

Robert J. Plemmons

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Current Status

Z.S. Reynolds Professor of Mathematics and Computer Science, Wake Forest University.

Education

Ph.D., Applied Mathematics, Auburn University, 1965, NDEA Fellowship.
B.S., Mathematics (Physics Minor), Wake Forest University, 1961, Athletic Scholarship.

Current Research Interests: Scientific Computation. Specifically: numerical linear algebra, ill-posed inverse problems, image processing, remote sensing.

Prior Academic Employment Background

- 1968-81 Associate Professor, Professor, University of Tennessee. Served a term as Head of Computer Science Department.
- 1981-91 Professor, N.C. State University. Founded the UNC Center for Research in Scientific Computation and served as Director.

Non-Academic Employment Background

- 1961-64 Professional baseball in Baltimore Orioles System (Spring and Summers).
- 1965-67 Research Scientist, National Security Agency.

Current Research Funding (Continuous research support from DoD and/or NSF grants, 1967-present)

- National Geospatial-Intelligence Agency (NGA). *Compression of Hyperspectral and LiDAR Data using Implicit Geometry and Non-Linear Tensor Based Compression*. Joint with The Boeing Company. September 2010 to September 2013.
- Air Force Office of Scientific Research (AFOSR). *Comprehensive Space-Object Characterization using Spectrally Compressive Polarimetric Sensing*. Joint with The University of New Mexico and Duke University. August 2011 to August 2014.

Selected Publications from Year 2000 to Present

- F. Li, M. Ng and R. Plemmons, *Coupled Segmentation and Denoising/Deblurring Models for Hyperspectral Material Identification*, Numerical Linear Algebra with Applications, vol. 19, pp. 153–173, January, 2012.
- N. Gillis, Q. Zhang and R. Plemmons, *Priors in Sparse Recursive Decompositions of Hyperspectral Images*, Proc. SPIE Conf. on Defense, Security and Sensing, April 2012.
- R. Jillela, A. Ross, V. Boddeti, B. Vijayakumar, X. Hu, R. Plemmons, V. Pauca, *An Evaluation of Iris Segmentation Algorithms in Challenging Periocular Images*. In Iris Recognition Biometrics, K. Bowyer and M. Burge (Eds.), Springer, 2012.

- X. Hu, P. Pauca and R. Plemmons. *Iterative Directional Ray-based Iris Segmentation for Challenging Periocular Images*, Proc. 6th Chinese Conference on Biometric Recognition, Beijing, In Biometric Recognition, Springer LNCS 7098, 2011.
- Q. Zhang, R. Plemmons, D. Kittle, D. Brady and S. Prasad, *Joint Segmentation and Reconstruction of Hyperspectral Data with Compressed Measurements*, Applied Optics, Vol. 50, pp. 4417–4435, 2011.
- N. Gillis and R.J. Plemmons, *Dimensionality Reduction, Classification, and Spectral Mixture Analysis using Nonnegative Underapproximation*, Optical Eng., Vol. 50, Feb. 2011.
- Q. Zhang, R. Plemmons, D. Kittle, D. Brady and S. Prasad, *Reconstructing and Segmenting Hyperspectral Images from Compressed Measurements*, Proc. Third IEEE Workshop on Hyperspectral Imaging: Evolution in Remote Sensing, Lisbon, June, 2011.
- N. Gillis and R. Plemmons, *Sparse Nonnegative Matrix Underapproximation and Its Application to Hyperspectral Image Analysis*, Proc. 3rd IEEE Workshop on Hyperspectral Imaging: Evolution in Remote Sensing (WHISPERS), Lisbon, June, 2011.
- S. Morigi, R. Plemmons, L. Reichel, and F. Sgallari, *A Hybrid Multilevel-active Set Method for large Box-constrained linear Discrete Ill-posed Problems*, Calcolo, Vol. 48, pp. 89-105, 2011.
- F. Li, M. Ng, R. Plemmons, S. Prasad and Q. Zhang, *Hyperspectral Image Segmentation, Deblurring, and Spectral Analysis*, Proc. SPIE Conf. on Defense, Security, and Sensing, Orlando, April, 2010.
- Q. Zhang, R. Guy and R. Plemmons, *Matrix Structures and Parallel Algorithms for Image Superresolution Reconstruction*, SIAM Journal on Matrix Analysis and Applications, Vol.31(4), pp. 1873-1893, 2010.
- D. Chen and R. Plemmons, *Nonnegativity Constraints in Numerical Analysis*, Paper presented at the Symposium on the Birth of Numerical Analysis, Leuven Belgium, October 2007. In The Birth of Numerical Analysis, World Scientific Press, A. Bultheel and R. Cools, Eds., pp. 109-140, 2009.
- P. Pauca, J. van der Gracht, R. Plemmons, S. Prasad, and T. Torgersen, *Pupil Phase Encoding for Multi-Aperture Imaging* Proc. Annual SPIE Conf., San Diego, August, 2008.
- P. Zhang, H. Wang, R. Plemmons and P. Pauca, *Tensor Methods for Hyperspectral Data Analysis: A Space Object Material Identification Study*, J. Optical Soc. Amer., Vol. 25, No. 12, pp. 3001-3012, Dec. 2008.
- M. Ng and R. Plemmons, *Blind Deconvolution and Structured Matrix Computations with Applications to Array Imaging*, Invited Chapter (46 pp.) in Blind Image Deconvolution: Theory and Applications, P. Campisi and K. Egiazarian, Eds., CRC Press, 2007.
- D. Bharkhada, H. Yu, R. Plemmons, G. Wang, *Line-source-based x-ray Tomography*, Inter. J. Biomedical Imaging, Vol. 2009, Article ID 534516, 8 pp., 2007.
- M. Berry, M. Browne, A. Langville, P. Pauca, and R. Plemmons *Algorithms and Applications for Approximate Nonnegative Matrix Factorization*, Computational Statistics & Data Analysis 52(1): 155-173, 2007. (Most cited paper in journal 2005-2010)
- A. Cichocki, R. Zdunek, S. Choi, R. Plemmons, and S. Amari *Novel Multi-layer Nonnegative Tensor Factorization with Sparsity Constraints*, Proc. of 8th International Conference on Adaptive and Natural Computing Algorithms, Warsaw, Poland, April 2007.

- P. Pauca, J. Piper and R. Plemmons, *Nonnegative Matrix Factorization for Spectral Data Analysis*, Lin. Alg. and Applic., Vol. 416, No. 1, pp. 29-47, 2006.
- R. Plemmons, *Inverse Problems in Atmospheric Imaging*, in Computer Mathematics and Applications: Advances and Developments, E. Lipitakis, Ed., LEA Press, Athens, Greece, pp. 195-204, 2006.
- J. Bardsley, S. Jefferies, J. Nagy and R. Plemmons, *A Computational Method for the Restoration of Images with an Unknown, Spatially-Varying Blur*, Optics Express, Vol. 14, no. 5, pp. 1767-1782, March, 2006.
- S. Shahnaz, M. Berry, P. Pauca, and R. Plemmons, *Document Clustering using Nonnegative Matrix Factorization*, Information Proc. and Manag., Vol. 42, pp. 373-386, 2006.
- Z. Mu, R. Plemmons and P. Santago, *Iterative Signal and Image Deconvolution for Estimation of the Complex Medium Response*, International Journal on Imaging Systems and Technology, 15, 266277, 2005.
- M. Chu and R. Plemmons, *Nonnegative Matrix Factorization and Applications*, Bulletin of the International Linear Algebra Society, Vol. 34, pp. 2-7, July 2005.
- P. Pauca, R. Plemmons, S. Prasad and J. van der Gracht, *High-Resolution Imaging Using Integrated Optical Systems*, International Journal on Imaging Systems and Technology, Vol. 14, No. 2, pp. 67-75, 2004 (invited paper).
- P. Pauca, J. Piper and R. Plemmons and M. Giffin, *Object Characterization from Spectral Data Using Nonnegative Factorization and Information Theory*, Proc. AMOS Tech. Conf., Maui, HI, Sept. 2004, on CD.
- P. Pauca, R. Plemmons, M. Giffin and K. Hamada, *Unmixing Spectral Data using Non-Negative Matrix Factorization*, Proc. AMOS Tech. Conf., Maui, HI, Sept. 2004, on CD.
- J.Y. Yuan, G.H. Golub, R.J. Plemmons, and W. Cecilio. *Semiconjugate Direction Methods for Real Positive Definite Systems*, BIT Numerical Mathematics, 44(1):189-207,2004.
- M. Catral, L. Han, M. Neumann and R. Plemmons, *On Reduced Rank Nonnegative Matrix Factorizations for Symmetric Matrices*, Lin. Alg. and Applic., Vol. 393, pp. 107-127, 2004.
- S. Prasad, T. Torgersen, V. Pauca, R. Plemmons, and J. van der Gracht, *Restoring Images with Space Variant Blur via Pupil Phase Engineering*, Optics in Information Systems, Special Issue on Computer Imaging, Vol. 4, No. 2, pp. 4-13, 2003.
- S. Prasad, T. Torgersen, P. Pauca, R. Plemmons, and J. van der Gracht, *Engineering the pupil phase to improve image quality*, Proc. SPIE, Vol. 5108 Visual Information Processing XII, edited by Z. Rahman, R. Schowengerdt, and S. Reichenbach (SPIE, Wellingham, WA), pp. 1-12, 2003.
- S. Prasad, R. Plemmons, P. Pauca and T. Torgersen, *Integrated Optics Systems for Image Quality Control*, Proc. AMOS Tech. Conf., Maui, HI, September, 2002.
- M. Chu and R. Plemmons. *Real-Valued, Low Rank Circulant Approximation*, SIAM J. on Matrix Analysis, 24, pp. 645-659, 2003.
- M. Chu , R. Funderlic and R. Plemmons, *Structured Low Rank Approximation*, Lin. Alg. and Applic., Vol. 336, pp. 157-172, 2002.
- J. van der Gratch, J. Nagy, V. Pauca and R. Plemmons, *Iterative Restoration of Wavefront Coded Imagery for Focus Invariance*, OSA Trends in Optics and Photonics, Integrated Computational Imaging Systems, OSA Tech. Dig., Washington, pp. 56-65, 2001.

- W. Cochran, R. Plemmons and T. Torgersen, *Exploiting Toeplitz Structure in Atmospheric Image Restoration*, Contemporary Mathematics, Vol. 280, pp. 177-198, 2001.
- R. Plemmons and P. Pauca, *Some Computational Problems Arising in Adaptive Optics Imaging Systems*, J. Comput. Appl. Math., Vol. 123, pp. 467-487, 2000.
- P. Pauca, B. Ellerbroek, R. Plemmons and X. Sun, *Structured Matrix Representations of Two-parameter Hankel Transforms in Adaptive Optics*, Linear Algebra Appl., Vol. 316, pp. 29-43, 2000.
- M. Ng, R. Plemmons and S. Qiao, *Regularization of RIF Blind Image Deconvolution*, IEEE Trans. Image Processing, Vol. 9(6), pp. 1130-1140, 2000.
- M. Chu, V. Pauca, R. Plemmons and X. Sun, *A Mathematical Framework for the Linear Reconstructor Problem in Adaptive Optics*, Linear Alg. Appl., Vol. 316, pp. 113-135, 2000.
- M. Ng, R. Plemmons and F. Pimentel, *A new approach to constrained total least squares image restoration*, Linear Alg. Appl., Vol. 316, pp. 237-258, 2000.

Books: Written and Edited

- A. Berman and R. Plemmons, **Nonnegative Matrices in the Mathematical Sciences**, SIAM, Philadelphia, PA, USA, 340 pp., 1994 (Revised second edition. First edition published by Academic Press, 1979).
- K. Gallivan, M. Heath, E. Ng, J. Ortega, B. Peyton, R. Plemmons, C. Romine, A. Sameh and R. Voigt, **Parallel Algorithms for Matrix Computations**, SIAM, Philadelphia, 197 pp., 1990.
- D. Brown, M. Chu, D. Ellison and R. Plemmons, Eds, **Proceedings of the Cornelius Lanczos International Centenary Conference**, SIAM, Philadelphia, 643 pp., 1993.
- A. Bjorck, R. Plemmons and H. Schneider, Eds, **Large Scale Matrix Problems**, North Holland, NY, 404 pp., 1981.
- G. Golub, A. Liu, F. Luk and R. Plemmons, Eds, **Scientific Computing**, Springer, Hong Kong, 315 pp., 1997.
- C. Meyer and R. Plemmons, Eds, **Linear Algebra, Markov Chains, and Queuing Models**, Springer, NY, 420 pp., 1993.

Synergistic Activities

- Author of over 250 articles and books.
- Directed Thirty-two M.S. students and twelve Ph.D. students.
- Society for Industrial and Applied Math (SIAM): served two terms on the Council and one term on the Board of Trustees.
- SIAM Activity Group Linear Algebra, Founding Vice-Chair, 1982, Chair 1984-86.
- SIAM Activity Group on Imaging Science, Founding Vice-Chair, 1999-2001.
- Member of APS, IEEE, OSA, SIAM and SPIE. Served on editorial boards of 9 journals.
- Honored as Engineering Educator of the year in 1999 for by the IEEE North Carolina Section for his work in the Wake Forest University Medical Engineering Program.
- Continuous research support from DoD and/or NSF grants, 1967-present.
- Testimony representing SIAM given before the U.S. Senate Committee on Defense Appropriations, and before the U.S. House of Representatives Committee on National Security, 1997-98.