

# Jimmy Vogel

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## EDUCATION

**PhD in Applied Mathematics**

Purdue University, December 2018, GPA 3.74

Thesis: On the Structured Eigenvalue Problem: Methods, Analysis, and Applications

PhD Advisors: Jianlin Xia (Purdue Math) and V. Ragu Balakrishnan (Purdue ECE)

**BS in Physics**

University of Michigan, May 2013, GPA 3.39

## RESEARCH INTERESTS

numerical linear algebra, optimization, computational physics

## EMPLOYMENT

**Research Mathematician**, Systems & Technology Research (August 2018 - present)

**Graduate Fellow**, Purdue College of Science (May 2017 - July 2017)

**R&D Intern**, Sandia National Lab., Comp. Structural Dynamics (May 2016 - April 2017)

**Research Assistant**, Purdue College of Electrical Engineering (August 2013 - April 2016)

**Teaching Assistant**, University of Michigan Math Department (September 2011 - April 2013)

## AWARDS / PRIZES

[1] "SIAM Student Travel Award," (\$850) to the SIAM Meeting on Parallel Programming, March 7-10, 2018, Tokyo, Japan

[2] "Cagiantas Dissertation Fellowship," (\$25,000 stipend and \$35,000 in tuition/fees/insurance support), Purdue College of Science, June 2017 - May 2018

[3] "Above and Beyond Award," Purdue Graduate Student Government (PGSG), in recognition of dedication to PGSG and service to the Purdue graduate student community, April 2017

[4] "SIAM Student Travel Award," (\$650) to the SIAM Meeting on Computational Science and Engineering, February 27 - March 3, 2017, Atlanta, GA

[5] "Outstanding presentation competition- 2nd place," SIAM-Purdue Student CS&E Conference, West Lafayette, IN, April 8, 2016

[6] "SIAM Student Travel Award," (\$859) to the SIAM Meeting on Applied Linear Algebra, October 26-30, 2015, Atlanta, GA

[7] "Outstanding presentation competition- honorable mention," Young Mathematicians Conference, July 27- July 29, 2012, Columbus, OH

## PAPERS

- [1] “A superfast divide-and-conquer method and approximation accuracy for structured eigenvalue solutions,” with J. Xia, S. Cauley, and V. Balakrishnan, *SIAM Journal on Scientific Computing*, 38 (2016), pp. A1358-A1382.

### Submitted

- [2] “On fast multi-rank updates to the symmetric eigenvalue problems,” with J. Xia, J. Moussa, and V. Balakrishnan, submitted to *SIAM Journal on Matrix Analysis*.
- [3] “Superfast divide-and-conquer method for structured eigenvalue decompositions,” with J. Xia, Z. Xin, S. Cauley, and V. Balakrishnan, submitted to *SIAM Review*.

### To Submit Shortly

- [4] “A fast and stable divide-and-conquer SVD with applications to data science,” with M. James, J. Xia, and V. Balakrishnan, preprint.
- [5] “Analysis of structured second order optimization methods via hierarchical matrices,” with J. Xia, and V. Balakrishnan, preprint.
- [6] “Fast solvers for multi-shifted PDEs, with J. Xia and V. Balakrishnan, preprint.
- [7] “Fast and stable algorithms for rank-structured approximations to the algebraic Riccati equations,” with J. Xia and V. Balakrishnan, preprint.
- [8] “Refined perturbation and stability analysis for structured eigenvalue problems,” with J. Xia and V. Balakrishnan, preprint.

## TALKS

### Invited Presentations

- [1] “Generalizations to the Superfast Divide-and-Conquer Eigenvalue Algorithm,” at the SIAM CS&E Conference, Spokane, WA, February 25 - March 1, 2019
- [2] “Generalizations to the Superfast Divide-and-Conquer Eigenvalue Algorithm,” at the SIAM Conference on Parallel Processing for Parallel Computing, Tokyo, Japan, March 7-10, 2018
- [3] “A Superfast Multi-Rank Eigenvalue Update: Algorithm, Analysis, and Applications,” (July 24, 2017), at the Meeting of the International Linear Algebra Society, Ames, IA, July 24-28, 2017
- [4] “Accelerating Parallel Optimization Methods with Hierarchical Matrix Computations,” (March 2, 2017), at the SIAM CS&E Conference, Atlanta, GA, February 27 - March 3, 2017
- [5] “A Superfast Multi-Rank Eigenvalue Update: Algorithm, Analysis, and Applications,” (July 11, 2016), at the SIAM Annual Meeting Boston, MA, July 11-15, 2016
- [6] “Near-Linear Time Eigendecomposition and SVD Algorithms.” (October 30, 2015), at the SIAM Conference on Applied Linear Algebra, Atlanta, GA, October 26 - October 30, 2015

- [7] “Superfast Divide-and-Conquer Eigensolvers.” (October 4, 2015),  
at the AMS Midwest Sectional Meeting Fall 2015, Chicago, IL,  
October 2 - October 4, 2015
- [8] “Superfast Divide-and-Conquer Eigensolvers.” (August 29, 2015),  
at Mathematical Foundations for Fast Multi-Resolution Interactions and Analysis,  
Durham, NC, August 28 - August 29, 2015
- [9] “A Superfast Divide-and-Conquer Algorithm for Structured Eigenvalue Solutions.”  
(July 9, 2014), at the SIAM Annual Meeting, Chicago, IL, July 7 - July 11, 2014

#### Contributed Talks

- [10] “Eigenvalue Optimization and Precision Medicine.” (November 11, 2017).  
at Purdue University Graduate Student Research Day, West Lafayette, IN
- [12] “Hierarchical Matrices and Control Theory.” (November 3, 2017)  
at Mid-Atlantic Numerical Analysis Day, Philadelphia, PA, October 3, 2017
- [12] “A Fast Multi-Rank Update to the Symmetric Eigenvalue Problem.” (April 23, 2016),  
at Midwest Numerical Analysis Day, La Crosse, WI, April 23, 2016
- [13] “A Fast Multi-Rank Update to the Symmetric Eigenvalue Problem.” (April 8, 2016).  
at SIAM-Purdue Student CS&E Conference, West Lafayette, IN, April 8, 2016
- [14] “Challenging Eigenvalue Problems” (November 14, 2015),  
at Purdue University Graduate Student Research Day.” West Lafayette, IN
- [15] “A Near-Linear Complexity SVD Algorithm.” (April 25, 2015),  
at Midwest Numerical Analysis Day, Dayton, OH, April 25, 2015
- [16] “A Near-Linear Complexity SVD Algorithm.” (November 22, 2014),  
at Purdue University Graduate Student Research Day, West Lafayette, IN
- [17] “A Superfast Divide-and-Conquer Algorithm for Structured Eigenvalue Solutions.”  
(May 3, 2014), at Midwest Numerical Analysis Day, Milwaukee, WI, May 3, 2014
- [18] “The Damped Navier-Stokes Equation for Image Inpainting.” (July 29, 2012),  
at the Young Mathematicians Conference, Columbus, OH, July 27- July 29, 2012

#### Local Seminars

- [19] “A Superfast Multi-Rank Update to the Symmetric Eigenvalue Problem” (March 8, 2017),  
at Purdue Numerical Linear Algebra Student Seminar (PUNLAG), West Lafayette, IN,
- [20] “Chordal Graph Theory and Semidefinite Optimization” (February 15, 2017),  
at Purdue University Department of Mathematics Student Colloq., West Lafayette, IN
- [21] “A Mathematician’s Introduction to Quantum Computing” (August 31, 2016),  
at Purdue University Department of Mathematics Student Colloq., West Lafayette, IN
- [22] “Superfast Divide-and-Conquer Eigensolvers” (June 21, 2016),  
Sandia Seminar, Albuquerque, NM
- [23] “An Introduction to Randomized Linear Algebra” (November 2, 2015),  
at Purdue University Department of Mathematics Student Colloq., West Lafayette, IN

- [24] “Superfast Divide-and-Conquer Eigensolvers.” (September 11, 2015),  
at Purdue University Center for Computational and Applied Mathematics (CCAM)  
Lunch Seminar, West Lafayette, IN
- [25] “A Friendly Introduction to Numerical Optimization.” (August 31, 2015),  
at Purdue University Department of Mathematics Student Colloq., West Lafayette, IN
- [26] “Fast Solvers for the HSS Eigenvalue Problem.” (February 23, 2015),  
at Purdue Numerical Linear Algebra Student Seminar (PUNLAG), West Lafayette, IN,
- [27] “Fast Solvers for HSS Linear Systems.” (February 16, 2015),  
at Purdue Numerical Linear Algebra Student Seminar (PUNLAG), West Lafayette, IN,
- [28] “An Introduction to Rank Structured Matrices.” (February 9, 2015),  
at Purdue Numerical Linear Algebra Student Seminar (PUNLAG), West Lafayette, IN,
- [29] “How Eigenvalues are Actually Computed.” (December 3, 2014),  
at Purdue University Department of Mathematics Student Colloq., West Lafayette, IN
- [30] “HSS Matrices and the Rank-Structured Eigenvalue Problem.” (April 23, 2014),  
at Purdue Numerical Linear Algebra Student Seminar (PUNLAG), West Lafayette, IN
- [31] “The Damped Navier-Stokes Equation for Image Inpainting.” (June 27, 2012)  
at the University of Michigan Math REU Symposium, Ann Arbor, MI

## **WORKSHOPS ATTENDED**

- [1] Strategic Doing 301: Leading Complex Collaborations, June 1-3, 2017, West Lafayette, IN
- [2] Workshop on Fast Direct Solvers, November 12-13, 2016, West Lafayette, IN
- [3] D-Wave Quantum Computing Tutorial, June 9, 2016, Los Alamos, NM
- [4] Parametrized Reduced Order Modeling Workshop, June 1-2, 2016, Albuquerque, NM
- [5] SIAM  $G^2S^3$  Randomization in Numerical Lin. Alg., June 15 - June 26, 2015. Delphi, Greece
- [6] CBMS-NSF Fast Direct Solvers for Elliptic PDEs. June 23 - June 29, 2014. Hannover, NH

## **JOURNAL REFEREE ACTIVITY**

Computational Optimization and Applications (Springer)

## **MEMBERSHIPS**

International Linear Algebra Society (ILAS)

Society for Industrial and Applied Mathematics (SIAM)

## **COMPUTER PROGRAMMING**

Matlab, Fortran, MPI, Open MP, C, C++, Python

## **FOREIGN LANGUAGES**

Fluent: Spanish

Translation Only: French, Latin

## LEADERSHIP/ORGANIZATIONAL DUTIES

### Society of Industrial and Applied Mathematics

- [1] Vice President, Purdue Student Chapter of SIAM, (2016-2018)
  - Organizer for SIAM-Purdue Student CS&E Conference, April 14, 2017
  - Organizer for SIAM-Purdue Linear Algebra Activity Group, 2016-2018
- [2] Mini-symposium organizer, "Structured Matrices and Applications," SIAM Conference on Applied Linear Algebra, Atlanta, GA, October 26 - October 30, 2015, co-organized with Haizhao Yang
- [3] Session chair, "Imaging Science," SIAM Annual Meeting, Boston, MA, July 11-16, 2016

### International Linear Algebra Society

- [4] Mini-symposium organizer, "Recent Advancements in Numerical Methods for Eigenvalue Computation," Meeting of the International Linear Algebra Society, Ames, IA, July 24-28, 2017, co-organized with Xin Ye

### Purdue Math Department

- [5] Graduate Student Representative, Purdue University Dept. of Mathematics, (2015-2016)
  - Planned and led first year PhD student orientation week
  - Planned and led prospective PhD student visit weekend
  - Organized several social events for PhD students (oversaw budget of \$4000)
  - Led bi-annual town halls and reported student comments and complaints to administration
  - Oversaw nominations and voting for bi-annual student-invited speaker lecture series
- [6] Seminar organizer, "Student Colloquium," Purdue University Department of Mathematics,
  - Fall 2016 Semester, organizer
  - Spring 2016 Semester, co-organized with Alejandra Gaitan
  - Fall 2015 Semester, co-organized with Ellen Weld
  - Spring 2017 Semester, co-organized with Ellen Weld
- [7] Seminar organizer, "Bridge to Research," Purdue University Department of Mathematics, Spring 2016 Semester, co-organized with Ellen Weld
- [8] Event organizer, "Graduate Student Research Day," Purdue University Department of Mathematics, November 21, 2015

### Purdue Graduate Student Government (PGSG)

- [9] PGSG Treasurer (2017-2018)
  - Oversaw budget of over \$300,000
  - Made monthly budget reports and recommendations on budget re-allocations to senate
  - Handled all reimbursements and disbursements of funds
- [10] Planning Committee, PGSG Grad Student Mental Health Awareness Week (2017-2018)
- [11] PGSG Capital Improvement Fund Allocation Committee Member (2017-2018)
- [12] Senator, Purdue Grad Student Senate, representing Math Dept., (2016-2017)
- [13] PGSG Senate Clerk (2016-2017)

- [14] PGSG Grant Review and Allocation Committee (GRAC)  
Committee vice-chair (2016-2017)  
Committee member (2016-2017)
- [15] Purdue Grade Appeal Committee Member (2016-2017)
- [16] Bills/Documentation Authored:
  - (a) FA17-R003, "Evaluation of Graduate Student Instructors," co-authored with Melissa James, resolution that condemns how the most common metrics used to evaluate graduate student instructors at Purdue are known to be biased towards women, racial minorities, and non-native English speakers according to many studies and suggests alternative methods for evaluation; passed by 32-0-5 senate vote (November 2017)
  - (b) FA17-B001, "Fall 2017 Budget Surplus Reallocation," recommended re-allocating \$14,000 in surplus funds to several new initiatives proposed by fellow grad students including marketing strategies, a mental health awareness week, and a symposium grant for student-led research conferences passed by unanimous senate vote (August 2017)
  - (c) "Purdue Graduate Student Government Financial Handbook 2017-2018 Academic Year," first annual comprehensive document with all rules, regulations, and procedures for PGSG finances, approved by unanimous executive board vote (July 2017)

## **CITIZENSHIP**

USA

born: San Diego, CA, USA, 1991

hometown (1995-2009): St. Paul, MN, USA