

# Anil Damle

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## Education

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**Stanford University** **9/2011 - 6/2016**

Ph.D. Computational and Mathematical Engineering

Thesis title: Sparse representations and fast algorithms for Kohn-Sham orbitals

Adviser: Lexing Ying

**University of Colorado Boulder** **8/2006 - 5/2011**

M.S. Applied Mathematics

Thesis title: Near optimal rational approximations of large data sets

Adviser: Gregory Beylkin

B.S. Applied Mathematics / Electrical and Computer Engineering  
Engineering Honors Program

## Current position

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**Cornell University** **7/2017 -**

Assistant Professor, Department of Computer Science

Field membership: Computer Science, Applied Mathematics, Mathematics, Physics, and Computational Science and Engineering

## Prior positions

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**University of California, Berkeley** **7/2016 - 7/2017**

NSF Postdoctoral Fellow, Department of Mathematics

## Submitted preprints

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Kangbo Li, Anil Damle “Automating Variational Differentiation” *arXiv preprints*, arXiv:2406.16154, 2024

Megan Flynn, Alexander Wang, Dean Edward Alvarez, Christopher De Sa, and Anil Damle “STAT: Shrinking Transformers After Training,” *arXiv preprints*, arXiv:2406.00061, 2024

Anil Damle, Silke Glas, Alex Townsend, Annan Yu “How to reveal the rank of a matrix?” *arXiv preprints*, arXiv:2405.04330, 2024

Robin Armstrong, Alex Buzali, and Anil Damle “Structure-aware Analyses and Algorithms for Interpolative Decompositions,” *arXiv preprints*, arXiv:2310.09452, 2023

John Paul Ryan and Anil Damle “Linear Time Kernel Matrix Approximation via Hyperspherical Harmonics,” *arXiv preprints*, arXiv:2202.03655, 2022

Austin R. Benson, Anil Damle, and Alex Townsend “Over-parametrized neural networks as under-determined linear systems,” *arXiv preprints*, arXiv:2010.15959, 2020

Vasileios Charisopoulos, Austin R. Benson, and Anil Damle “Incrementally Updated Spectral Embeddings,” *arXiv preprints*, arXiv:1909.01188, 2019

## Journal Publications

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Kangbo Li, Hsin-Yu Ko, Robert A DiStasio Jr, and Anil Damle “Unambiguous and robust formulation for Wannier localization,” *Physical Review B* 110, 085127, 2024

Wenyun Zuo, Anil Damle, and Shripad D Tuljapurkar “Sensitivity and uncertainty in the Lee-Carter mortality model,” *International Journal of Forecasting*, 2024

Eric Fuemmeler, Anil Damle, Robert DiStasio “Selected Columns of the Density Matrix in an Atomic Orbital Basis I: An Intrinsic and Non-Iterative Orbital Localization Scheme for the Occupied Space,” *Journal of Chemical Theory and Computation* 19 (23), 2023

Heather Wilber, Anil Damle, and Alex Townsend “Data-driven Algorithms for signal processing with rational functions,” *SIAM Journal on Scientific Computing* 44 (3), C185-C209, 2022

Vasileios Charisopoulos, Austin R. Benson, and Anil Damle “Communication-efficient distributed eigenspace estimation,” *SIAM Journal on Mathematics of Data Science* 3 (4), 1067-1092, 2021

John Paul Ryan and Anil Damle “Parallel Skeletonization for Integral Equations in Evolving Multiply-Connected Domains,” *SIAM Journal on Scientific Computing* 43 (3), A2320-A2351, 2021

Anil Damle, and Yuekai Sun “Uniform bounds for invariant subspace perturbations,” *SIAM Journal on Matrix Analysis and Applications* 41 (3), 1208–1236, 2020

Thomas Reeves, Anil Damle, and Austin R. Benson “Network Interpolation,” *SIAM Journal on Mathematics of Data Science* 2 (2), 505–528, 2020

Anil Damle, Antoine Levitt, and Lin Lin “Variational formulation for Wannier functions with entangled band structure,” *SIAM Multiscale Modeling and Simulation* 17 (1), 167-191, 2019

Anil Damle, Victor Minden, and Lexing Ying “Simple, direct and efficient multi-way spectral clustering,” *Information and Inference: a Journal of the IMA* 8 (1), 2019

Anil Damle and Lin Lin “Disentanglement via entanglement: A unified method for Wannier localization,” *SIAM Multiscale Modeling and Simulation* 16 (3), 1392-1410, 2018

Victor Minden, Kenneth L. Ho, Anil Damle, Lexing Ying “A recursive skeletonization factorization based on strong admissibility,” *SIAM Multiscale Modeling and Simulation* 15 (2), 2017

Anil Damle, Lin Lin and Lexing Ying “Computing Localized Representations of the Kohn–Sham Subspace Via Randomization and Refinement,” *SIAM Journal on Scientific Computing* 39 (6), 2017

Victor Minden, Anil Damle, Kenneth Ho and Lexing Ying “Fast spatial Gaussian process maximum likelihood estimation via skeletonization factorizations,” *SIAM Multiscale Modeling and Simulation* 15 (4), 2017

Anil Damle, Lin Lin and Lexing Ying “SCDM-k: Localized orbitals for solids via selected columns of the density matrix,” *Journal of Computational Physics* 334 (1), 2017

Anil Damle and Yuekai Sun “A geometric approach to archetypal analysis and non-negative matrix factorization,” *Technometrics* 59 (3), 2017

Victor Minden, Anil Damle, Kenneth Ho and Lexing Ying “A technique for updating hierarchical skeletonization-based factorizations of integral operators,” *SIAM Multiscale Modeling and Simulation* 14 (1), 2016

Anil Damle, Lin Lin and Lexing Ying “Compressed representation of Kohn-Sham orbitals via selected columns of the density matrix,” *Journal of Chemical Theory and Computation* 11 (4), 2015

Anil Damle, Lin Lin and Lexing Ying, “Pole expansion for solving a type of parametrized linear systems in electronic structure calculations,” *SIAM Journal on Scientific Computing* 36 (6), 2014

Anil Damle, Gregory Beylkin, Terry Haut and Lucas Monzón, “Near optimal rational approximations of large data sets”, *Applied and Computational Harmonic Analysis* 35 (2), 2013

## Conferences with Proceedings

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Jerry Chee, Megan Flynn (née Renz), Anil Damle, and Chris De Sa “Model Preserving Compression for Neural Networks,” *Advances in Neural Information Processing Systems* (35), 2022

Vasileios Charisopoulos and Anil Damle “Communication-efficient distributed eigenspace estimation with arbitrary node failures,” *Advances in Neural Information Processing Systems* (35), 2022

John Paul Ryan, Sebastian Ament, Carla P Gomes, and Anil Damle “The Fast Kernel Transform,” *Proceedings of The 25th International Conference on Artificial Intelligence and Statistics* PMLR 151:11669-11690, 2022.

Vasileios Charisopoulos, Austin R. Benson, and Anil Damle “Entrywise convergence of iterative methods for eigenproblems,” *Advances in Neural Information Processing Systems* (33), 2020

Geoff Pleiss, Martin Jankowiak, David Eriksson, Anil Damle, Jacob R. Gardner “Fast matrix square roots with applications to Gaussian processes and Bayesian optimization,” *Advances in Neural Information Processing Systems* (33), 2020

Matanya B. Horowitz, Anil Damle and Joel W. Burdick, “Linear Hamilton Jacobi Bellman equations in high dimensions,” *Proceedings Conference on Decision and Control*, Los Angeles, CA, pp. 5880-5887, Dec. 2014

Anil Damle and Lucy Y. Pao. “Simultaneous numerical optimization for data association and parameter estimation,” *Proceedings Joint IEEE Conference on Decision and Control and European Control Conference*, Orlando, FL, pp. 7800-7805, Dec. 2011

## Talks

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SIAM Conference on Applied Linear Algebra, Paris (May 2024)

Applied Math Seminar, UC Berkeley (March 2024)

Applied Math Seminar, University of Toronto (March 2024)

CCM seminar, Flatiron Institute (December 2023)

ICIAM 2023, Tokyo (August 2023)

Numerical Analysis in the 21st Century, Oxford (August 2023)

30 years of Acta Numerica, virtual (June 2022)

Householder Symposium XXI, Selva di Fasano (June 2022)

Model Reduction in Quantum Mechanics, UCLA (April 2022)

SIAM Conference on Applied Linear Algebra, Virtual (May 2021)

University of Chicago Applied Math Colloquium, Virtual (October 2020)

Oxford Numerical Analysis Seminar, Virtual (April 2020)

Wannier90 v3.0: new features and applications, Virtual (March 2020)

SCAN Seminar, Cornell University (January 2020)

Joint ATD + AMPS Annual Workshop, Washington (October 2019)

Cornell Center for Applied Math Colloquium, Cornell (September 2019)

International Congress on Industrial and Applied Mathematics, Valencia (July 2019)

International Congress on Industrial and Applied Mathematics, Valencia (July 2019)

Linear Algebra and Optimization Seminar, Stanford (May 2019)

Cornell Center for Applied Math Colloquium, Cornell (September 2018)

SIAM Conference on Mathematical Aspects of Materials Science, Portland (July 2018)

SIAM Conference on Applied Linear Algebra, Hong Kong (May 2018)

Workshop on Mathematical Methods in Quantum Chemistry, Oberwolfach (March 2018)

CSoI seminar, Purdue University (November 2017)

SCAN seminar, Cornell University (September 2017)

CS Brown Bag seminar, Cornell University (August 2017)

SIAM Annual Meeting, Pittsburgh (July 2017)  
Householder Symposium XX, Virginia Tech (June 2017)  
Applied Mathematics and Analysis Seminar, Duke University (October 2016)  
SIAM Annual Meeting, Boston (July 2016)  
SIAM Conference on Mathematical Aspects of Materials Science, Philadelphia (May 2016)  
Linear Algebra and Optimization Seminar, Stanford (April 2016)  
Joint Annual Meeting of GAMM and DMV, Braunschweig (March 2016)  
Computer Science Colloquium, Cornell University (February 2016)  
SIAM Conference on Applied Linear Algebra, Atlanta (October 2015)  
Applied Math Seminar, University of California Berkeley (September 2015)  
International Congress on Industrial and Applied Mathematics, Beijing (August 2015)  
Applied Math Seminar, Stanford University (April 2015)  
Bay Area Scientific Computing Day, Stanford University (December 2014)  
Lawrence Berkeley National Lab (April 2014)

## Awards

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### **Excellence in Teaching and Advising Award 2022**

Cornell University, Bowers CIS

### **James and Mary Tien Excellence in Teaching Award, 2021**

Cornell University, College of Engineering

### **Jack Youden Prize for Best Expository Paper, 2017**

Technometrics

### **Gene Golub Doctoral Dissertation Award, 2016**

Stanford University, ICME

### **Postdoctoral Fellowship in Mathematical Sciences, 2016**

National Science Foundation

### **Gerald J. Lieberman Fellowship, 2015**

Stanford University

*“The Lieberman Fellowship recognizes doctoral students who have demonstrated broad potential for leadership in academia.”*

### **Simons Foundation Math+X Graduate Assistantship, 2014**

Stanford University, Math+X

### **Teaching Assistant Award, 2014**

Stanford University, ICME

### **Student Leadership Award, 2013**

Stanford University, ICME

### **Graduate Research Fellowship, 2011**

National Science Foundation

## **Graduate students**

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### **PhD committee chair (current)**

Robin Armstrong, Applied Mathematics

Mai Huynh, Applied Mathematics

Megan Flynn, Physics

### **PhD committee chair (graduated)**

John Ryan, Computer Science

Thesis: Fast Kernel Matrix Approximations by Series Expansions

Kangbo Li, Computer Science

Thesis: The Theory of Combinatory Differentiation and Locality in Quantum Chemistry

### **MS committee chair (graduated)**

Abhay Singh, Computer Science

Thesis: Algorithmic Considerations for Spectral Clustering, and Learning Graphs from Labeled Data

## **Cornell Teaching**

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CS 4220 / MATH 4260 / CS 5223: Numerical Analysis: Linear and Nonlinear Problems (Spring 2024; 78 students)

CS 7290 / MATH 7290: Scientific Computing Seminar (Spring 2024; 13 students)

CS 6210: Matrix Computations (Fall 2023; 24 students)

CS 7340: Special Topics in Technology and Society (Fall 2023; 6 students)

CS 7290 / MATH 7290: Scientific Computing Seminar (Fall 2023; 9 students)

CS 7290 / MATH 7290: Scientific Computing Seminar (Spring 2023; 12 students)

CS 4/5780: Introduction to Machine Learning (Fall 2022; 364 students)

CS 7290 / MATH 7290: Scientific Computing Seminar (Fall 2022; 8 students)

CS 6210: Matrix Computations (Spring 2022; 34 students)

CS 7290 / MATH 7290: Scientific Computing Seminar (Spring 2022; 8 students)

CS 4/5780: Introduction to Machine Learning (Fall 2021; 367 students)

CS 7290 / MATH 7290: Scientific Computing Seminar (Fall 2021; 6 students)

CS 6220: Data-sparse Matrix Computations (Spring 2021; 6 students)

CS 7290 / MATH 7290: Scientific Computing Seminar (Spring 2021; 12 students)

CS 3220: Computational Mathematics for Computer Science (Fall 2020; 26 students)  
 CS 7290 / MATH 7290: Scientific Computing Seminar (Fall 2020; 16 students)  
 CS 6220: Data-sparse Matrix Computations (Spring 2020; 27 students)  
 CS 7290 / MATH 7290: Scientific Computing Seminar (Spring 2020; 11 students)  
 CS 3220: Computational Mathematics for Computer Science (Fall 2019; 25 students)  
 CS 7290 / MATH 7290: Scientific Computing Seminar (Fall 2019; 12 students)  
 CS 4220 / MATH 4260: Numerical Analysis: Linear and Nonlinear Problems (Spring 2019; 74 students)  
 CS 7290 / MATH 7290: Scientific Computing Seminar (Spring 2019; 6 students)  
 CS 6210: Matrix Computations (Fall 2018; 38 students)  
 CS 7290 / MATH 7290: Scientific Computing Seminar (Fall 2018; 8 students)  
 CS 4220 / MATH 4260: Numerical Analysis: Linear and Nonlinear Problems (Spring 2018; 63 students)  
 CS 6220: Data-sparse Matrix Computations (Fall 2017; 29 students)

## Service

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### Professional society memberships

Society for Industrial and Applied Mathematics; Association for Computing Machinery

### Householder Symposium XXII

*Chair, local organizing committee*

*Summer 2025*

### BIRS Workshop on Challenges, Opportunities, and New Horizons in Rational Approximation

*Co-organizer*

*Spring 2025*

### Cornell Center for Applied Mathematics

Cornell University

*First year programming committee*

*AY 2024-2025*

### Cornell Center for Applied Mathematics

Cornell University

*PhD admissions committee*

*AY 2017-2018, 2018-2019, and 2023-2024*

### Cornell Computer Science Department

Cornell University

*Lecturer hiring committee*

*AY 2023-2024*

### Cornell SCAN seminar co-organizer

Cornell University

*Co-organizer*

*Fall 2018 –*

### Cornell Computer Science Department

Cornell University

*Graduate Distinction Committee*

*Summer 2021 –*

<b>Cornell Computer Science Department</b>	Cornell University
<i>PhD admissions committee</i>	<i>AY 2020-2021, 2021-2022, and 2022-2023</i>
<b>Cornell Computer Science Department</b>	Cornell University
<i>Recruiting committee</i>	<i>AY 2022-2023</i>
<b>Cornell Center for Applied Mathematics</b>	Cornell University
<i>Colloquium committee</i>	<i>AY 2021-2022</i>
<b>Cornell Computer Science Department</b>	Cornell University
<i>Colloquium committee</i>	<i>Fall 2018 and Fall 2019</i>
<b>Cornell Computer Science Department</b>	Cornell University
<i>PhD requirements committee</i>	<i>Spring 2018</i>

### **Reviewer**

Information and Inference: A Journal of the IMA, ICML, ICLR, NeurIPS, NeurIPS Area Chair, SIAM Journal on Scientific Computing, SIAM Journal on Matrix Analysis and Applications, Applied and Computational Harmonic Analysis, Communications on Mathematical sciences, Journal of Computational Physics, Journal of Machine Learning Research, SIAM book proposals, Springer book proposals, Cambridge University Press book proposals, Journal of Chemical Theory and Computation, Advances in Computational Mathematics, SIAM Journal on Mathematics of Data Science, SIAM/ASA Journal on Uncertainty Quantification, Physica Status Solidi B: Basic Solid State Physics, Journal of Computational Chemistry, Physical Review B, and Reviews of Modern Physics.

### **Minisymposium (co-)organizer**

SIAM Conference on Applied Linear Algebra 2018, SIAM Conference on Mathematics of Data Science 2020, SIAM Annual Meeting 2020