

JOEL A. TROPP
research publications

Available electronically at <http://users.cms.caltech.edu/~jtropp/>

SUBMITTED FOR PUBLICATION

- 1 J. A. Tropp, “Simplicial faces of the set of correlation matrices.” Nov. 2016.
- 2 J. A. Tropp, A. Yurtsever, M. Udell, and V. Cevher, “Practical sketching algorithms for low-rank matrix approximation.” Under revision, *SLAM J. Matrix Anal. Appl.*, May 2017.
- 3 S. Oymak and J. A. Tropp, “Universality laws for randomized dimension reduction, with applications.” Under revision, *Inform. Inference*, Feb. 2017.
- 4 R. Moarref, A. S. Sharma, J. A. Tropp, and B. J. McKeon, “A foundation for analytical developments in the logarithmic region of turbulent channels.” Sep. 2014.

THESES

- 5 J. A. Tropp, *Topics in Sparse Approximation*, PhD Dissertation, Computational and Applied Mathematics, Univ. Texas at Austin, Aug. 2004.
- 6 J. A. Tropp, *Infinitesimals: History and Application*. Senior Thesis, Mathematics Dept., Univ. Texas at Austin, May 1999.

MONOGRAPH

- 7 J. A. Tropp, “An Introduction to Matrix Concentration Inequalities.” *Foundations & Trends in Machine Learning*. Vol. 8, num. 1–2, pp. 1–230, May 2015.

BOOK CHAPTERS

- 8 J. A. Tropp, “The expected spectral norm of a sum of independent random matrices: An elementary approach.” *High-Dimensional Probability VII: The Cargèse Volume*. Eds. C. Houdré, D. M. Mason, P. Reynaud-Bouret, and J. Rosinski. Ser. Progress in Probability 71. Birkhäuser, Basel, 2016.
- 9 J. A. Tropp, “Convex recovery of a structured signal from independent random measurements.” *Sampling Theory, a Renaissance: Compressive Sensing and Other Developments*. Ed. G. Pfander. Ser. Applied and Numerical Harmonic Analysis. Birkhäuser, Basel, 2015.

BOOK REVIEW

- 10 J. A. Tropp, “*A Mathematical Introduction to Compressive Sampling*, by S. Foucart and H. Rauhut, Birkhäuser, 2013. ISBN 978-0-8176-4948-7.” Invited review, *Bull. Amer. Math. Soc.*, July 2016.

REFEREED JOURNAL PAPERS

- 11 J. A. Tropp, “Second-order matrix concentration inequalities.” Accepted to *Appl. Comput. Harmonic Anal.*, July 2016. To appear.
- 12 D. Paulin, L. Mackey, and J. A. Tropp, “Efron–Stein inequalities for random matrices.” *Ann. Probab.*, Vol. 44, num. 5, 2016.
- 13 J. A. Tropp, “Integer factorization of a positive-definite matrix.” *SLAM J. Discrete Math.*, Vol. 29, num. 4, pp. 1783–1791, 2015.
- 14 J. Bruer, J. A. Tropp, V. Cevher, and S. J. Becker, “Designing statistical estimators that balance sample size, risk, and computational cost,” *IEEE J. Selected Topics Signal Processing*, Vol. 9, num. 4, pp. 612–624, June 2015.

- 15 R. Horstmeyer, R. Y. Chen, X. Ou, B. Ames, J. A. Tropp, C. Yang, “Solving ptychography with a convex relaxation.” *New J. Phys.*, Vol. 17, article 053044, pp. 1–15, May 2015.
- 16 G. Lerman, M. B. McCoy, J. A. Tropp, and T. Zhang, “Robust computation of linear models by convex relaxation.” *Found. Comput. Math.* Vol. 15, num. 2, pp. 363–410, Apr. 2015.
- 17 R. Moarref, M. R. Jovanovic, J. A. Tropp, A. S. Sharma, and B. J. McKeon, “A low-order decomposition of turbulent channel flow via resolvent analysis and convex optimization.” *Phys. Fluids*, Vol. 26, num. 1, 051701, pp. 1–7, 2014.
- 18 J. L. Bourguignon, J. A. Tropp, A. S. Sharma, and B. J. McKeon, “Compact representation of wall-bounded turbulence using compressive sampling.” *Phys. Fluids*, Vol. 26, num. 1, 015109, pp. 1–20, 2014.
- 19 D. Amelunxen, M. Lotz, M. B. McCoy, and J. A. Tropp, “Living on the edge: Phase transitions in convex programs with random data.” *Inform. Inference*, Vol. 3, num. 3, pp. 224–294, 2014. Inaugural **IMA Information & Inference Best Paper Prize**, 2015.
- 20 M. B. McCoy and J. A. Tropp, “From Steiner formulas for cones to concentration of intrinsic volumes.” *Discrete Comput. Geom.* Vol. 51, num. 4, pp. 926–963, 2014.
- 21 M. B. McCoy and J. A. Tropp, “Sharp recovery bounds for convex deconvolution, with applications.” May 2012. *Found. Comput. Math.* Vol. 14, num. 3, pp. 503–567, 2014.
- 22 L. Mackey, M. I. Jordan, R. Y. Chen, B. Farrell, and J. A. Tropp, “Matrix concentration inequalities via the method of exchangeable pairs.” *Ann. Probab.*, Vol. 42, num. 3, pp. 906–945, 2014.
- 23 R. Y. Chen and J. A. Tropp, “Subadditivity of matrix phi-entropy and concentration of random matrices.” *Electron. J. Probab.* Vol. 19, num. 27, pp. 1–30, 2014.
- 24 D. Needell and J. A. Tropp, “Paved with good intentions: Analysis of a randomized block Kaczmarz method.” *Linear Algebra Appl.* Vol. 441, pp. 199–221, Jan. 2014.
- 25 R. Moarref, A. S. Sharma, J. A. Tropp, and B. J. McKeon, “Model-based scaling and prediction of the streamwise energy intensity in high Reynolds-number turbulent flows.” *J. Fluid Mech.*, Vol. 734, pp. 275–316, 2013.
- 26 G. Pfander, H. Rauhut, and J. A. Tropp, “The restricted isometry property for time–frequency structured random matrices.” *Probab. Theory Related Fields*, Vol. 156, num. 3–4, pp. 707–737, August 2013.
- 27 R. Y. Chen, A. Gittens, and J. A. Tropp, “The masked sample covariance estimator: An analysis via matrix concentration inequalities.” *Inform. Inference*, Vol. 1, pp. 2–20, 2012.
- 28 J. A. Tropp, “User-friendly tail bounds for sums of random matrices,” *Found. Comput. Math.*, Vol. 12, num. 4, pp. 389–434, 2012.
- 29 H. Rauhut, J. Romberg, and J. A. Tropp, “Restricted isometries for partial circulant matrices.” *Appl. Comput. Harmon. Anal.*, Vol. 32, pp. 242–254, 2012.
- 30 J. A. Tropp, “A comparison principle for functions of a uniformly random subspace.” *Probab. Theory Related Fields*, Vol. 153, num. 3–4, pp. 759–769, 2012.
- 31 J. A. Tropp, “From the joint convexity of quantum relative entropy to a concavity theorem of Lieb.” *Proc. Amer. Math. Soc.*, Vol. 140, num. 5, pp. 1757–1760, May 2012.
- 32 J. A. Tropp, “Improved analysis of the subsampled randomized Hadamard transform.” *Adv. Adapt. Data Anal.*, special issue, “Sparse Representation of Data and Images,” Vol. 3, num. 1–2, pp. 115–126, 2012.
- 33 M. B. McCoy and J. A. Tropp, “Two proposals for robust PCA via semidefinite programming.” *Electron. J. Stat.*, Vol. 5, num. 0, pp. 1123–1160, June 2011.

- 34 N. Halko, P.-G. Martinsson, and J. A. Tropp, “Finding structure with randomness: Probabilistic algorithms for constructing approximate matrix decompositions.” *SLAM Rev.*, Vol. 53, num. 2, pp. 217–288, June 2011.
- 35 J. A. Tropp, “Freedman’s inequality for matrix martingales.” *Electron. Commun. Probab.*, Vol. 16, pp. 262–270, Mar. 2011.
- 36 J. A. Tropp and S. J. Wright, “Computational methods for sparse solution of linear inverse problems.” *Proc. IEEE*, special issue “Applications of sparse representation and compressive sensing.” Vol. 98, num. 6, pp. 948–958, June 2010.
- 37 J. A. Tropp, M. Duarte, J. N. Laska, J. Romberg, and R. G. Baraniuk, “Beyond Nyquist: Efficient sampling of sparse, bandlimited signals.” *IEEE Trans. Inform. Theory*, Vol. 56, num. 1, pp. 520–544, Jan. 2010.
- 38 D. Needell and J. A. Tropp, “CoSaMP: Iterative signal recovery from incomplete and inaccurate samples.” *Appl. Comput. Harmon. Anal.*, Vol. 26, pp. 301–321, 2009. Selected for the **Research Highlights** section of *Communications of the ACM* (June 2010). Selected as a **Fast-Breaking Paper in Mathematics** by Thomson Reuters ScienceWatch (Aug. 2010).
- 39 J. A. Tropp, “Norms of random submatrices and sparse approximation.” *Comptes Rendus Acad. Sci. Paris, Ser. I*, Vol. 346, pp. 1271–1274, 2008.
- 40 J. A. Tropp, “On the linear independence of spikes and sines.” *J. Fourier Anal. Appl.*, Vol. 14, pp. 838–858, 2008.
- 41 J. Brickell, I. S. Dhillon, S. Sra, and J. A. Tropp, “The metric nearness problem,” *SIAM J. Matrix Anal. Appl.*, Vol. 30, num. 1, pp. 375–296, Apr. 2008. Selected for **SIAM 2011 Outstanding Paper Prize**.
- 42 A. C. Gilbert, M. J. Strauss, and J. A. Tropp, “A tutorial on fast Fourier sampling,” *Signal Processing Mag.*, pp. 57–66, Mar. 2008.
- 43 I. S. Dhillon, R. W. Heath Jr., T. Strohmer, and J. A. Tropp, “Constructing packings in Grassmannian manifolds via alternating projection,” *Exper. Math.*, Vol. 17, num. 1, pp. 9–35, 2008.
- 44 J. A. Tropp, “On the conditioning of random subdictionaries,” *Appl. Comput. Harmon. Anal.*, Vol. 25, pp. 1–24, 2008. Selected for **Eighth Monroe H. Martin Prize** (2011) for an outstanding paper in applied mathematics by a young researcher.
- 45 J. A. Tropp, “The random paving property for uniformly bounded matrices,” *Studia Math.*, Vol. 185, num. 1, pp. 67–82, 2008.
- 46 J. A. Tropp and A. C. Gilbert, “Signal recovery from random measurements via Orthogonal Matching Pursuit.” *IEEE Trans. Inform. Theory*, Vol. 53, num. 12, pp. 4655–4666, Dec. 2007.
- 47 I. S. Dhillon and J. A. Tropp, “Matrix nearness problems with Bregman divergences,” *SIAM J. Matrix Anal. Appl.*, Vol. 29, num. 4, pp. 1120–1146, Nov. 2007.
- 48 M. Sustik, J. A. Tropp, I. S. Dhillon, and R. W. Heath Jr., “On the existence of equiangular tight frames.” *Linear Algebra Appl.*, Vol. 426, num. 2–3, pp. 619–635, 2007.
- 49 J. A. Tropp, A. C. Gilbert, and M. J. Strauss, “Algorithms for simultaneous sparse approximation. Part I: Greedy pursuit,” *J. Signal Processing*, Vol. 86, special issue on “Sparse approximations in signal and image processing,” pp. 572–588, Apr. 2006. Selected for **EUSIPCO 2010 Best Paper Award**.
- 50 J. A. Tropp, “Algorithms for simultaneous sparse approximation. Part II: Convex relaxation,” *J. Signal Processing*, Vol. 86, special issue on “Sparse approximations in signal and image processing,” pp. 589–602, Apr. 2006.
- 51 J. A. Tropp, “Just relax: Convex programming methods for identifying sparse signals,” *IEEE Trans. Inform. Theory*, Vol. 52, num. 3, pp. 1030–1051, Mar. 2006.

- 52 I. S. Dhillon, R. W. Heath Jr., M. Sustik, and J. A. Tropp, “Generalized algorithms for constructing Hermitian matrices with prescribed diagonal and spectrum,” *SIAM J. Matrix. Anal. Appl.*, Vol. 27, num. 1, pp. 61–71, June 2005.
- 53 J. A. Tropp, “Recovery of short, complex linear combinations via l_1 minimization,” *IEEE Trans. Inform. Theory*, Vol. 51, num. 4, pp. 1568–1570, Apr. 2005.
- 54 J. A. Tropp, I. S. Dhillon, R. W. Heath Jr., and T. Strohmer, “Designing structured tight frames via alternating projection,” *IEEE Trans. Inform. Theory*, Vol. 51, num. 1, pp. 188–209, Jan. 2005.
- 55 J. A. Tropp, I. S. Dhillon, and R. W. Heath Jr., “Finite-step algorithms for constructing optimal CDMA sequences,” *IEEE Trans. Inform. Theory*, Vol. 50, num. 11, pp. 2916–2921, Nov. 2004.
- 56 J. A. Tropp, “Greed is good: Algorithmic results for sparse approximation,” *IEEE Trans. Inform. Theory*, Vol. 50, num. 10, pp. 2231–2242, Oct. 2004.

REFEREED CONFERENCE PAPERS

- 57 A. Yurtsever, M. Udell, J. A. Tropp, and V. Cevher, “Sketchy decisions: Convex low-rank matrix optimization with optimal storage.” Artificial Intelligence and Statistics (AISTATS), Fort Lauderdale, Apr. 2017. Oral presentation (top 5% of submissions).
- 58 J. Bruer, J. A. Tropp, V. Cevher, and S. J. Becker, “Time–data tradeoffs by aggressive smoothing,” in *Advances in Neural Information Processing Systems 27*, Montreal, Dec. 2014.
- 59 V. Bittorf, B. Recht, C. Ré, and J. A. Tropp, “Factoring nonnegative matrices with linear programs,” in *Advances in Neural Information Processing Systems 25*, pp. 1223–1231, Stateline, NV, Dec. 2012.
- 60 J. Lee, B. Recht, R. Salakhutdinov, N. Srebro, and J. A. Tropp, “Practical large-scale optimization for max-norm regularization,” in *Advances in Neural Information Processing Systems 23*, pp. 1297–1305, Vancouver, Dec. 2010.
- 61 J. A. Tropp, “Column subset selection, matrix factorization, and eigenvalue optimization,” in *Proc. 2009 ACM–SIAM Symp. Discrete Algorithms*, pp. 978–986, New York, Jan. 2009.
- 62 M. Mishali, Y. C. Eldar, and J. A. Tropp, “Efficient sampling and stable reconstruction of wide band sparse analog signals,” in *Proc. 25th IEEE Conv. Electrical and Electronic Engineers in Israel*, Eilat, Dec. 2008. Selected for **Best Student Paper Award**.
- 63 D. Needell, J. A. Tropp, and R. Vershynin, “Greedy signal recovery review,” in *Proc. 42nd Asilomar Conf. Signals, Systems, and Computers*, Pacific Grove, Oct. 2008.
- 64 A. C. Gilbert, M. J. Strauss, J. A. Tropp, and R. Vershynin, “One sketch for all: Fast algorithms for Compressed Sensing,” in *Proc. 39th ACM Symp. Theory of Computing*, San Diego, Jun. 2007.
- 65 A. C. Gilbert, M. J. Strauss, J. A. Tropp, and R. Vershynin, “Algorithmic linear dimension reduction in the l_1 norm for sparse vectors,” invited paper, special session “Compressed Sensing,” in *Proc. 44th Annual Allerton Conf. Communication, Control, and Computing*, Allerton, Sep. 2006.
- 66 S. Sra and J. A. Tropp, “Row-action methods for Compressed Sensing,” in *Proc. 2006 IEEE Int. Conf. Acoustics, Speech, and Signal Processing*, Vol. 3, pp. 868–871, Toulouse, May 2006.
- 67 K. K. Herrity, A. C. Gilbert, and J. A. Tropp, “Sparse approximation via iterative thresholding,” in *Proc. 2006 IEEE Int. Conf. Acoustics, Speech, and Signal Processing*, Vol. 3, pp. 624–627, Toulouse, May 2006.
- 68 J. A. Tropp, M. B. Wakin, M. F. Duarte, D. Baron, and R. G. Baraniuk, “Random filters for compressive sampling and reconstruction,” in *Proc. 2006 IEEE Int. Conf. Acoustics, Speech, and Signal Processing*, Vol. 3, pp. 872–875, Toulouse, May 2006.

- 69 A. C. Gilbert and J. A. Tropp, “Applications of sparse approximation in communications,” in *Proc. 2005 IEEE Int. Symp. Information Theory*, pp. 1000–1004, Adelaide, Sept. 2005.
- 70 J. A. Tropp, A. C. Gilbert, and M. J. Strauss, “Simultaneous sparse approximation via greedy pursuit,” special session “Sparse representations in signal processing,” in *Proc. 2005 IEEE Int. Conf. Acoustics, Speech, and Signal Processing*, Vol. 5, pp. 721–724, Philadelphia, Mar. 2005.
- 71 I. S. Dhillon, S. Sra, and J. A. Tropp, “Metric Nearness: Problem formulation and algorithms.” *Advances in Neural Information Processing 17*, pp. 361–368, Vancouver, Dec. 2004.
- 72 R. W. Heath Jr., J. A. Tropp, I. S. Dhillon, and T. Strohmer, “Construction of equiangular signatures for synchronous CDMA systems,” in *Proc. 2004 IEEE Int. Symp. Spread Spectrum Technologies*, pp. 708–712, Sydney, Aug. 2004.
- 73 J. A. Tropp, I. S. Dhillon, and R. W. Heath Jr., “Optimal CDMA signatures: a finite-step approach,” in *Proc. 2004 IEEE Int. Symp. Spread Spectrum Technologies*, pp. 335–340, Sydney, Aug. 2004.
- 74 J. A. Tropp, I. S. Dhillon, R. W. Heath Jr. and T. Strohmer, “CDMA signature sequences with low peak-to-average-power ratio via alternating projection,” in *Proc. 37th Asilomar Conf. Signals, Systems, and Computers*, pp. 475–479, Monterey, Nov. 2003.
- 75 J. A. Tropp, A. C. Gilbert, S. Muthukrishnan, and M. J. Strauss, “Improved sparse approximation over quasi-incoherent dictionaries,” invited paper, special session “Redundant representations in image processing,” in *Proc. 2003 IEEE Int. Conf. Image Processing*, vol. 1, pp. 37–40, Barcelona, Sept. 2003.
- 76 J. A. Tropp, R. W. Heath Jr., and T. Strohmer, “Optimal CDMA signature sequences, inverse eigenvalue problems, and alternating minimization,” in *Proc. 2003 IEEE Int. Symp. Information Theory*, p. 407, Yokohama, July 2003.

OTHER CONFERENCE PAPERS

- 77 J. A. Tropp, “The sparsity gap: Uncertainty principles proportional to dimension,” invited paper, in *Proc. 44th Ann. IEEE Conf. Information Sciences and Systems*, pp. 1–6, Princeton, Mar. 2010.
- 78 A. C. Gilbert, M. J. Strauss, J. A. Tropp, and R. Vershynin, “Sublinear approximation of compressible signals,” invited paper, special session “Compressive Sensing,” in *Proc. SPIE Intelligent Integrated Microsystems*, pp. 623206.01–09, Orlando, Apr. 2006.
- 79 J. A. Tropp, “Random filters for compressive sampling,” invited paper, special session on “Sparse representations and compressed sensing,” in *Proc. 2006 IEEE Conf. Information Sciences and Systems*, Princeton, Mar. 2006.
- 80 J. A. Tropp, “Complex equiangular tight frames,” in *Proc. SPIE Wavelets XI*, pp. 590401.01–11, San Diego, Aug. 2005.
- 81 J. A. Tropp, “Average-case analysis of greedy pursuit,” invited paper, in *Proc. SPIE Wavelets XI*, pp. 590412.01–11, San Diego, Aug. 2005.

SELECTED TECHNICAL REPORTS

- 82 M. B. McCoy and J. A. Tropp, “The achievable performance of convex demixing.” ACM Report 2017-02, Caltech, Feb. 2017. Research dated Sep. 2013.
- 83 J. A. Tropp, A. Yurtsever, M. Udell, and V. Cevher, “Randomized single-view algorithms for low-rank matrix approximation.” ACM Report 2017-01, Caltech, Jan. 2017. Research dated Aug. 2016.
- 84 D. Paulin, L. Mackey, and J. A. Tropp, “Deriving matrix concentration inequalities from kernel couplings,” Technical Report 2014-10, Stanford Department of Statistics, Aug. 2014. Research dated May 2013.
- 85 A. Gittens and J. A. Tropp, “Tail bounds for all eigenvalues of a sum of random matrices,” ACM Report 2014-02, Caltech, Aug. 2014. Research dated Apr. 2011.

- 86 A. Gittens and J. A. Tropp, “Error bounds for randomized matrix approximation schemes,” ACM Report 2014-01, Caltech, Aug. 2014. Research dated Nov. 2009.
- 87 R. Y. Chen, A. Gittens, and J. A. Tropp, “The masked sample covariance estimator: An analysis via the matrix Laplace transform,” ACM Report 2012-01, Caltech, Feb. 2012.
- 88 C. Probel and J. A. Tropp, “Large-scale PCA with sparsity constraints,” ACM Report 2011-02, Caltech, Aug. 2011.
- 89 J. A. Tropp, “Column subset selection, matrix factorization, and eigenvalue optimization,” ACM Report 2008-02, Caltech, Mar. 2008. Revised, July 2008.
- 90 A. C. Gilbert, M. J. Strauss, J. A. Tropp, and R. Vershynin, “Algorithmic linear dimension reduction in the l_1 norm for sparse vectors,” Nov. 2005. Revised, Aug. 2006.
- 91 A. C. Gilbert and J. A. Tropp, “Signal recovery from random measurements via Orthogonal Matching Pursuit: The Gaussian Case,” ACM Report 2007-01, Caltech, 2007. Research dated Apr. 2005; revised Nov. 2006 and Aug. 2007.
- 92 J. A. Tropp, “Just relax: Convex programming methods for subset selection and sparse approximation,” ICES Report 04-04, Univ. Texas at Austin, Feb. 2004.
- 93 J. A. Tropp, “Greed is good: Algorithmic results for sparse approximation,” ICES Report 03-04, Univ. Texas at Austin, Feb. 2003.