Marc Millstone

marc@stationarypoint.com ¶ http://www.stationarypoint.com
2100 Western Avenue, Apt. 63 • Seattle WA 98121 ¶ 215.704.7479

Interests: Computational methods, algorithm design, shipping product, TDD, parallel computation, cloud computing, learning

Current Work

T.J. Watson Research Center • IBM

Research staff member • Mathematical Sciences Group (January 2011–present)

Proposed, organized and led a small, interdisciplinary team (2-3 members) in implementing (in Scala) modern, distributed tools for Business Analytics.

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Post-doctoral researcher • Mathematical Sciences Group (June–December 2010)

Developed and implemented (in C++) new algorithms and tools to solve industrial problems in lithography.

Worked successfully with a third-party in integrating these ideas into their product.

Ph.D. Thesis

Real-Space Localization Methods for Minimizing the Kohn-Sham Energy

Developed and implemented (in Matlab) new optimization algorithms for minimizing the Kohn-Sham energy of a molecule. This allowed the electronic-structure of large molecular systems to be first analyzed computationally as opposed to experimentally.

Education

Courant Institute of Mathematical Sciences • New York University

Ph.D. • Computer Science (May 2011)

Advisor: Michael Overton • New York University

Advisor: Juan Meza • Lawrence Berkeley National Lab

M.Sc. • Mathematics (2006)

Thesis: HIFOO1.5: *Structured control of linear systems with non-trivial feedthrough*

School of Engineering and Applied Sciences • University of Pennsylvania

B.S.E.(with honors) • Mathematics & Computer Science (2004)

Minor • Mechanical Engineering

Past Research

Boeing Research & Technology • The Boeing Company (Fall 2008–Fall 2009)

Designed and implemented(in C/Python) new algorithms to generate optimal paths for patrolling a given terrain under sensor-based visibility constraints.

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Studied and developed new methods for surrogate-based optimization of expensive-to-compute discontinuous functions with applications to an industrial assignment problem.

Department of Mathematics • New York University (Fall 2005–present)

Developed and maintained HIFOO, an open-source Matlab package using nonsmooth optimization methods for fixed-order H-infinity controller design. Visit the HIFOO webpage for a complete description of the software and its application to industrial engineering problems.

Computational Research Division • Lawrence Berkeley National Lab (Summer 2008)

Analyzed acceleration techniques for the Self-Consistent Field iteration. Integrated these ideas into the Matlab package KSSOLV.

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Pregraduate Research & Work

GRASP Lab • University of Pennsylvania (Summer 2004)
Designed and implemented (in Matlab) an algorithm showing that for any rotationally symmetric projection with a single virtual viewpoint, it is possible to compute a two mirror system that realizes the projection exactly.

Department of Computer Science • University of Pennsylvania (2003-2004)
Applied and implemented algorithms from PDE-constrained optimization to design optimal controllers for hybrid systems governed by the heat equation.

GRASP Lab • University of Pennsylvania (2002-2004)
Implemented (in C++) physics-based models for deformation, friction and cutting allowing the simulation of surgery using a haptic device.

Robotics Group • Columbia University (Summer 2003)
Implemented (in C/C++) fast algorithms for in-the-field camera calibration to be used for real-time image registration at archaeological sites.

Wharton Research Data Services • University of Pennsylvania (2000-2002)
Implemented (in Perl/SAS) production code for CGI and database query generation. This allowed the first simple, "point and click" interface for generating large and complex SAS queries in WRDS.

Averstar, Inc. • NASA IV&V (1998-2000)
Designed and implemented web tools (in Perl/SQL) to facilitate the analysis and exchange of specific, project-related "issues" among different verification and validation groups throughout NASA.

Skill Set

Advanced programming experience
C/C++, Scala, Matlab

Working programming experience
Cocoa, Fortran, Objective–C, Python

Relevant mathematical knowledge
Numerical optimization, numerical linear algebra, algorithm design

Teaching

New York University
Instructor, Fundamental Algorithms (graduate), Summer 2007
Organizer/Leader, Optimization Reading Group (graduate), Spring 2007
Recitation Leader, Fundamental Algorithms (graduate), Spring 2008
Recitation Leader, Basic Algorithms (undergraduate), Fall 2007
Teaching Assistant, Probability and Statistics (undergraduate), Spring 2006
Teaching Assistant, Mathematical Analysis (graduate), Fall 2005

University of Pennsylvania
Teaching Assistant, Theory of Computation (graduate), Spring 2004
Teaching Assistant, Theory of Computation (undergraduate), Fall 2003
Teaching Assistant, Introduction to Engineering (undergraduate), Fall 2002

Selected Publications

Design-specific joint optimization of masks and sources on a very large scale. Kafai Lai, Maria Gabrani, *et. al.* SPIE proceedings , Vol. 7973, 797308-(1-13), 2011.

Multiobjective Robust Control with HIFOO2.0. S. Gumussoy, D. Henrion, M. Millstone and M.L. Overton. IFAC Symposium on Robust Control Design, Haifa, 2009.

H-infinity Strong Stabilization via HIFOO, a Package for Fixed-Order Controller Design. S. Gumussoy, M. Millstone and M.L. Overton.CDC. 2008.

Fixed-order and Structure H-infinity Control with Model Based Feedforward for Elastic Web Winding Systems. D. Knittel, D. Henrion, M. Millstone and M. Vedrines. IFAC Symposium on Large Scale Systems. July 2007

Realizing any central projection with a mirror pair. R. Andrew Hicks, Marc Millstone, and Kostas Daniilidiis. Applied Optics 45, Issue 28; pages 7205-7210. 1 October 2006.