

## Todd Munson

*Computational Scientist*

Mathematics and Computer Science Division

Argonne National Laboratory

Argonne, IL 60439-4844

Phone: 630-252-4279

<http://www.mcs.anl.gov/~tmunson>

*Senior Fellow*

Computation Institute

University of Chicago

Chicago, IL 60637

Fax: 630-252-5986

Email: [tmunson@mcs.anl.gov](mailto:tmunson@mcs.anl.gov)

---

## Education and Training

- Argonne National Laboratory, Mathematics and Computer Science (MCS) Division, Numerical Optimization, Postdoc, 2000–2002
- University of Wisconsin at Madison, Computer Science, Ph.D., 2000
- University of Wisconsin at Madison, Computer Science, M.S., 1996
- University of Nebraska at Omaha, Computer Science, B.S. (summa cum laude), 1995

## Research Interests

Algorithms for numerical optimization and equilibrium problems, applications of mathematical programming, and linear algebra for large sparse systems

## Research and Professional Experience

- 2010–present: *Senior Fellow*, Computation Institute, University of Chicago
- 2006–present: *Computational Scientist*, MCS Division, Argonne National Laboratory
- 2004–2010: *Fellow*, Computation Institute, University of Chicago
- 2004–2006: *Assistant Scientist*, MCS Division, Argonne National Laboratory
- 2002–2004: *Enrico Fermi Scholar*, MCS Division, Argonne National Laboratory
- Fall 2002: *Lecturer*, Electrical and Computer Engineering Department, Northwestern University
- 2000–2002: *Postdoctoral Fellow*, MCS Division, Argonne National Laboratory
- 1999–2000: *Distinguished Graduate Fellow in Computer Science*, Department of Computer Science, University of Wisconsin at Madison
- Summer 1997: *Givens Fellow*, MCS Division, Argonne National Laboratory
- 1996–1999: *Research Assistant*, Department of Computer Science, University of Wisconsin at Madison

## Honors and Awards

- Kavli Frontiers Fellow, National Academy of Sciences, 2007
- Presidential Early Career Award for Scientists and Engineers, Executive Office of the President of the United States, 2006
- Early Career Scientist and Engineer Award, United States Department of Energy, 2006
- Beale-Orchard-Hayes Prize, Mathematical Optimization Society, 2003
- Enrico Fermi Scholar, Argonne National Laboratory, 2002–2004
- Outstanding Graduate Student Research Award, University of Wisconsin at Madison, 2000
- Distinguished Graduate Fellow in Computer Science, University of Wisconsin at Madison, 1999–2000
- SIAM Student Travel Award, SIAM, 1999
- GAMS Travel Awards, GAMS Development Corporation, 1999
- Givens Research Associateship, Argonne National Laboratory, 1997
- Summer Research Assistantship, University of Chicago at Madison, 1996
- NSF Research Experience for Undergraduates, University of Nebraska at Lincoln, 1993
- Honors Scholarship Recipient, University of Nebraska at Omaha, 1993–1995

## Journal Publications

1. (with M. Ferris) “Interfaces to PATH 3.0: Design, Implementation, and Usage,” *Computational Optimization and Applications*, 12 (1999), pages 207–227.
2. (with M. Ferris and C. Kanzow) “Feasible Descent Algorithms for Mixed Complementarity Problems,” *Mathematical Programming*, 86 (1999), pages 475–497.
3. (with M. Ferris) “Complementarity Problems in GAMS and the PATH Solver,” *Journal of Economic Dynamics and Control*, 24 (2000), pages 165–188.
4. (with M. Ferris) “Modeling Languages and Condor: Metacomputing for Optimization,” *Mathematical Programming*, 88 (2000), pages 487–506.
5. (with F. Facchinei, M. Ferris, A. Fischer, and C. Kanzow) “The Semismooth Algorithm for Large Scale Complementarity Problems,” *INFORMS Journal on Computing*, 13 (2001), pages 294–311.
6. (with M. Ferris) “Interior-Point Methods for Massive Support Vector Machines,” *SIAM Journal on Optimization*, 13 (2003), pages 783–804.
7. (with M. Ferris) “Semismooth Support Vector Machines,” *Mathematical Programming*, 101 (2004), pages 185–204.
8. (with J. Moré) “Computing Mountain Passes and Transition States,” *Mathematical Programming*, 100 (2004), pages 151–182.
9. (with S. Benson) “Flexible Complementarity Solvers for Large-Scale Applications,” *Optimization Methods and Software*, 21 (2006), pages 155–168.
10. (with S. Bhowmick, E. Boman, K. Devine, A. Gebremedhin, B. Hendrickson, P. Hovland, and A. Pothen) “Combinatorial Algorithms Enabling Computational Science: Tales from the Front”, *Journal of Physics: Conference Series*, 46 (2006), pages 453–457.
11. (with Y. Chen, B. Hobbs, and S. Leyffer) “Leader-Follower Equilibria for Electric Power and  $\text{NO}_x$  Allowances Markets,” *Computational Management Science*, 3 (2006), pages 307–330.
12. (with E. Dolan and J. Moré) “Optimality Measures for Performance Profiles,” *SIAM Journal on Optimization*, 16 (2006), pages 891–909.
13. (with L. Freitag, P. Knupp, and S. Shontz) “A Comparison of Two Optimization Algorithms for Mesh Quality Improvement,” *Engineering with Computers*, 22 (2006), pages 61–74.
14. “Mesh Shape-Quality Optimization Using the Inverse Mean-Ratio Metric,” *Mathematical Programming*, 110 (2007), pages 561–590.
15. (with J. Moré and J. Sarich) “Optimization in SciDAC Applications,” *Journal of Physics: Conference Series*, 78 (2007), article 012052.
16. (with E. Dolan, R. Fourer, J.-P. Goux, and J. Sarich) “Kestrel: A Callable Interface to the NEOS Server,” *INFORMS Journal on Computing*, 20 (2008), pages 525–538.
17. (with S. Leyffer, J. Linderoth, J. Luedtke, and A. Miller) “Applications and Algorithms for Mixed Integer Nonlinear Programming,” *Journal of Physics: Conference Series*, 180 (2009), article 012014.
18. (with J. Elliott, I. Foster, K. Judd, and E. Moyer) “CIM-EARTH: Framework and Case Study”, *The B.E. Journal of Economic Analysis and Policy*, 10 (2010), article 11.
19. (with J. Elliott, I. Foster, S. Kortum, F. Pérez Cervantes, and D. Weisbach) “Trade and Carbon Taxes,” *American Economic Review: Papers and Proceedings*, 100 (2010), pages 465–469.
20. (with D. Hanson, Y. Kryukov, and S. Leyffer) “Optimal Control Model of Technology Transition”, *International Journal of Global Energy Issues*, 33 (2010), pages 154–175.
21. (with S. Leyffer) “Solving Multi-Leader-Common-Follower Games,” *Optimization Methods and Software*, 25 (2010), pages 601–623.
22. (with J. Kreutz, T. Huynh, F. Shen, W. Du and R. Ismagilov, “Theoretical design and analysis of multivolume digital assays with wide dynamic range validated experimentally with microfluidic digital PCR,” *Analytical Chemistry*, 83 (2011), 8158–8168.
23. (with J. Elliott, M. Franklin, M. Loudermilk and I. Foster) “Propagation of Data Error and Parametric Sensitivity in Computable General Equilibrium Model Forecasts,” *Computational Economics*, 39 (2012), 219–241.
24. (with H.-R. Fang and S. Leyffer) “A Pivoting Algorithm for Linear Programs with Linear Complementarity Constraints,” *Optimization Methods and Software*, 27 (2012), 89–114.
25. (with J. Elliott, I. Foster, S. Kortum and G. K. Jush), “Unilateral carbon taxes, border adjustments,

and carbon leakage,” *Theoretical Inquiries in Law*, 14 (2013), 207–243.

## Refereed Proceedings

26. (with M. Ferris) “Case Studies in Complementarity: Improving Model Formulation,” in *Ill-Posed Variational Inequalities and Regularization Techniques*, M. Thera and R. Tichatschke editors, Springer Verlag, 1999.
27. (with M. Ferris and D. Ralph) “A Homotopy Method for Mixed Complementarity Problems Based on the PATH Solver,” in *Numerical Analysis 1999*, D. Griffiths and G. Watson editors, Chapman and Hall, 2000.
28. (with M. Ferris and K. Sinapiromsaran) “A Practical Approach to Sample-Path Simulation Optimization,” in *Proceedings of the 2000 Winter Simulation Conference*, J. Joines, R. Barton, K. Kang, and P. Fishwick editors, Omnipress, 2000.
29. (with M. Ferris) “Preprocessing Complementarity Problems,” in *Complementarity: Applications, Algorithms, and Extensions*, M. Ferris, O. Mangasarian, and J.-S. Pang editors, Kluwer Academic Publishers, 2001.
30. (with L. Freitag, P. Knupp, and S. Shontz) “A Comparison of Optimization Software for Mesh Shape-Quality Improvement Problems,” in *Proceedings of the 11th International Meshing Roundtable*, 2002.
31. (with L. Freitag, P. Knupp, and S. Shontz) “A Comparison of Inexact Newton and Coordinate Descent Mesh Optimization Techniques,” in *Proceedings of the 13th International Meshing Roundtable*, 2004.
32. (with M. Anitescu, D. Negrut, and P. Zapol) “Simulating Nanoscale Processes in Solids using DFT and the Quasicontinuum Method,” in *Proceedings of IMECE 2005, ASME International Mechanical Engineering Congress and Exposition*, 2005.
33. (with P. Hovland) “The FeasNewt Benchmark,” in *Proceedings of the 2005 IEEE International Symposium on Workload Characterization (IISWC2005)*, October 2005.
34. (with N. Voshell, S. Shontz, L. Freitag, and P. Knupp) “A Patch-Based Mesh Optimization Algorithm for Partitioned Meshes”, *Proceedings of the 9th International Workshop on State-of-the-Art in Scientific and Parallel Computing (PARA’08)*, May 2008.
35. (with E. Ng, J. Sarich, S. Wild, H. Aktulga, C. Yang, P. Maris, J. P. Vary, N. Schunck, M. G. Bertolli, M. Kortelainen, W. Nazarewicz, T. Papenbrock and M. V. Stoitsov) “Advancing Nuclear Physics through TOPS Solvers and Tools”, in *Proceedings of SciDAC 2011*, July 2011.
36. (with L. Wang, J. Lee, M. Anitescu, A. El Azab, L. McInnes and B. Smith) “A Differential Variational Inequality Approach for the Simulation of Heterogeneous Materials”, in *Proceedings of SciDAC 2011*, July 2011.
37. (with J. Chen, P. Hovland and J. Utke) “An Integer Programming Approach to Optimal Derivative Accumulation”, in *Recent Advances in Algorithmic Differentiation (AD2012)*, July 2012.
38. (with N. Goldberg and S. Leyffer), “A new perspective on convex relaxations of sparse SVM”, in *Proceedings of SIAM International Conference on Data Mining (SDM13)*, May 2013.

## Miscellaneous Articles

39. (with M. Ferris) “Linear Programming for Emergency Broadcast Systems,” *SIAG/Optimization News and Views*, 10 (1999), pages 6–8.
40. (with E. Dolan, R. Fourer, and J. Moré) “Optimization on the NEOS Server,” *SIAM News*, 35 (2002), pages 4–9.
41. “Optimizing the Quality of Mesh Elements,” *SIAG/Optimization News and Views* 16 (2005), pages 27–34.

## Other Preprints and Technical Reports

42. “Algorithms and Environments for Complementarity,” Ph.D. Dissertation, Mathematical Programming Technical Report MP 00-02, University of Wisconsin at Madison, 2000.
43. (with E. Dolan) “The Kestrel Interface to the NEOS Server,” Argonne Technical Memorandum ANL/MCS-TM-248, 2001.
44. (with E. Dolan, R. Fourer, and J. Moré) “The NEOS Server for Optimization: Version 4 and Beyond,” Argonne Preprint ANL/MCS-P947-0202, 2002.
45. “Mesh Shape-Quality Optimization Using the Inverse Mean-Ratio Metric: Tetrahedral Proofs,” Argonne Technical Memorandum ANL/MCS-TM-275, 2004.
46. (with E. Dolan and J. Moré) “Benchmarking Optimization Software with COPS 3.0,” Argonne Technical Memorandum ANL/MCS-TM-273, 2004.
47. (with M. Anitescu, D. Negrut, and P. Zapol) “Density Functional Theory-Based Nanostructure Investigation: Theoretical Considerations,” Argonne Preprint ANL/MCS-P1252-0505, 2005.
48. (with M. Friedlander, N. I. M. Gould, and S. Leyffer) “A Filter Active-Set Trust-Region Method,” Argonne Preprint ANL/MCS-P1456-0907, 2007.
49. (with S. Leyffer) “A Globally Convergent Filter Method for MPECs,” Argonne Preprint ANL/MCS-P1457-0907, April 2009.
50. (with Q. Li and M. Ferris) “Linear Algebra Enhancements to the PATH Solver,” Argonne Preprint ANL/MCS-P1565-1208, May 2009.
51. (with J. Elliott, I. Foster, K. Judd, and E. Moyer) “CIM-EARTH: Community Integrated Model of Economic and Resource Trajectories for Humankind”, Argonne Technical Memorandum ANL/MCS-TM-307, Version 0.1, January 2010.
52. (with S. Benson, L. McInnes, J. Moré, and J. Sarich) “TAO Users Manual (revision 1.10.1)”, Argonne Technical Memorandum ANL/MCS-TM-242, Version 1.10.1, July 2010.
53. (with A. Mahajan) “Exploiting Second-Order Cone Structure for Global Optimization,” Argonne Preprint ANL/MCS-P1801-1010, October 2010.
54. (with J. Elliott, I. Foster and M. Loudermilk), “Impact on US Gasoline Prices of Eliminating Biofuels Production: An Equilibrium Analysis”, Argonne Preprint ANL/MCS-1983-1111, January 2012.
55. (with J. Sarich, S. Wild, S. Benson and L. McInnes) “TAO 2.0 Users Manual”, Argonne Technical Memorandum ANL/MCS-TM-322, January 2012.
56. (with E. Gawlik, J. Sarich, and S. Wild), “The TAO Linearly Constrained Augmented Lagrangian Method for PDE-Constrained Optimization”, Argonne Preprint ANL/MCS-2004-0112, February 2012.
57. (with M. Snir, R. Wisniewski, J. Abraham, S. Adve, S. Bagchi, P. Balaji, J. Belak, P. Bose, F. Capello, B. Carlson, A. Chien, P. Coteus, N. Debardeleben, P. Diniz, C. Engelmann, M. Erez, S. Fazzari, A. Geist, R. Gupta, F. Johnson, S. Krishnamoorthy, S. Leyffer, D. Liberty, S. Mitra, R. Schreiber, J. Stearley and E. van Hensbergen, “Addressing Failures in Exascale Computing”, Argonne Technical Memorandum ANL/MCS-TM-332, March 2013.

## Professional Activities

- Journal Activities
  - *Editorial Board*: Mathematical Methods of Operations Research (2008–)
  - *Technical Editor*: Mathematical Programming Computation (2008–)
  - *Advisory Board*: MPEC World (2001–)
  - *Area Coordinator*: Optimization Online (2000–)
- Conference Activities
  - *Co-Chair*: Institute for Computational Economics, University of Chicago (2005–2012).
  - *Organizing Committee*: SIOPT 2014 (2013–)
  - *Local Organizing Committee*: ISMP 2009 (2007–2009)
  - *Cluster Chair*: International Conference on Continuous Optimization (2013)
  - *Session Organizer*: INFORMS International Meeting (2001), Mathematical Programming Symposium (2003, 2006, 2009, 2012), SIAM Conference on Optimization (2002, 2005, 2008, 2011), ICIAM Meeting (2003), SIAM Annual Meeting (2006)
  - *Organizer*: Optimization Technology Center Seminar Series (2001–2002)
- Community Service
  - *Referee*: various journals including SIAM Journal on Optimization, SIAM Journal on Scientific Computing, SIAM Journal on Numerical Analysis, Mathematical Programming, Computational Optimization and Applications, Optimization Methods and Software, Journal of Global Optimization, Annals of Operations Research, Journal of Economic Dynamics and Control, and Proceedings of AD2004 Conference
  - *Administrator*: NEOS Server (2000–2012)
- Societies
  - *Member*: Institute for Operations Research and the Management Sciences, Mathematical Optimization Society, Society for Industrial and Applied Mathematics