

Caleb C. Magruder

Norbert Wiener Assistant Professor
Mathematics

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Education

Ph.D. Computational and Applied Mathematics, Rice University, May 2017

Thesis: Accelerating Newton's Method for large-scale optimal control via reduced-order modeling

Advisor: Matthias Heinkenschloss

M.S. Mathematics, Virginia Polytechnic Institute and State University, May 2013

Thesis: Model reduction of linear time-periodic dynamical systems

Advisors: Serkan Gugercin and Christopher Beattie

B.S. Electrical Engineering, Virginia Polytechnic Institute and State University, May 2011

B.S. Mathematics, Virginia Polytechnic Institute and State University, May 2011

Professional Experience

Norbert Wiener Assistant Professor, Mathematics Department, Tufts University, 2017-present

Research Experience

ExxonMobil Corporate Strategic Research; Clinton, NJ

Summer 2015: Bayesian uncertainty quantification in core flooding inverse problem

Summer 2014: PDE constrained optimization in the core flooding inverse problem

Rice University; Houston, TX

2013 - 2017: Accelerating optimal control of parabolic PDEs via reduced order modeling

Virginia Tech Mathematics Department; Blacksburg, VA

2011 - 2013: Reduced order modeling of linear time-periodic dynamical systems

2009 - 2011: Reduced order modeling of unstable large-scale dynamical systems

Virginia Tech Mobile and Portable Radio Group; Blacksburg, VA

2006: Simulation of electromagnetic signals as they enter the earth's atmosphere via FPGA

Publications

Peer-Reviewed Publications

C. Magruder, J. Brandman, H. Denli, “Uncertainty quantification in core flooding,” (Submitted to SIAM Journal of Uncertainty Quantification).

C. C. Magruder, S. Gugercin, C. A. Beattie, “Linear time-periodic dynamical systems: An H2 analysis and a model reduction framework,” *Mathematical Modelling of Dynamical Systems*, 2017.

C. Magruder, C.A. Beattie, S. Gugercin, “Rational Krylov methods for optimal L2 model reduction,” *Proceedings of the 49th IEEE Conference on Decision and Control*, Atlanta, GA, 2010, pp. 6797 - 6802.

Other Publications

C. Magruder, “Accelerating Newton’s Method for large-scale optimal control via reduced-order modeling,” Ph.D. Thesis, Computational and Applied Mathematics Department, Rice University, Houston, TX, 2017.

C. Magruder, “Model reduction of linear time-periodic dynamical systems,” M.S. Thesis, Mathematics Department, Virginia Tech, Blacksburg, VA, 2013.

C. Magruder, S. Gugercin, “Model reduction of inhomogeneous initial conditions,” Technical Report, Virginia Tech, Blacksburg, VA, 2012. (Layman Prize Winner 2011)

Presentations

Seminar Presentations

“Adjoint-based differentiation for optimization with implicit constraints,” Computational and Applied Math Seminar at Tufts University, Medford, MA, 2017.

“Accelerating Newton’s Method for semilinear parabolic control via reduced-order modeling,” Applied Mathematics Seminar at University of Texas Rio Grande Valley, Edinburg, TX, 2016.

Conference Presentations

“Accelerating Newton’s Method for semilinear parabolic control via reduced-order modeling,” SIAM Conference on Computational Science and Engineering, Atlanta, GA, 2017.

“Accelerating Newton’s Method for semilinear parabolic control via reduced-order modeling,” SIAM Annual Meetings, Boston, MA, 2016.

“PDE constrained optimization for core flooding,” SIAM Conference on Computational Science and Engineering, Salt Lake City, UT, 2015.

“Rational Krylov methods for optimal L2 model reduction,” Southeastern-Atlantic Regional Conference on Differential Equations, 2010, Blacksburg, VA.

“Rational Krylov methods for optimal L2 model reduction,” *Proceedings of the 49th IEEE Conference on Decision and Control*, 2010, Atlanta, GA.

Poster Presentations

“Accelerating Newton’s Method for large-scale time-dependent optimal control via reduced order modeling,” Institute for Mathematics and its Applications Frontiers in PDE-constrained Optimization Workshop, 2016, Minneapolis, MN.

“Accelerating Newton’s Method for large-scale time-dependent optimal control via reduced order modeling,” Ken Kennedy Institute for Information Technology Oil and Gas HPC Conference, 2016, Houston, TX.

“Estimation of relative permeabilities in porous media flow,” Ken Kennedy Institute for Information Technology Oil and Gas HPC Conference, 2015, Houston, TX.

Other Presentations

“Model reduction for semilinear parabolic partial differential equations,” Rice Computational and Applied Mathematics Graduate Seminar, Houston, TX, 2016.

“Uncertainty quantification in core flooding,” Rice Computational and Applied Mathematics Graduate Seminar, Houston, TX, 2015.

“PDE constrained optimization for core flooding,” Rice Computational and Applied Mathematics Graduate Seminar, Houston, TX, 2014.

“Making big problems smaller,” Rice Center for Engineering Leadership, SCREECH Competition, Houston, TX, 2013. (Selected as “Best Presenter in Group”)

“Interpolatory frameworks for model reduction,” Rice Computational and Applied Mathematics Graduate Seminar, Houston, TX, 2013.

“Model reduction of inhomogeneous initial conditions,” Layman Undergraduate Research Competition, Blacksburg, VA, 2011.

Teaching Experience

Tufts University, Mathematics Department; Medford, MA

MATH 150: Constrained Optimization, *Instructor of Record*, Spring 2018

MATH 070: Linear Algebra, *Instructor of Record*, Spring 2018

MATH 087: Mathematical Modeling and Computation, *Instructor of Record*, Fall 2017

MATH 032: Calculus I, *Recitation Instructor* (3 sections), Fall 2017

Rice University, Computational and Applied Mathematics Department; Houston, TX

CAAM 335: Matrix Analysis, *Instructor of Record*, Fall 2016

CAAM 335: Matrix Analysis, *Instructor of Record*, Fall 2015

CAAM 336: Differential Equations in Science and Engineering, *Teaching Assistant*, Spring 2015

CAAM 335: Matrix Analysis, *Teaching Assistant*, Fall 2014

CAAM 554: Numerical Analysis II, *Grader*, Spring 2014

CAAM 501: Analysis I, *Grader*, Fall 2013

Virginia Tech, Mathematics Department; Blacksburg, VA

MATH 2984H: Mathematics in a Computational Context, *Teaching Assistant*, Spring 2013

MATH 1206: Calculus II, *Instructor of Record*, Fall 2012

MATH 2224: Multivariable Calculus, *Instructor of Record*, Summer 2012

MATH 1224: Vector Geometry, *Recitation Teaching Assistant*, Fall 2011

Professional Service

Schlumberger-Tufts Computational and Applied Mathematics Seminar

Co-Organizer (2017 - 2018): Selected seminar speakers to present computational and applied mathematics research relevant to petroleum engineering

Richard Tapia Center for Excellence & Equity Summer Camp; Houston, TX

Lead Instructor of Mathematics (2017): Trained and supervised eight instructors for a summer mathematics camp for high school students from underserved communities in Texas

Society for Industrial and Applied Mathematics, Rice Student Chapter; Houston, TX

President (2015 - 2016): Organized activities for faculty, graduate students and undergraduate students to meet and network with members in SIAM-related fields

Vice President (2014 - 2015): Formed academic panel to answer questions from graduate students and postdoctoral researchers on academic career paths in applied mathematics and affiliated fields

Rice Center for Engineering Leadership, Rice University; Houston, TX

Presentation Coach (2015 - 2016): Coached undergraduates in written, oral and visual communication for class projects and senior design presentations

Other Experience

Student Managed Endowment Fund for Educational Development, Virginia Tech; Blacksburg, VA

Derivative Investments Manager (2009 - 2010): Developed and reported monthly portfolio risk analytics

Co-Chief Executive Officer (2008 - 2009): Managed \$5.0 million student-run portfolio for Virginia Tech

Area Manager (2007 - 2008): Researched publicly traded securities in energy and materials sectors

Fortigent Wealth Management; Rockville, MD

Research Intern (2007): Evaluated and selected equity portfolio managers for high net worth clients

Honors and Awards

Recognition for Outstanding Efforts and Accomplishments on behalf of SIAM Student Chapter, 2016

ExxonMobil K2I High Performance Computing Graduate Fellowship, 2015 - 2016

BP K2I High Performance Computing Graduate Fellowship, 2014 - 2015

National Science Foundation Graduate Research Fellowship, Honorable Mention, 2013

Rice Center for Engineering Leadership SCREECH Competition, "Best Presenter in Group", 2013

Last updated: December 8, 2017