# Misha Elena Kilmer
# Curriculum Vitae (Condensed)


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| Department of Mathematics | (617) 627-2005 |
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**Research Areas**: Numerical Linear and Multilinear Algebra, Scientific Computing, Inverse Problems, Image Classification and Recognition

**Employment History**:

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| 8/16 – present | William Walker Professor of Mathematics, Tufts University, Boston, MA |
| 9/05 – present | Adjunct Prof., Department of Computer Science, Tufts University, Boston, MA |
| 8/13 – 6/19 | Department Chair, Department of Mathematics, Tufts University, Boston, MA |
| 9/05 – 8/16 | Professor, Department of Mathematics, Tufts University, Boston, MA |
| 9/99 – 8/05 | Assistant Professor, Mathematics, Tufts University, Boston, MA |
| 1/98 – 8/99 | Visiting Scientist, ECE Dept., Northeastern University, Boston, MA |
| 9/94 – 12/97 | Research Assistant University of Maryland, College Park, MD. |

**Education**:

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| Dec. 1997 | Ph.D. in Applied Mathematics, University of Maryland, College Park |
| May 1992 (1994) | B.S. (M.A.) in Mathematics, Wake Forest University |

**Research and Teaching Awards and Recognition**:

- SIAM Fellow, Class of 2019, April 2019.
- ICERM (Brown Univ.) Semester on-site visitor, Model and Dimension Reduction in Uncertain and Dynamic Systems, January 27 - May 1, 2020.
- Householder XX Poster Blitz prize, 2017.
- Received Endowed Chair: William Walker Professor of Mathematics, 2016.
- Direct promotion to from Assistant Professor to Full Professor (skipping associate level), 2005.
- Tufts Undergraduate Initiative on Teaching Award, 2001.
- SIAM Student Paper Prize, 1997.

**Editorial Work**:

- Section Editor, SIAM Review, Research Spotlights, 2018 present
- Associate Editor, SIAM Journal for Scientific Computing, 2009 present
- Associate Editor, SIAM Journal for Matrix Analysis and Applications, 2012 2018
- Associate Editor, SIAM Undergraduate Research On-line, 2008 2014
- Special Issue Editor, Linear Algebra and its Applications, (G. W. Stewart birthday issue), 2010

**Publication Summary**: Over 65 refereed publications, incl. 1 co-edited book with commentaries; 2 invited (refereed) book chapters. SIAM Review Research Spotlights summaries each issue. Over 4,300 citations, h-index of 27, i10-index of 42. See Google Scholar Profile for full publication list. Further details below.

**Patents/Filings**:

- Kilmer (Tufts) and Hoge (Brigham and Womens Hospital, Boston), "Magnetic Resonance Imaging by Subspace Projection" Awarded 2010. US7869639B2.
- Horesh (IBM), Hao (Oracle), and Kilmer (Tufts), "Non-intrusive method for supplementation of mis-specified simulation models" Awarded 2018. US20190205488A1.
- Horesh (IBM), O. A. Malik (U CO), S. Ubaru (IBM), Kilmer (Tufts), Avron (Tel Aviv) "System for prediction on time varying graphs," Invention Reference P201907072, filed 2019.
- Kilmer (Tufts), Horesh (IBM), Avron (Tel Aviv), Newman (Tufts), "System and Method for Optimal Multi-dimensional Data Compression by Tensor Tensor Decompositions," Filing reference No. 16/289064, 2019.
- Horesh (IBM), Newman (Emory), Avron (Tel Aviv), Kilmer (Tufts), "System and Method for Deep Tensor Neural Networks," Patent Reference P201803885US01, filed 2018.

**Recent Grants Awarded**:

- (Co-PI) NSF TRIPODS, 10/1/2019 – 09/30/2022. $1.5M.
- (PI) NSF DMS-1821148, 9/1/2018 – 8/30/2021. "Collaborative Proposal: A TensorBased Computational Framework for Model Reduction and Structured Matrices." Tufts: $140,000.
- (PI) IBM TJ Watson, 1/2018 – 12/2019. "Tensor Decompositions and Quantum Computing." $100,000.
- (Co-PI) NSF DMS-1720291, 9/1/2017 – 8/30/2020. "Collaborative Proposal: NoFRILS Inversion: Novel Feature-Based, Randomized Methods for Large Scale Inversion." Tufts: $284,131.
- (PI) sub from USC, Janus-GLAIVE (IARPA primary), 2015-2016 Phase I-II Total $363, 577.
- (Co-PI) NSF:CIF:SMALL 1319653, 9/1/2013 8/30/2016: "Optimal Sampling and Recovery for Multilinear Signals and Systems". $483,000.
- (PI) NSF DMS 1217161, 9/1/2012 – 8/30/2015. "Collaborative Research: Innovative, Integrated Strategies for Nonlinear Parametric Inversion." $190,001.
- (Co-PI) NIH R01-CA154774 7/12/2011 – 6/30/2016. "Near Infrared Spectral Imaging of the Breast for Cancer Detection and Monitoring." Total Award to Tufts: $2,223,119.

**Plenary/Keynote Presentations**:

- SIAG-LA Plenary, International Linear Algebra Society (ILAS) Annual Meeting, Galway, Ireland, June 2020.
- Plenary, Cormack Conference, Tufts University, August 2019.
- Keynote Address, Sonia Kovalevsky Days, WPI, March 2019.
- Plenary, 6th IMA Conference on Numerical Linear Algebra and Optimization, Birmingham, UK, Jun. 2018.
- Plenary, Advancing Womens Impact in Mathematics Symposium, WPI, Apr. 2018.
- Keynote, Computational Inverse Problems (PCH 60), Denmark, Aug. 2017.
- Plenary, SIAM Computational Science and Engineering, Atlanta, Feb. 2017. (See also SIAM News Article about this talk.)
- Keynote, Mid-Atlantic Numerical Analysis Day, Temple University, Nov. 2015.
- Plenary, Householder Symposium, XIX, Belgium, June 2014.
- Plenary, SIAM Applied Linear Algebra Meeting, Valencia, Spain, June 2012.
- Plenary, Householder Symposium XVIII, CA, June 2011.

- Plenary, Householder Symposium XVII, Germany, June 2008.
- Plenary, Preconditioning 2005, Emory University, Atlanta, May 2005.
- Plenary, Householder Symposium XVI, PA, May 2005.
- SIAG-LA plenary, International Linear Algebra Society (ILAS) Annual Meeting, Auburn University, AL, June 2002.

**Workshop Talks/Leadership**:

- WiSDM (Women in Data Science and Mathematics), weeklong workshop group leader, ICERM, July 2019.
- RMMC Summer School, Inverse Problems in Imaging, Univ. of Wyoming, June 2019.
- IMA Workshop "Recent Advances in Machine Learning and Computational Methods for Geoscience," Minneapolis, MN, Oct. 2018. (Video of this talk.)
- Manitoba Workshop on Mathematical Imaging Science, May 2017. (Video of presentation.)

**Selected Recent Seminar/Minisymposia Talks**:

- NC State, Applied Mathematics Seminar, Nov. 2019.
- Penn State, Computational and Applied Mathematics Seminar, Oct. 2019.
- Invited speaker, AMS Special Session on Recent Advances in Structured Matrices and Their Applications, April 2019.
- Minisymposium co-organizer and speaker, AMS/SIAM/MAA Joint Meetings, Jan 2018.
- ICERM: Recent Advances in Seismic Modeling and Inversion: From Analysis to Applications, Fall 2017.
- Distinguished Lecture Series in Computational Science and Engineering, MIT, April 2017.
- Algorithm and Theory Distinguished Lecture Series, IBM Watson, Dec. 2016.
- SIAM Annual Meeting, Session on Model reduction approaches in wavefield simulations and imaging, July, 2016.
- ICIAM 2015, China, Mini on Optimality in reduced order modeling and inversion.
- ICIAM 2015, China, Mini on Image restoration: new algorithms and new applications.
- Copper Mountain Conference on Iterative Methods, Spring 2018, 2016, 2014.

**Books**: *Selected Works of G. W. Stewart, with Commentaries,* Misha E. Kilmer and Dianne P. OLeary, Editors. Birkhauser, July, 2010. 6/19 Chapter download report from SpringerLink: 18,353 chapter downloads since published.

**Book Chapters (Invited)**:

1. Ning Hao, Lior Horesh, and Misha E. Kilmer, Nonnegative Tensor Decomposition, in Compressed Sensing and Sparse Filtering, Springer Series on Signals and Communication Technology, Avisha Y. Carmi, Lyudmila Mihaylova, Simon J. Godsill, Eds., 2014.
2. Ning Hao, Lior Horesh, and Misha E. Kilmer, Nuclear norm optimization and its application to observation model specification, in Compressed Sensing and Sparse Filtering, Springer Series Signals and Communication Technology, Avisha Y. Carmi, Lyudmila Mihaylova, Simon J. Godsill, Eds., 2014

**Publications (Preprint and Peer Reviewed Since 2013)**:

1. S. Gazzola, M. E. Kilmer, J. Nagy, O. Semerici, E. L. Miller, *An Inner-Outer Iterative Method for Edge Preservation in Image Restoration and Reconstruction*, arXiv preprint arXiv:1912.13103, 2019. Submitted, 2019.
2. M. E. Kilmer, L. Horesh, H. Avron, E. Newman, *Tensor-Tensor Products for Optimal Representation and Compression*, arXiv preprint, 2019. Journal submission pending.
3. OA Malik, S Ubaru, L Horesh, M E Kilmer, H Avron, *Tensor Graph Convolutional Networks for Prediction on Dynamic Graphs*, arXiv preprint arXiv:1910.07643, 2019. Journal submission pending.
4. E Newman and Misha Kilmer, *Non-negative Tensor Patch Dictionary Approaches for Image Compression and Deblurring Applications*, arXiv preprint arXiv:1910.00993, 2019. Submitted, 2019.
5. R. Minster, A.K. Saibaba, and M. E. Kilmer, *Randomized Algorithms for low-rank Decompositions in the Tucker Format*, accepted to SIAM Journal on Mathematics of Data Science, 2019. To appear. (preprint version exists arXiv:1905.07311)
6. S. S. Aslan, E de Sturler, M. E. Kilmer, *Randomized Approach to Nonlinear Inversion Combining Random and Optimized Simultaneous Sources and Detectors*, SIAM Journal on Scientific Computing, Vol. 41, No. 2, B229-B249. (preprint version exists arXiv:1706:05586)
7. E. Newman, L. Horesh, H. Avron, M. E. Kilmer, *Stable Tensor Neural Networks for Rapid Deep Learning*, arXiv preprint arXiv:1811.06569, 2019. Journal submission pending.
8. J. Zhang, A. K. Saibaba, M. E. Kilmer, and S. Aeron, *A Randomized Tensor Singular Value Depcomposition Based on the t-Product*, Numerical Linear Algebra with Applications, Vol. 25, No. 5, 2018.
9. E. Newman, M. E. Kilmer, L. Horesh, *Image Classification Using Local Tensor Singular Value Decomposition*, 2017 IEEE 7th International workshop on Computation Advances in Advances in Multi-Sensor Adaptive Processing (CAMSAP), 2017.
10. M. O'Connell, M. E. Kilmer, E. de Sturler, S. Gugercin, *Computing Reduced Order Models via Inner-Outer Krylov Recycling*, SIAM Journal on Scientific Computing, Vol. 39, No. 2, B272-B297, 2017.
11. S. Soltani, M. E. Kilmer, P. C. Hansen, *A Tensor-based Dictionary Learning Approach to Tomographic Image Reconstruction*, BIT Numerical Mathematics, Vol. 56, No. 4, 1425-1454, 2016.
12. E. Kernfeld, N. Majumder, S. Aeron, M. E. Kilmer, *Multilinear Subspace Clustering*, 2016 IEEE Statistical Signal Processing Workshop (SSP), 2016.
13. E. Kernfeld, M. E. Kilmer, S. Aeron, *Tensor-tensor Products with Invertible Linear Transforms*, Linear Algebra and its Applications, Vol 485, 545–570, 2015.
14. A. K. Saibaba, M. E. Kilmer, E. L. Miller, S. Fantini, *Fast Algorithms for Hyperspectral Diffuse Optical Tomography*, SIAM Journal on Scientific Computing, Vol. 37, No. 5, B712-B743, 2015.
15. E. de Sturler, S. Gugercin, M. E. Kilmer, S. Chaturantabut, C. Beattie, M. O'Connell, *Nonlinear Parametric Inversion Using Interpolatory Model Reduction*,SIAM Journal on Scientific Computing, Vol. 37, No. 3, B495-B517, 2015.
16. G. Ely, S. Aeron, N. Hao, M. E. Kilmer, *5D Seismic Data Completion and Denosing Using a Novel Class of Tensor Decompositions*, Geophysics, Vol. 80, No. 4, V83-V95, 2015.
17. J. M. Chung, M. E. Kilmer, D. P. O'Leary, *A Framework for Regularization via Operator Approximation*, SIAM Journal on Scientific Computing, Vol. 37, No. 2, B332-B359, 2015.
18. A. K. Saibaba, N. Krishnamurthy, P. G. Anderson, J. M. Kainerstorfer, A. Sassaroli, E. L.

Miller, S. Fantini, M. E. Kilmer, *3D Parameter Reconstruction in Hyperspectral Diffuse Optical Tomography*, Conference Proceedings, Optical Tomography and Spectroscopy of Tissue XI, 2015.

19. E. Kernfeld, S. Aeron, M. E. Kilmer, *Clustering Multi-way Data: A Novel Algebraic Approach*, arXiv preprint arXiv:1412.7056, 2014.
20. M. I. Espanol and M. E. Kilmer, *A Wavelet-based Multilevel Approach for Blind Deconvolution Problems*, SIAM J. on Scientific Computing, Vol. 36, No. 4, 1678-1693, 2014.
21. O. Semerici, N. Hao, M. E. Kilmer and E. L. Miller, *Tensor-based Formulation and Nuclear Norm Regularization of Multienergy Computed Tomography*, IEEE Trans. on Image Processing, Vol. 23, No. 4, 1678-1693, 2014.
22. A. R. Nectow, M. E. Kilmer, and D. L. Kaplan, *Quantifying Cellular Alignment of Anisotropic Biomaterial Platforms*, Journal of Biomedical Materials Research Part A, Vol. 102, No. 2, 420-428, 2014.
23. Z. Zhang, G. Ely, S. Aeron, N. Hao, M. E. Kilmer, *Novel Methods for Multilinear Data Completion and De-noising Based on Tensor-SVD*, Proceedings of the IEEE CVPR (selected for presentation), 2014.
24. D. Chen, M. E. Kilmer and P. C. Hansen, *"Plug-and-Play" Edge-Preserving Regularization*, Electronic Transactions on Numerical Analysis, Vol. 41, 465-477, 2014.
25. G. Ely, S. Aeron, N. Hao and M. E. Kilmer, *5D and 4D Pre-stack Seismic Data Completion Using Tensor Nuclear Norm (TNN)*, SEG 2013, Houston, TX, 2013.
26. F. Larusson, P. G. Anderson, E. Rosenberg, M. E. Kilmer, A. Sassaroli, S. Fantini, E. L. Miller, *Parametric Estimation of 3D tubular Structures for Diffuse Optical Tomography*, Biomedical Optics Express, 2013.
27. A. Nectow, M. E. Kilmer and D. Kaplan, *Quantitative Assessment of Nerve Cell Alignment*, Tissue Engineering Part C: Methods, 2013.
28. N. Hao, M. E. Kilmer, K. Braman and R. C. Hoover, *Facial Recognition using Tensor-Tensor Decomposition*, SIAM Journal on Imaging Science, 2013.
29. M. E. Kilmer, K. Braman, N. Hao and R. C. Hoover, *Third Order Tensors as Operators on Matrices: A Theoretical and Computational Framework with Applications in Imaging*, SIAM Journal on Matrix Analysis and Applications, 2013.

**Selected SIAM Service**:

- Co-Chair, SIAM Applied Linear Algebra Meeting, 2021
- Co-Chair, SIAM Computational Science and Engineering Meeting, 2021
- Mid-Career Panelist, SIAM Computational Science and Engineering Meeting, 2019, see recent SIAM News article for quotations
- Committee Member, Gene Golub SIAM Summer School, Jan. 2018 Dec. 2021
- Invited Minisymposium organizer to represent the SIAG/LA; SIAM Annual Meeting, July 2016
- Program Committee Member:
  SIAM Annual Meeting 2012
  SIAM Conference on Imaging Science, 2012
  SIAM Computational Science and Engineering Meeting 2009
  SIAM Linear Algebra Meeting 2009; Preconditioning 2007
- Co-organizer, Session on Career Development, SIAM Annual 2008, SIAM CS&E Mar. 2009
- Prize Committee Member:
  SIAM CSE Early Career Prize Committee, 2016-2017
  SIAM Activity Group on Linear Algebra, Best LA Paper Prize Committee, 2015

AWM/SIAM Sonia-Kovalesky Lecture Prize Selection Committee, 2007  2009

- Panelist, Mid-career Transition Panel, SIAM CS&E Meeting, 2019
- Panelist, SIAM Career Panel, SIAM CS&E Meeting, 2017 and SIAM Annual Meeting 2016
- Secretary, SIAM Activity Group on Linear Algebra, 2004-2006; Nominating Cmte. Chair, 2006

**Recent Additional Professional Service**:

- Copper Mountain Conference on Iterative Methods, 2008-current
- NSF Panel and Site Team Reviews
- Minisymposium organizer (SIAG-LA invited), SIAM Annual Meeting, July 2016.
- Minisymposium co-organizer, SIAM Imaging Sciences, May, 2016.
- Minisymposium co-organizer, Celebrating the Contributions of Dianne P. OLeary, SIAM Applied Linear Algebra, 2015.
- Minisymposium co-organizer (x 2), SIAM Computational Science and Engineering, 2015.
- Mathematics Department Colloquium, VA Tech, Nov. 2014.
- Reviewer for DOE and International funding agencies
- Prize/awards committees (SIAM, AMS)
- External International Thesis examiner

**Selected Tufts University and Departmental Service**

University:

- Member, Data Intensive Studies Center Faculty Advisory Committee, 2019 –
- Member, Research & Scholarship Subcommittee of the IT Governance Committee, Fall 2019 –
- Member, Search Committee for Director of the Data Intensive Studies Center, 2017 – 2019
- Co-Chair, Research and Scholarship Subcommittee, IT Governance, 2015 – Spr 19
- Member, IT Steering Committee, 2015 – 2019
- Member, planning committee, Ctr. for Computational & Data-Enabled Research, 2015 – 2016
- GREAT, 2015 panelist
- Co-Chair, Computational Subcommittee, SEC Leaders group, 2014 – 2015
- Thematic Area Working Group on Computational and Quantitative Skills and Methods, Co-Chair of the Computational Subcommittee, 2014 – 2015
- Tufts Summer Scholars Evaluation Committee member, Spring 2013
- Tufts Univ. Special Advisor to the President and Interim Provost on Matters of Academic Appointments 09/2011 – 06/2012
- Arts and Sciences Dean Search Committee, Spring-Summer 2010
- Arts, Sciences and Engineering Tenure and Promotion Committee, May 2007 – Aug 2008, May 2009 – April 2011 (Chair, May 2010 – April 2011)
- Department-external Thesis committee member

Department:

- Department Chair, Sept. 2013 – Summer 2019
- NWAP Hiring Committees, 2013 – 2014, 2016 – 2017, 2018 – 2019
- CDA Hiring Committee, 2017 – 2018
- Curriculum Committee, 2014 – 2016
- Course Assignment Committee, 2013 – 2019
- Graduate Committee, multiple (non-consecutive) years

- Scientific Computing Hiring Committee, 2013 – 2014
- Dept. representative, Tufts Open House and Majors events, (multiple years)
- NA, PDE, Qual Examiner (multiple years)

**Students and Postdocs Supervised**: 2 Postdocs, 6 PhD, 2 MA (thesis), 15 undergrad RAs, 7 visiting students

**Referee Work**: *SIAM Review, ISSAC97, proceedings for ICS03, International Conference on Supercomputing, Math Comp., SIAM Journal on Matrix Analysis and Appl., SIAM Journal on Sci. Comput., IEEE Trans. on Signal Processing, IEEE Trans. Geoscience and Remote Sensing, Linear Algebra and its Applications, Computers and Mathematics with Applications, IEEE Trans. Image Processing, Optics Express, Stat, Applied Optics, BIT, Journal of Computational and Applied Math, Applied and Computational Harmonic Analysis, IEEE Signal Processing Letters, Inverse Problems, Optimization Methods and Software, SIAM Journal on Numerical Analysis, Computational Optimization and Applications, Communications in Nonlinear Science and Numerical Simulations, Pattern Analysis and Applications, Applied Numerical Mathematics, Computational Statistics and Data Analysis, IEEE Trans. Neural Networks and Learning Systems, Numerical Algorithms.*