Elaine T. Hale

Rice University
6100 Main St. - MS 134
Houston, Texas 77005-1892
(713)348-3702
ehale@rice.edu

Education

Ph.D., Chemical Engineering University of Texas at Austin	2005
M.S., Chemical Engineering University of Texas at Austin	2004
B.S., Chemical Engineering Georgia Institute of Technology	2000

Dissertation: "Numerical Methods for d-Parametric Nonlinear Programming with Chemical Process Control and Optimization Applications"

Advisors

Doctoral:	Professor S. Joe Qin	University of Texas at Austin
Post-Doctoral:	Professor Yin Zhang	Rice University

Academic Positions

Pfeiffer/VIGRE Instructor Department of Computational and Applied Mathematics Rice University, Houston, Texas	2005 – present

Honors and Awards

AAUW Selected Professions Fellowship	2003 – 2004
University of Texas at Austin Continuing Fellowship	2003 – 2004
College of Engineering Thrust 2000 Fellowship	2000 – 2004
NSF Graduate Research Fellowship	2000 – 2003
David Bruton, Jr. Graduate Fellowship	2000 – 2003

Research Interests

Continuous numerical optimization
Uncertain and large-scale nonlinear programming
Modeling, control and optimization of chemical processes
Computational image processing

Publications

1. Hale, Elaine T. and Yin Zhang. Case Studies for a first-order robust nonlinear programming formulation. *Journal of Optimization Theory and Applications*, 134(1) 27-45, 2007.

2. Hale, Elaine T. and S. Joe Qin. Explicit model predictive control for nonlinear systems. In revision for *Computers & Chemical Engineering*.

3. Hale, Elaine T., Wotao Yin and Yin Zhang. Fixed-point continuation for *l*1-minimization: methodology and convergence. Submitted to SIAM *Journal on Optimization.*

4. Hale, Elaine T., Wotao Yin and Yin Zhang. A numerical study of fixed-point continuation applied to compressed sensing. In preparation for *IEEE Transactions on Information Theory*.

5. Hale, Elaine T. First-order robust real-time optimization. In preparation for *Computers & Chemical Engineering*.

6. Hale, Elaine T. and S. Joe Qin. Implicit manifold approximation for multi-parametric nonlinear programming. In preparation for *SIAM Journal on Optimization.*

Refereed Conference Papers

1. Hale, Elaine T. and S. Joe Qin. Multi-parametric nonlinear programming and the evaluation of implicit optimization model adequacy. In Proceedings of the 7th International Symposium on the Dynamics and Control of Process Systems, Cambridge, MA, July 5-8, 2004.

2. Hale, Elaine T. and S. Joe Qin. Subspace model predictive control and a case study. In Proceedings of the American Control Conference, Anchorage, AK, May 8-10, 2002, 4758-4763.

Invited Talks

1. Fixed-point continuation for compressed sensing signal reconstruction. Presented at the Department of Computational and Applied Mathematics Colloquium at Rice University, September 10, 2007.

2. Case studies for a first-order robust nonlinear programming formulation. Presented at ExxonMobil Upstream Research Company, October 26, 2006.

3. The Potential of Multi-Parametric Nonlinear Programming: Numerical Methods and Applications. Presented at the Department of Computational and Applied Mathematics Graduate Seminar at Rice University, November 16, 2005.

4. Numerical Methods for Parametric Nonlinear Programming. Presented at the University of Texas at Austin Mathematics Department's Working Dynamical Systems Seminar, January 26, 2005.

Software Developed

POPAK 2003 – present
Only numerical code for multi-parametric nonlinear programming. First multi-dimensional predictor-corrector algorithm to implement singularity handling in an integrated manner.

FPC 2007
Fixed-point continuation solver for $l1$-regularized weighted least squares. Appropriate for large-scale problems with dense data. Co-developed with Yin Zhang and Wotao Yin.

Teaching Experience

Sp '08	Instructor	Differential Equations in Sci. and Eng.	Rice U., CAAM 336
F '07	Instructor	Matrix Analysis	Rice U., CAAM 335
Sp '07	Instructor	Matrix Analysis	Rice U., CAAM 335
F '06	Instructor	Matrix Analysis	Rice U., CAAM 335
Sp '06	Instructor	Intro. to Engineering Computation	Rice U., CAAM 210
F '05	Instructor	Intro. to Engineering Computation	Rice U., CAAM 210
F '04	Asst. Instructor	Applied Statistics	U. Texas, CHE 253K
	Only chemical engineering graduate student to serve as an instructor of record.		
Su '02	Teaching Asst.	Chem. Reactor Analysis and Design	U. Texas, CHE 372
F '00	Teaching Asst.	Chem. Reactor Analysis and Design	U. Texas, CHE 372

Mentoring Experience

Computational Medical Image Processing Research Seminar 2005 – 2006
Research mentor for three undergraduate students as part of the Rice University VIGRE project. Students conducted and interpreted numerical experiments concerning compressed sensing signal recovery.

Rice University AGEP Program Summer 2006
Co-research mentor for one program participant. Demonstrated the feasibility of using undergraduate bioreactor lab data to estimate parameters in an ODE model. The results were used to add a modeling activity to the lab module.

Conference Presentations

1. Compressed sensing signal recovery in the presence of noise. To be presented at the 2008 Joint Mathematics Meetings in San Diego, California, January 9, 2008.

2. Origami fold patterns as patchwork: An origami crane quilt. To be presented at the 2008 Joint Mathematics Meetings in San Diego, California, January 9, 2008.

3. Connecting linear algebra to the real world through group presentations. To be presented at the 2008 Joint Mathematics Meetings in San Diego, California, January 8, 2008. Joint work with Sean Hardesty.

4. A numerical comparison of three state estimation schemes applied to a nonlinear stochastic system. To be presented in the AMS Special Session on Stochastic, Large-Scale, and Hybrid Systems with Applications, I at the Joint Mathematics Meetings in San Diego, California, January 7, 2008.

5. A numerical comparison of compressed sensing reconstruction algorithms. Presented at the Second International Conference on Continuous Optimization in Hamilton, Ontario, August 13, 2007. Joint work with Wotao Yin and Yin Zhang.

6. Convergence rate of an interior point gradient method for the totally non-negative least squares problem (preliminary report). Presented at the 2007 Joint Mathematics Meetings in New Orleans, Louisiana, January 8, 2007. Joint work with Yin Zhang.

7. Introducing eigenvalues by way of the resolvent. Presented at the 2007 Joint Mathematics Meetings in New Orleans, Louisiana, January 6, 2007. Joint work with Steven J. Cox.

8. First-order robust real-time optimization. Presented at the American Institute for Chemical Engineers 2006 Annual Meeting in San Francisco, California, November 15, 2006.

9. Deterministic approaches to nonlinear chemical process design, control and optimization under uncertainty. Poster presented at the American Institute for Chemical Engineers 2006 Annual Meeting in San Francisco, California, November 12, 2006.

10. Two case studies for a first-order robust nonlinear programming formulation. Presented at the 6th Annual Modeling and Optimization: Theory and Applications Conference in Waterloo, Ontario Canada, July 24, 2006. Joint work with Yin Zhang.

11. Marrying form and function: Mathematics as motivation in an introductory programming course for engineers and applied mathematicians. Presented at the 2006 Joint Mathematics Meetings in San Antonio, Texas, January 14, 2006. Joint work with Steven J. Cox and Brad Peercy.

12. Nonlinear MPC using multi-parametric nonlinear programming solutions. Presented at the American Institute for Chemical Engineers 2005 Annual Meeting in Cincinnati, Ohio, November 3, 2005. Joint work with S. Joe Qin.

13. Numerical methods for parametric nonlinear programming and their application to the optimization of a chemical process. Poster presented at the American Institute for Chemical Engineers 2005 Annual Meeting in Cincinnati, Ohio, October 30, 2005.

14. Multi-parametric nonlinear programming: An update. Presented at the Texas and Wisconsin Modeling and Control Consortium Meeting in Austin, Texas, February 7, 2005. Joint work with S. Joe Qin.

15. Communicating the problem solving process through memoranda. Presented at the 2005 Joint Mathematics Meetings in Atlanta, Georgia, January 5, 2005.

16. Power outage data for the statistics classroom. Presented at the 2005 Joint Mathematics Meetings in Atlanta, Georgia, January 7, 2005.

17. Multi-parametric nonlinear programming. Presented at the Texas and Wisconsin Modeling and Control Consortium Meeting in Austin, Texas, February 9, 2004. Joint work with S. Joe Qin.

18. Subspace model predictive control and a case study. Presented at the Texas and Wisconsin Modeling and Control Consortium Meeting in Austin, Texas, February 18, 2002. Joint work with S. Joe Qin.

Research and Industrial Experience

Lab Assistant II 2000
Georgia Institute of Technology, Atlanta, Georgia

Redesigned LabView user interfaces and updated portions of the lab manual for an undergraduate process control laboratory.

Undergraduate Research 1999
Georgia Institute of Technology, Atlanta, Georgia
Ran reactions and wrote a literature review on the production of magnetic nanoparticles in supercritical water under Dr. Amyn Teja and Linda Holm.

Engineering Co-op 1997 –1999
Ethicon, Inc., Cornelia, Georgia

Process engineering including statistical design and analysis of experiments for a polymer extrusion process, collection of polymer rheology data, and equipment validation. All work was done in an FDA and ISO 9000 regulated environment.

Service

Journal Referee 2004 – present
Chemical Engineering Science, Journal of Mathematical Analysis and Applications, Journal of Optimization Theory and Applications, Journal of Process Control

Rice University CS-CAMP 2006
Spoke to high school girls about careers in science and engineering.

American Society for Engineering Education (ASEE) 2004 – 2005
National Outstanding Teaching Medal Selection Committee

University of Texas at Austin Student Chapter of the ASEE
President 2003 – 2004
Officer 2002 – 2003

University of Texas at Austin LBJ School of Public Affairs 2003
Assisted with a calculus review course offered to incoming master's students.

Professional Development

Negotiating the Ideal Faculty Position 2007
A Workshop for Women in Science and Engineering hosted by Rice University's ADVANCE Program, October 14-16, 2007.

ASPECTS Certificate in Leading Discussions 2005
University of Texas at Austin Division of Instructional Innovation and Assessment

Tools for Teaching: A Seminar for Experienced TAs 2003

Professional Membership

American Society for Engineering Education (ASEE)
Mathematical Association of America (MAA)
Mathematical Programming Society (MPS)
Sustainable Engineering Forum (SEF)
Society for Industrial and Applied Mathematics (SIAM)

References

S. Joe Qin Chemical Engineering University of Southern California
925 Bloom Walk HED 211, Los Angeles, CA 90089 (213)740-0317 sqin@usc.edu

Yin Zhang Computational and Applied Mathematics Rice University
6100 Main St., MS 134, Houston, TX 77005 (713)348-5744 zhang@caam.rice.edu

Thomas E. Marlin Chemical Engineering McMaster University
1280 Main St. W., Hamilton, ON, Canada L8S 4L7 (905)525-9140 x27125 marlint@mcmaster.ca

Mark Embree Computational and Applied Mathematics Rice University
6100 Main St. MS, 134, Houston, TX 77005 (713)348-1892 embree@rice.edu