) version control systems (CVS, SVN, Microsoft SourceSafe), parallel computing (PVM, MPI), grid computing (Condor), graph theory (Graphviz, Boost/Graph) and discrete event simulation (Arena).

Honors and Awards

- Co-author on two patent proposals related to Distributed Linear Programming (at SAS, 2007).
- 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 and Dynamic Cut Generation in Integer Programming”, *Mathematical Programming*, V106-2, 261-285, 2006.
- T. Ralphs, M. Galati “Decomposition in Integer Programming”, book chapter in *Integer Programming: Theory and Practice*, CRC Press 2005.
- 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

- 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), Seattle, WA, October 2007.
 - *INFORMS Annual Conference* (invited), Pittsburgh, PA, November 2006.
 - *The International Symposium on Mathematical Programming* (invited), Federal University of Rio de Janeiro, Rio de Janeiro, Brazil, August 2006.
 - *INFORMS Annual Conference* (invited), San Francisco, CA, November 2005.
 - *INFORMS Computing Society Conference* (invited), Baltimore, MD, January 2005.
 - *INFORMS Annual Conference* (invited), Denver, CO, October 2004.
 - *CORS/INFORMS Joint International Conference* (invited), Banff, Alberta, Canada, May 2004.
- M. Galati, “Aggregation and Mixed Integer Rounding to Solve MILPs”, *CORAL Optimization Seminar Series, Lehigh University* (invited), Bethlehem, PA, July 2005.
- 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.
- 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.
- 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)
 - Session Organizer and Chair (ISMP 2006)
- INFORMS – Institute for Operations Research and the Management Science (1998 - Present)
 - Computing Society (2003 – Present)
 - Optimization Society (2003 – Present)
 - Session Organizer and Chair (Informs 2006/2007, Informs-Opt 2008)
- SIAM – Society of Industrial and Applied Mathematics (1998 - Present)
- MAA – Mathematical Association of America (1994 - 2003)
- NAIC – National Association of Investors Corporation (1999 - 2003)
- 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

- Radhika Kulkarni – SAS Institute – radhika.kulkarni@sas.com
- Manoj Chari – SAS Institute – manoj.chari@sas.com
- Mark Booth – IBM Service Parts Solutions – boothm@us.ibm.com
- Gardner Pomper – Network Now – gardner@networkknow.org
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- Jeff Linderoth – University of Wisconsin IE – linderoth@wisc.edu
- Joseph Hartman – University of Florida IE – hartman@ise.ufl.edu
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