

# JOEL A. TROPP

*curriculum vitae*

## CONTACT INFORMATION

**Title:** Steele Family Professor of Applied & Computational Mathematics  
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California Institute of Technology  
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## EDUCATIONAL BACKGROUND

### **PhD in Computational and Applied Mathematics**

Univ. Texas at Austin, Aug. 2004

Dissertation Title: *Topics in Sparse Approximation*. Advisors: I. S. Dhillon and A. C. Gilbert.

### **MS in Computational and Applied Mathematics**

Univ. Texas at Austin, May 2001

### **BS in Mathematics** with Special Honors

### **BA in Plan II Liberal Arts Honors**

Graduated *magna cum laude* with concentrations in **Computer Science** and **Latin**

Univ. Texas at Austin, May 1999

Senior Thesis Title: *Infinitesimals: History and Application*. Advisor: J. L. Bona.

## ACADEMIC POSITIONS

### **Steele Family Professor of Applied & Computational Mathematics**

Division of Engineering and Applied Science, Caltech, May 2017–Present

### **Professor of Applied & Computational Mathematics**

Division of Engineering and Applied Science, Caltech, Mar. 2012–April 2017

### **Assistant Professor of Applied & Computational Mathematics**

Division of Engineering and Applied Science, Caltech, Aug. 2007–Feb. 2012

### **T. H. Hildebrandt Research Assistant Professor and NSF Postdoctoral Fellow**

Mathematics Dept., Univ. Michigan at Ann Arbor, Sep. 2005–July 2007

### **Research Assistant Professor**

Mathematics Dept., Univ. Michigan at Ann Arbor, Sep. 2004–Aug. 2005

## SELECTED HONORS AND AWARDS

Thomson Reuters Highly Cited Researcher in Computer Science, 2014, 2015, and 2016

IMA Information & Inference Best Paper Award, 2015

SPIE Compressive Sampling Pioneer Award, 2015

SIAM Invited Address at the Joint Mathematical Meetings, 2015

November 2012 Caltech Academics and Research Committee (ARC) Professor of the Month  
SIAM 2011 Outstanding Paper Prize  
German–American Kavli Frontiers of Science Fellow, 2011  
Eighth Monroe H. Martin Prize, 2011  
EUSIPCO Best Paper Award, 2010  
Alfred P. Sloan Research Fellowship, 2010  
Sixth Vasil A. Popov Prize, 2010  
2008 Presidential Early Career Award for Scientists and Engineers (PECASE), presented Jan. 2010  
The Associated Students of Caltech (ASCIT) 32nd Annual Award for Excellence in Teaching, 2008  
ONR Young Investigator Program (YIP) grant, 2008  
NSF Mathematical Sciences Postdoctoral Research Fellowship, 2005  
NSF Graduate Fellowship (Applied Mathematics), 2000  
Computational and Applied Mathematics Graduate Fellowship, Univ. Texas at Austin, 1999  
Barry M. Goldwater Natural Sciences Scholarship, 1998  
Phi Beta Kappa, 1997

## PRODUCTS OF SCHOLARLY ACTIVITY

Lists of research publications and presentations are available separately.

## COURSES TAUGHT

**Concentration Inequalities**, ACM 217, Caltech. Fall 2013 and Winter 2017.  
**Applied Real and Functional Analysis**, ACM 105, Caltech. Winter 2016.  
**Topics in Convexity: Matrix Analysis**, ACM 204, Caltech. Winter 2015.  
**Linear Algebra and Applied Operator Theory**, ACM 104, Caltech. Fall 2014 and Fall 2015.  
**Introduction to Probability and Random Processes with Applications**, ACM 116, Caltech. Fall 2012.  
**Introduction to Optimization**, ACM 113, Caltech. Winter 2011, Winter 2012, and Winter 2013.  
**Markov Chains, Discrete Stochastic Process, and Applications**, ACM 216, Caltech. Winter 2010, Winter 2011, and Spring 2012.  
**Methods of Applied Statistics and Data Analysis**, ACM/ESE 118, Caltech. Winter 2008 and Fall 2009.  
**Wavelets and Modern Signal Processing**, ACM 126ab, Caltech. Winter–Spring 2009.  
**Numerical Analysis of Wavelet Methods**, reading course, Univ. Michigan at Ann Arbor. Fall 2006.  
**Theory of Algorithms**, Math 416, Univ. Michigan at Ann Arbor. Fall 2006.  
**Introduction to Numerical Methods**, Math 471, Univ. Michigan at Ann Arbor. Fall 2005 and Fall 2006.  
**Introduction to Probability**, Math 425, Univ. Michigan at Ann Arbor. Fall 2005.  
**Calculus II**, Math 116, Univ. Michigan at Ann Arbor. Winter 2005.  
**Calculus I**, Math 115, Univ. Michigan at Ann Arbor. Fall 2004.

## RESEARCH SUPERVISION AND ADVISING

### POSTDOCTORAL SUPERVISION

Ke Wang, Postdoctoral Scholar, Caltech, Summer 2015–Summer 2016. Currently Research Asst. Prof., Hong Kong Univ. Science & Technology (HKUST).

Madeleine Udell, Center for Mathematics of Information (CMI) Postdoctoral Fellow, Caltech, Summer 2015–Summer 2016. Currently Asst. Prof. Operations Research and Information Engineering, Cornell Univ.

Brendan Ames, von Kármán Instructor, Caltech, Fall 2013–Summer 2014. Currently Asst. Prof. Mathematics at Univ. Alabama.

Michael B. McCoy, Postdoctoral Scholar, Caltech, Summer 2013–Spring 2014. Currently Full Stack Software Engineer at Qadium.

Rashad Moarref, Postdoctoral Scholar, Caltech, Winter 2012–Summer 2014. Supervised with Beverley McKeon.

Brendan Farrell, von Kármán Instructor, Caltech, Fall 2011–Summer 2013; Postdoctoral Scholar, Caltech, Fall 2013–Spring 2014. Currently Founder, HowLoud Inc.

Risi Kondor. CMI Postdoctoral Fellow, Caltech, Fall 2009–Summer 2011. Supervised with Andreas Krause. Currently Asst. Prof. Statistics at Univ. Chicago.

#### DOCTORAL ADVISING

John J. Bruer, Applied & Computational Mathematics, Caltech, January 2017.  
Dissertation title: *Recovering structured low-rank operators using nuclear norms.*

Richard Y. Chen, Applied & Computational Mathematics, Caltech, July 2016.  
Dissertation title: *Concentration inequalities of random matrices and solving ptychography with a convex relaxation.*

Alex Gittens, PhD Applied & Computational Mathematics, Caltech, June 2013.  
Dissertation title: *Topics in randomized numerical linear algebra.*  
Currently Asst. Prof. Computer Science, Rensselaer Polytechnic Institute.

Michael B. McCoy, PhD Applied & Computational Mathematics, Caltech, June 2013.  
Dissertation title: *A geometric analysis of convex demixing.*  
Currently Full Stack Software Engineer at Qadium.

Peter Stobbe, PhD Applied & Computational Mathematics, Caltech, June 2013. Supervised with Andreas Krause.  
Dissertation title: *Convex analysis for minimizing and learning submodular set functions.*  
Currently Quantitative Researcher at Optiver.

#### DOCTORAL COMMITTEES

Christos Thrampoulidis, PhD Electrical & Computer Engineering, Caltech 2016.  
Advisor: Babak Hassibi. Dissertation title: *Recovering structured signals in high dimensions via non-smooth convex optimization: Precise performance analysis.*

Kishore Jaganathan, PhD Electrical & Computer Engineering, Caltech 2016.  
Advisor: Babak Hassibi. Dissertation title: *Convex programming-based phase retrieval: Theory and applications.*

Krishna Shankar, PhD Mechanical & Civil Engineering, Caltech 2016.  
Advisor: J. Burdick. Dissertation title: *Kinematics and local motion planning for quasi-static whole-body mobile manipulation.*

Roarke Horstmeyer, PhD Electrical & Computer Engineering, Caltech 2015.  
Advisor: C. Yang. Dissertation title: *Computational microscopy: turning megapixels into gigapixels.*

Samet Oymak, PhD Electrical & Computer Engineering, Caltech, 2014.  
Advisor: B. Hassibi. Dissertation title: *Convex relaxation for low-dimensional representation: Phase transitions and limitations.*

Hyoung Jun Ahn, PhD Applied & Computational Mathematics, Caltech, 2014.  
Advisor: B. Hassibi. Dissertation title: *Random propagation in complex systems: Nonlinear matrix recursions and epidemic spread.*

Matthew Faulkner, PhD Computer Science, Caltech, 2014.  
Advisor: A. Krause. Dissertation title: *Community sense and response systems.*

Anastasios Zouzias, PhD Computer Science, Univ. Toronto, 2013.

Advisor: M. Braverman. Dissertation title: *Randomized primitives for linear algebra and applications*.

Juhwan Yoo, PhD Electrical & Computer Engineering, Caltech, 2012.

Advisor: B. Hassibi. Dissertation title: *Compressed sensing receivers: Theory, design and performance limits*.

Amin Khajehnejad, PhD Electrical & Computer Engineering, Caltech, 2012.

Advisor: B. Hassibi. Dissertation title: *Combinatorial regression and improved basis pursuit for sparse estimation*.

Svitlana Vyetrenko, PhD Applied & Computational Mathematics, Caltech, 2011.

Advisor: T. Ho. Dissertation title: *Network coding for error correction*.

Stephen Becker, PhD Applied & Computational Mathematics, Caltech, 2011.

Advisor: E. Candès. Dissertation title: *Practical Compressed Sensing: Modern Data Acquisition and Signal Processing*.

Yaniv Plan, PhD Applied & Computational Mathematics, Caltech, 2011.

Advisor: E. Candès. Dissertation title: *Compressed Sensing, Sparse Approximation, and Low-Rank Matrix Estimation*.

Weiyu Xu, PhD Electrical Engineering, Caltech, 2009.

Advisor: B. Hassibi. Dissertation title: *Compressive Sensing for Sparse Approximation: Constructions, Algorithms, and Analysis*.

Ali Vakili, PhD Electrical Engineering, Caltech, 2009.

Advisor: B. Hassibi. Dissertation title: *Randomized Matrix Recursions in Estimation, Control, and Adaptive Filtering*.

Paige Randall, PhD Applied & Computational Mathematics, Caltech, 2009.

Advisor: E. Candès. Dissertation title: *Sparse Recovery via Convex Optimization*.

Sarah Sweatlock, PhD Applied & Computational Mathematics, Caltech, 2008.

Advisor: R. McEliece. Dissertation title: *Asymptotic Weight Analysis of LDPC Code Ensembles*.

Julia Lipman, PhD Computer Science, Univ. Michigan at Ann Arbor, 2007.

Advisor: Q. Stout. Dissertation title: *Performance Analysis of Local Synchronization*.

## PROFESSIONAL SERVICE

### CURRENT UNIVERSITY ADMINISTRATION

Faculty Board Steering Committee, Caltech, Sep. 2016–Present.

Center for Data Driven Discovery (CDDD) Advisory Committee, Caltech, Jan. 2015–Present.

Faculty Board, elected member, Caltech, July 2012–June 2018.

### PAST UNIVERSITY ADMINISTRATION

Online Curriculum Committee, Caltech, July 2013–June 2016.

Faculty Search Committee in Computing & Mathematical Sciences (CMS), Chair, Caltech, Sep. 2015–June 2016.

Faculty Search Committee in Computing & Mathematical Sciences (CMS), Caltech, Oct. 2014–Aug. 2015.

Computing & Mathematical Sciences (CMS) Colloquium chair, Caltech, May 2014–June 2015.

Core Curriculum Steering Committee, Caltech, July 2013–June 2016.

Committee on Moore/Sloan Solicitation for Data Science Challenges, Caltech, Dec. 2012–Jan. 2013.

Faculty Search Committee in Computing & Mathematical Sciences (CMS), Caltech, Oct. 2012–Apr. 2013.

Faculty Search Committee in Applied & Computational Mathematics (ACM), Caltech, Jan. 2010–May 2012. Chair, Oct. 2011–May 2012.

Applied & Computational Mathematics (ACM) Colloquium chair, Caltech, May 2008–April 2014.

**OUTSIDE ADMINISTRATION**

AMS Short Course Subcommittee, Feb. 2016–Jan. 2019.

SIAM Council, Jan. 2016–Dec. 2019.

SIAM Council representative to SIAM Board, Jan. 2017–Dec. 2019.

**MEETINGS ORGANIZED**

Concentration inequalities and applications, Institut de Études Scientifique, Cargèse, May 2018.

Random Matrix Workshop, Foundations of Computational Mathematics, Barcelona, July 2017.

Information Theory and Concentration Phenomena, Institute for Mathematics and its Applications (IMA), University of Minnesota at Twin Cities, Minneapolis, Apr. 2015.

SIAM Minisymposium on Matrix Concentration Inequalities, Joint Mathematical Meetings (JMM), San Antonio, Jan. 2015.

Special session, “Advances in compressive sensing,” 10th Intl. Conf. Sampling Theory and Applications (SampTA 2013), Bremen, July 2013.

Systems, Information, Learning, and Optimization (SILO) Workshop, Madison, June 2013.

Sparse and Low-Rank Approximation Workshop, Banff International Research Station, Mar. 2011.

2006 Sparse Approximation Workshop, Princeton, Nov. 2006.

**TECHNICAL PROGRAM COMMITTEES**

2010 IEEE International Symposium on Information Theory (ISIT), 2010.

2007 IEEE Statistical Signal Processing Workshop, Madison, Aug. 2007.

**EDITORIAL BOARD MEMBERSHIPS**

*Applied and Computational Harmonic Analysis*, Sep. 2012–Present.

*Constructive Approximation*, Mar. 2011–Present.

*Journal of Fourier Analysis and Applications*, Jan. 2013–Present.

*SIAM Journal on Matrix Analysis and Applications*, Jan. 2013–Dec. 2018.

**REVIEWER FOR THE FOLLOWING JOURNALS**

*Advances in Adaptive Data Analysis*

*Alea*

*Annals of Statistics*

*Applied and Computational Harmonic Analysis*

*Constructive Approximation*

*EURASIP Journal of Signal Processing*

*Electronic Journal of Probability*

*Electronic Communications in Probability*

*Forum of Mathematics, Pi*

*Foundations and Trends in Machine Learning*

*Foundations of Computational Mathematics*

*IEEE Journal of Selected Topics in Signal Processing*

*IEEE Signal Processing Letters*

*IEEE Transactions on Information Theory*

*IEEE Transactions on Signal Processing*

*Journal of the Association for Computing Machinery*

*Journal of the American Mathematics Society*  
*Journal of Approximation Theory*  
*Journal of Fourier Analysis and Applications*  
*Journal of Functional Analysis*  
*Journal of Statistical Physics*  
*Mathematical Programming*  
*Numerische Mathematik*  
*Probability Theory and Related Fields*  
*Proceedings of the IEEE*  
*SIAM Journal on Imaging Sciences*  
*SIAM Journal on Matrix Analysis and Applications*  
*SIAM Review*  
*Statistical Science*

**REVIEWER FOR THE FOLLOWING CONFERENCES**

2014 IEEE International Symposium on Information Theory (ISIT)  
2012 International Workshop on Approximation Algorithms for Combinatorial Optimization Problems (APPROX)  
2011 ACM–SIAM Symposium on Discrete Algorithms (SODA)  
2010 IEEE International Symposium on Information Theory (ISIT)  
2009 Neural Information Processing Systems (NIPS)  
2008 ACM Symposium on Theory of Computing (STOC)  
2007 IEEE Symposium on Foundations of Computer Science (FOCS)  
2005 IEEE International Conference on Communications (ICC)  
2004 IEEE Global Communications Conference (GLOBECOM)  
2004 IEEE International Symposium on Information Theory (ISIT)

**REVIEWER FOR THE FOLLOWING GRANTING AGENCIES**

Air Force Office of Scientific Research (AFOSR)  
Engineering and Physical Sciences Research Council (EPSRC)  
Gordon & Betty Moore Foundation (GBMF)  
International Centre for Mathematical Sciences (ICMS)  
National Science Foundation (NSF)

**PROFESSIONAL SOCIETIES**

Member, SIAM

**RESEARCH GRANTS**

Grantor: **ONR/C4ISR**, BAA N00014-16-R-BA01, “Long-range BAA”  
Project Title: “Efficient algorithms for low-rank matrix optimization with applications to matrix factorization”  
Award Number: N00014-17-1-214  
Principal Investigator: Joel A. Tropp  
Dates: Jan. 2017–Dec. 2019

Grantor: **AFOSR**, BRI Program “Foundations of energy transfer in multi-physics flow phenomena”  
Project Title: “Wall turbulence with designer properties”  
Award Number: FA9550-12-1-0469

Principal Investigators: Beverley McKeon and Joel A. Tropp, David Goldstein, Mark Sheplak  
Dates: Sep. 2012–Nov. 2015

Grantor: **ONR/C4ISR**, 2008 PECASE Award  
Project Title: “Linear inverse problems with matrix data”  
Award Number: N00014-11-1-0025  
Principal Investigator: J. A. Tropp  
Dates: Nov. 2010–Sep. 2015

Grantor: **Alfred P. Sloan Foundation**  
Dates: Sep. 2010–Sep. 2012

Grantor: **AFOSR**, MURI Topic 2009-17, “Information dynamics in networks”  
Project Title: “Information dynamics as a foundation for network management”  
Award Number: FA9550-09-1-0643  
Subcontracted by Princeton Univ., Principal Investigator: R. A. Calderbank  
Subcontract Principal Investigator: J. A. Tropp  
Dates: June 2009– May 2014

Grantor: **ONR/C4ISR**, 2008 Young Investigator Program (YIP)  
Project Title: “Compressive Signal Processing: Theory and Applications”  
Award Number: N00014-08-1-0883  
Principal Investigator: J. A. Tropp  
Dates: June 2008–May 2011

Grantor: **DARPA/MTO**, BAA 08-03, “Analog-to-Information Receiver Development Program”  
Project Title: “Information-scalable analog-to-information receivers”  
Award Number: N66001-08-1-2065  
Subcontracted by Rice Univ., Principal Investigator: R. G. Baraniuk  
Subcontract Principal Investigator: J. A. Tropp  
Dates: June 2008–May 2011

Grantor: **DARPA/MTO**, BAA 05-35, “Analog-to-Information Receiver Development Program”  
Project Title: “Theory and practice of analog-to-information conversion”  
Award Number: N66001-06-1-2011  
Subcontracted by Rice Univ., Principal Investigator: R. G. Baraniuk  
Subcontract Principal Investigators: A. C. Gilbert, M. J. Strauss, and J. A. Tropp  
Dates: Jan.–Dec. 2006

## PATENTS

“Ptychography imaging systems and methods with convex relaxation.” Inventors: R. Horstmeyer, R. Y. Chen, J. A. Tropp, and C. Yang. US Patent 20,150,331,228. Granted 2015.

“Method and apparatus for on-line compressed sensing.” Inventors: R. G. Baraniuk, D. Baron, M. A. Davenport, M. F. Duarte, M. Elnozahi, S. Kirolos, J. N. Laska, Y. Massoud, T. Ragheb, J. A. Tropp, and M. B. Wakin. US Patent 8,687,689. Granted 2014.

## CONSULTING

Employer: **United Technologies Research Center**  
Project: “Randomized and Distributed Matrix Factorization for Missing Data Inference” (for ONR Computational Methods for Decision Making program)  
Dates: Apr. 2017–Sept. 2018

Employer: **United Technologies Research Center**

Project: “Quantifying Dynamic Complexity” (for DARPA META-II program)

Dates: June 2011–Sep. 2011

Employer: **SA Photonics**

Project: “Analog-to-Information Sensing for Software-Defined Receivers” (for Navy SBIR topic N92-106)

Dates: Sep. 2009–Mar. 2010

## **PERSONAL INFORMATION**

Date of Birth: 18 July 1977. Citizenship: USA.

Languages: Can read French and Spanish