

# CURRICULUM VITAE : GILBERT STRANG

Work: Department of Mathematics, M.I.T.  
Cambridge MA 02139  
Phone: 617-253-4383  
Fax: 617-253-4358  
e-mail: [gs@math.mit.edu](mailto:gs@math.mit.edu)  
URL: <http://math.mit.edu/> gs

Home: 7 Southgate Road  
Wellesley MA 02482  
Phone: 781-235-9537

## Education

1. 1952–1955 William Barton Rogers Scholar, M.I.T. (S.B. 1955)
2. 1955–1957 Rhodes Scholar, Oxford University (B.A., M.A. 1957)
3. 1957–1959 NSF Fellow, UCLA (Ph.D. 1959)

## Positions Held

1. 1959–1961 C.L.E. Moore Instructor, M.I.T.
2. 1961–1962 NATO Postdoctoral Fellow, Oxford University
3. 1962–1964 Assistant Professor of Mathematics, M.I.T.
4. 1964–1970 Associate Professor of Mathematics, M.I.T.
5. 1970– Professor of Mathematics, M.I.T.

## Awards and Duties

1. Alfred P. Sloan Fellow (1966–1967)
2. Chairman, M.I.T. Committee on Pure Mathematics (1975–1979)
3. Chauvenet Prize, Mathematical Association of America (1976)
4. Council, Society for Industrial and Applied Mathematics (1977–1982)
5. NSF Advisory Panel on Mathematics (1977–1980) (Chairman 1979–1980)
6. CUPM Subcommittee on Calculus (1979–1981)
7. Fairchild Scholar, California Institute of Technology (1980–1981)

8. Honorary Professor, Xian Jiaotong University, China (1980)
9. American Academy of Arts and Sciences (1985)
10. Taft Lecturer, University of Cincinnati (1977)
11. Gergen Lecturer, Duke University (1983)
12. Lonseth Lecturer, Oregon State University (1987)
13. Magnus Lecturer, Colorado State University (2000)
14. Blumberg Lecturer, University of Texas (2001)
15. AMS-SIAM Committee on Applied Mathematics (1990–1992)
16. Vice President for Education, SIAM (1991–1996)
17. MAA Science Policy Committee (1992–1995)
18. Committee on the Undergraduate Program in Mathematics, MAA (1993–1996)
19. President of SIAM (1999–2000)
20. Chair, Joint Policy Board for Mathematics (1999)
21. Chair, SIAM Committee on Science Policy (2001–2002)
22. Honorary Fellow, Balliol College, Oxford (1999)
23. Honorary Member, Irish Mathematical Society (2002)
24. US National Committee on Mathematics (2001–2004, Chair 2003–2004)
25. Award for Distinguished Service to the Profession, SIAM (2003)
26. Graduate School Teaching Award, MIT (2003)
27. Abel Prize Committee, Oslo (2003–2005)
28. Von Neumann Prize Medal, US Association for Computational Mechanics (2005)
29. Ford Prize for “Pascal Matrices” with Alan Edelman, Mathematical Association of America (2005)
30. Distinguished University Teacher of Mathematics, New England Section, Mathematical Association of America (2006)
31. Franklin and Deborah Tepper Haimo Prize, MAA (2006)
32. Su Buchin Prize, International Congress of Industrial and Applied Mathematics (ICIAM, Zurich, 2007)

33. Henrici Prize (ICIAM, Zurich, 2007)
34. National Academy of Sciences (2009)
35. Doctor Honoris Causa, University of Toulouse (2010)
36. Doctor Honoris Causa, Aalborg University (2013)

## Journal Editor

1. *Numerische Mathematik* (Honorary Editor from 1996)
2. *International Journal for Numerical Methods in Engineering*
3. *Archive for Rational Mechanics and Analysis* (to 1990)
4. *Studies in Applied Mathematics*
5. *Computer Methods in Applied Mechanics and Engineering* (to 2004)
6. *SIAM Journal of Numerical Analysis* (to 1977)
7. *Numerical Functional Analysis and Optimization*
8. *Physica D: Nonlinear Phenomena* (to 1986)
9. *Communications in Numerical Methods in Engineering*
10. *SIAM Journal on Matrix Analysis and Applications* (to 1993)
11. *Acta Applicandae Mathematicae*
12. *Proceedings of the Edinburgh Mathematical Society* (to 1993)
13. *Mathematical Modelling and Numerical Analysis*
14. *Japan Journal of Applied Mathematics*
15. *Structural Optimization*
16. *Royal Society of Edinburgh, Proceedings A*
17. *Computational Optimization and Applications*
18. *SIAM Review* (to 2001)
19. *COSMOS*, National University of Singapore
20. *Numerical Algorithms* (to 2004)
21. *Communications in Information and Systems*

22. *International Journal of Mathematics and Computer Science*

23. *Communications in Information and Systems*

24. *International Journal of Mathematics and Computer Science*

## Books

1. An Analysis of the Finite Element Method, with George Fix, Prentice-Hall (1973). Second edition, Wellesley-Cambridge Press (2008).
2. Linear Algebra and Its Applications, Academic Press (1976). Second Edition : Harcourt Brace Jovanovich (1980). Third Edition : Brooks/Cole (1988). Fourth Edition : Brooks/Cole/Cengage (2006).
3. Introduction to Applied Mathematics, Wellesley-Cambridge Press (1986).
4. Nonlinear Partial Differential Equations in Applied Science, H. Fujita, P. Lax, G. Strang, editors, Lecture Notes in Numerical and Applied Analysis 5, Kinokuniya/North Holland (1982).
5. Topics in Nonsmooth Mechanics, J. J. Moreau, P. D. Panagiotopoulos, G. Strang, editors, Birkhuser (1988).
6. Calculus, Wellesley-Cambridge Press (1991). Second Edition (2010).
7. Introduction to Linear Algebra, Wellesley-Cambridge Press (1993). Second Edition (1998). Third Edition (2003). Fourth Edition (2009).
8. Wavelets and Filter Banks, with Truong Nguyen, Wellesley-Cambridge Press (1996).
9. Linear Algebra, Geodesy, and GPS, with Kai Borre, Wellesley-Cambridge Press (1997).
10. Computational Science and Engineering, Wellesley-Cambridge Press (2007).
11. Algorithms for Global Positioning, with Kai Borre, Wellesley-Cambridge Press (2012).
12. Essays in Linear Algebra, Wellesley-Cambridge Press (2012).
13. Differential Equations and Linear Algebra, Wellesley-Cambridge Press (2014).

## Video Lectures (MIT OpenCourseWare)

1. 18.06 Linear Algebra
2. 18.085 18.086 Computational Science and Engineering
3. Highlights of Calculus

## Articles

1. An improvement on the Holzer table based on a suggestion of Rayleigh's, with S.H. Crandall, *J. Appl. Mechanics*, Paper 56-A27 (1957).
2. On the order of convergence of the Crank-Nicolson procedure, *J. Math. and Physics* 83 (1959) 141-144.
3. Difference methods for mixed boundary-value problems, *Duke Math. Journal* 27 (1960) 221-232.
4. On the Kantorovich inequality, *Proc. Amer. Math. Soc.*, 11 (1960) 468.
5. A note on the joint spectral radius, with G.-C. Rota, *Proc. Netherlands Academy* 22 (1960) 379-381.
6. Finite difference techniques for a boundary problem, with L. Ehrlich, J. Riley and B.A. Troesch, *J. Soc. Ind. Appl. Math.* (1961).
7. Eigenvalues of Jordan products, *Amer. Math. Monthly* 69 (1962) 37-40.
8. Trigonometric polynomials and difference methods of maximum accuracy, *J. Math. and Phys.* 41 (1962) 147-154.
9. Polynomial approximation of Bernstein type, *Trans. Amer. Math. Soc.* 105 (1962) 525-535.
10. Comparison theorems for supremum norms, with H. Schneider, *Numerische Math.* 4 (1962) 15-20.
11. Accurate partial difference methods I: Linear Cauchy problems, *Arch. Rat. Mech. Anal.* 12 (1963).
12. Accurate partial difference methods II: Non-linear problems, *Numerische Math.* 6 (1964) 37-46.
13. Wiener-Hopf difference equations, *J. Math. Mechanics* 13 (1964) 85-96.
14. Unbalanced polynomials and difference methods for mixed problems, *SIAM J. Numer. Anal.* 2 (1964) 46-51.
15. Necessary and insufficient conditions for well-posed Cauchy problems, *J. Diff. Eq.* 2 (1966) 107-114.
16. Matrix theorems for partial differential and difference equations, with J. Miller, *Math. Scand.* 18 (1966) 113-133.
17. Implicit difference methods for initial-boundary value problems, *J. Math. Anal. Appl.* 16 (1966) 188-198.
18. On strong hyperbolicity, *J. Math. Kyoto Univ.* 6 (1967) 397-417.

19. A variant of Caratheodory's problem, *Proc. Edinburgh Math. Soc.* 16 (1968) 43-48.
20. The nucleus of a set, *Canad. Math. Bull.* 11 (1968) 65-72.
21. On the construction and comparison of difference schemes, *SIAM J. Numer. Anal.* 5 (1968) 506-517.
22. Approximating semigroups and the consistency of difference schemes, *Proc. Amer. Math. Soc.* 20 (1969) 1-7.
23. Hyperbolic initial-boundary value problems in two unknowns, *J. Diff. Eq.* 6 (1969) 161-171.
24. On numerical ranges and holomorphic semigroups, *J. d'Analyse Math.* 22 (1969) 299-318.
25. On multiple characteristics and the Levi-Lax conditions for hyperbolicity, *Arch. Rat. Mech. Anal.* 33 (1969) 358-373.
26. Fourier analysis of the finite element method in Ritz-Galerkin theory, with G. Fix, *Studies in Appl. Math.* 48 (1969) 265-273.
27. Toeplitz operators in a quarter-plane, *Bull. Amer. Math. Soc.* 76 (1970) 1303-1307.
28. The correctness of the Cauchy problem, with H. Flaschka, *Advances in Math.* 6 (1971) 347-349.
29. The finite element method and approximation theory, *SYNSPADE Proceedings*, Academic Press (1971) 547-584.
30. The change in solution due to change in domain, with A. Berger, *AMS Symposium on Partial Differential Equations*, Berkeley (1971) 199-206.
31. Approximation in the finite element method, *Numerische Math.* 19 (1972) 81-98.
32. Approximate boundary conditions in the finite element method, with R. Scott and A. Berger, *Symposia Mathematica X*, Istituto Nazionale di Alta Matematica (1972) 295-313.
33. Variational crimes in the finite element method, "The Mathematical Foundations of the Finite Element Method", ed. by A.K. Aziz, Academic Press (1973) 689-710.
34. A Fourier analysis of the finite element variational method, with G. Fix, *Constructive Aspects of Functional Analysis*, Edizioni Cremonese, Rome (1973) 795-840.
35. Piecewise polynomials and the finite element method, *AMS Bulletin* 79 (1973) 1128-1137.
36. Optimal conditioning of matrices, with C. McCarthy, *SIAM J. Numer. Anal.* 10 (1973) 370-388.

37. The dimension of piecewise polynomial spaces and one-sided approximation, Proc. Conference on Numerical Analysis, Dundee, Springer Lecture Notes 363 (1974) 144-152.
38. One-sided approximation and plate bending, Lecture Notes in Computer Science 11, Springer-Verlag (1974) 140-155.
39. One-sided approximation and variational inequalities, with U. Mosco, Bull. Amer. Math. Soc. 80 (1974) 308-312.
40. The finite element method—linear and nonlinear applications, Proc. Intern. Congress of Mathematicians, Vancouver (1974).
41. Free boundaries and finite elements in one dimension, with W. Hager, Math. Comp. 29 (1975) 1020-1031.
42. A homework exercise in finite elements, Inter. J. Num. Meth. in Engineering 11 (1977) 411-418.
43. Some recent contributions to plasticity theory, J. Franklin Institute 302 (1977) 429-442.
44. Discrete plasticity and the complementarity problem, Proceedings U.S.-Germany Symposium: Formulations and Computational Algorithms in Finite Element Analysis, M.I.T. Press (1977) 839-854.
45. Uniqueness in the theory of variational inequalities, Advances in Math. 22 (1976) 356-363.
46. A minimax problem in plasticity theory, Functional Analysis Methods in Numerical Analysis, ed. M.Z. Nashed, Springer Lecture Notes 701 (1979) 319-333.
47. A family of model problems in plasticity, Proc. Symp. Computing Methods in Applied Sciences, ed. R. Glowinski and J.L. Lions, Springer Lecture Notes 704 (1979) 292-308.
48. The saddle point of a differential program, with H. Matthies and E. Christiansen, Energy Methods in Finite Element Analysis, ed. by R. Glowinski, E. Rodin, and O.C. Zienkiewicz, John Wiley (1979).
49. The solution of nonlinear finite element equations, with H. Matthies, Inter. J. Num. Meth. in Eng. 14 (1979) 1613-1626.
50. Mathematical and computational methods in plasticity, with H. Matthies and R. Temam, Proc. IUTAM Symp. on Variational Methods in the Mechanics of Solids, S. Nemat-Nasser, ed., Pergamon (1980) 20-28.
51. Spectral decomposition in advection-diffusion analysis by finite element methods, with R. Nickell and D. Gartling, Proc. FENOMECH Symp., Stuttgart (1978); Computer Methods in Appl. Mech. and Eng. 17 (1979) 561-580.

52. Existence de solutions relaxées pour les équations de la plasticité, with R. Temam, *Comptes Rendus Acad. Sc. Paris* 287 (1978) 515-519.
53. Functions of bounded deformation, with R. Temam, *Arch. Rat. Mech. Anal.* 75 (1980) 7-21.
54. Numerical computations in nonlinear mechanics, with H. Matthies, Paper 79-PVP-103, *Amer. Soc. Mech. Eng.* (1979); *Proceedings of the 4th Symposium on Computing Methods in Applied Sciences and Engineering*, ed. R. Glowinski and J.L. Lions, 517-525, North-Holland (1980).
55. Duality and relaxation in the variational problems of plasticity, with R. Temam, *J. de Mécanique* 19 (1980) 1-35.
56. The quasi-Newton method in finite element calculations, Chapter 20 in *Computational Methods in Nonlinear Mechanics*, J.T. Oden, ed., North-Holland (1980).
57. The application of quasi-Newton methods in fluid mechanics, with M. Engelman and K.J. Bathe, *Int. J. Num. Meth. Eng.* 17 (1981) 707-718.
58. A problem in capillarity and plasticity, with R. Temam, *Nondifferentiable and Variational Techniques in Optimization*, D.C. Sorenson, R.J.B. Wets, eds., *Mathematical Programming Study* 17 (1982) 91-102.
59. Optimal design for torsional rigidity, with R. Kohn, *Proc. Int. Symp. on Mixed and Hybrid Finite Element Methods*, Atlanta (1981).
60. Optimal design of cylinders in shear, with R. Kohn, *MAFELAP Conference*, Brunel (1981).
61. The width of a chair, *American Math. Monthly* 89 (1982) 529-534.
62. Structural design optimization, homogenization, and relaxation of variational problems, with R. Kohn, *Proceedings of Conference on Disordered Media*, *Lecture Notes in Physics* 154, Springer-Verlag (1982) New York.
63. Hencky-Prandtl nets and constrained Michell trusses, with R. Kohn, *Conference on Optimum Structural Design*, Tucson (1981), *Computer Methods in Applied Mechanics and Engineering* 36 (1983) 207-222.
64. The optimal accuracy of difference schemes, with A. Iserles, *Transactions Amer. Math. Soc.* 277 (1983) 770-803.
65. Duality in the classroom, *American Math. Monthly* 91 (1984) 250-254.
66. Maximal flow through a domain, *Mathematical Programming* 26 (1983) 123-143.
67. Barriers to stability, with A. Iserles, *SIAM J. Numerical Analysis* 20 (1983) 1251-1257.

68.  $L^1$  and  $L^\infty$  and approximation of vector fields in the plane, “Nonlinear Partial Differential Equations in Applied Science,” H. Fujita, P. Lax, and G. Strang, eds., Lecture Notes in Num. Appl. Anal. 5 (1982) 273-288.
69. Notes on softening and local instability, with M. Abdel-Naby, in “Computational Aspects of Penetration Mechanics,” Springer Lecture Notes in Engineering 3, J. Chandra and J. Flaherty, eds. (1983).
70. A negative results for nonnegative matrices, Journal of Xian Jiaotong University 17 (1983) 69-72.
71. Numerical and biological shape optimization, with A. Philpott, in “Unification of Finite Element Methods,” Math. Studies 94, H. Kardestuncer, ed., North-Holland (1984).
72. Explicit relaxation of a variational problem in optimal design, with R. Kohn, Bull. Amer. Math. Soc. 9 (1983) 211-214.
73. Optimal design and relaxation of variational problems, with R. Kohn, Communications on Pure and Appl. Math. 39 (1986) 113-137 (Part I), 139-182 (Part II), 353-377 (Part III).
74. The constrained least gradient problem, with R. Kohn, in Non-Classical Continuum Mechanics, R. Knops and A. Lacey, eds., Cambridge University Press (1987).
75. The optimal design of a two-way conductor, with R. Kohn, in Nonsmooth Mechanics, P.D. Panagiotopoulos et al, eds., Birkhuser (1987).
76. Fibered structures in optimal design, with R. Kohn, Ordinary and Partial Differential Equations, B. Sleeman and R. Jarvis, eds., Pitman Research Notes 157, Longman (1987).
77. Optimal design in elasticity and plasticity, with R. Kohn, Int. J. Numerical Meths. in Eng. 22 (1986) 183-188.
78. A framework for equilibrium equations, SIAM Review 30 (1988) 283-297.
79. Karmarkar’s algorithm in a nutshell, SIAM News 18 (1985) 13.
80. Karmarkar’s algorithm and its place in applied mathematics, Math. Intelligencer 9 (1987) 4-10.
81. A proposal for Toeplitz matrix calculations, Studies in Appl. Math. 74 (1986) 171-176.
82. The Toeplitz-circulant eigenvalue problem  $Ax = \lambda Cx$ , with A. Edelman, pp. 109-117 in Oakland Conf. on PDE’s and Applied Mathematics, L. Bragg and J. Dettman, eds., Longman (1987).
83. Patterns in linear algebra, American Math. Monthly 96 (1989) 105-117.

84. Paradox lost: Natural boundary conditions in the Ritz- Galerkin method, with J. Storch, *Int. J. Numerical Methods in Engineering* 26 (1988) 2255-2266.
85. Dual extremum principles in finite elastoplastic deformation, with Y. Gao, *Acta Appl. Mathematicae* 17 (1989) 257-268.
86. Toeplitz equations by conjugate gradients with circulant preconditioner, with R. Chan, *SIAM J. Sci. Stat. Comp.* 10 (1989) 104-119.
87. Geometric nonlinearity: Potential energy, complementary energy, and the gap function, with Y. Gao, *Quarterly of Applied Mathematics* 47 (1989) 487-504.
88. Teaching modern engineering mathematics, *Applied Mechanics Review* 39 (1986) 1319-1321; SEFI Proceedings, L. Rade, ed., Chartwell-Bratt (1988).
89. Sums and differences vs. integrals and derivatives, *College Mathematics Journal* 21 (1990) 20-27.
90. Wavelets and dilation equations: A brief introduction, *SIAM Review* 31 (1989) 614-627.
91. Inverse problems and derivatives of determinants, *Archive Rational Mech. and Analysis* 114 (1991) 255-265.
92. A thousand points of light, with D. Hardin, *Third Conference on Technology in Collegiate Mathematics* (1990).
93. A chaotic search for  $i$ , *College Math. Journal* 22 (1991) 3-12.
94. The optimal coefficients in Daubechies wavelets, *Physica D* 60 (1992) 239-244.
95. Polar area is the average of strip areas, *Amer. Math. Monthly* 100 (1993) 250-254.
96. The fundamental theorem of linear algebra, *Amer. Math. Monthly* 100 (1993) 848-855.
97. "Wavelet transforms versus Fourier transforms", *Bull. Amer. Math. Soc.* 28 (1993) 288-305.
98. Graphs, matrices, and subspaces, *College Math. Journal* 24 (1993) 20-28.
99. The asymptotic probability of a tie for first place, with B. Eisenberg and G. Stengle, *Annals of Applied Probability* 3 (1993) 731-745.
100. Continuity of the joint spectral radius: Applications to wavelets, with C. Heil, *Linear Algebra for Signal Processing*, A. Bojanczyk and G. Cybenko, eds., IMA 69 (1994) Springer-Verlag.
101. Convolution, reconstruction, and wavelets, *Advances in Computational Mathematics: New Delhi*, H.P. Dikshit and C.A. Micchelli, eds. (1994), World Scientific Publishing.
102. Short wavelets and matrix dilation equations, with V. Strela, *IEEE Trans. on Signal Processing* 43 (1995) 108-115.

103. Orthogonal multiwavelets with vanishing moments, with V. Strela, Proc. SPIE Conference on Mathematics of Imaging, J. Optical Eng. 33 (1994) 2104-2107.
104. Wavelets, American Scientist 82 (1994) 250-255.
105. Every unit matrix is a LULU, Linear Algebra and Its Applications 265 (1997) 165-172.
106. Finite element multiwavelets, with V. Strela, Proc. Maratea NATO Conference, Kluwer (1995).
107. Approximation by translates of refinable functions, with C. Heil and V. Strela, Numerische Mathematik 73 (1996) 75-94.
108. The cascade algorithm for the dilation equation, Proc. Argonne Conference on Wavelets (1994).
109. Eigenvalues ( $\downarrow 2$ ) and convergence of the cascade algorithm, IEEE Trans. Signal Processing 44 (1996) 233-238.
110. The applications of multiwavelet filter banks to image processing, with P. Heller, V. Strela, P. Topiwala, and C. Heil, IEEE Trans. Image Processing, 8 (1999) 548-563.
111. Asymptotic analysis of Daubechies polynomials, with Jianhong Shen, Proc. Amer. Math. Soc. 124 (1996) 3819-3833.
112. Biorthogonal multiwavelets and finite elements, with V. Strela, preprint (1996).
113. Condition numbers for wavelets and filter banks, Computational and Appl. Math. (Brasil) 15 (1996) 161-179.
114. Eigenvalues of Toeplitz matrices with  $1 \times 2$  blocks, Zeit. Angew. Math. Mech. 76 (1996) 37-39.
115. Asymptotic structures of Daubechies scaling functions and wavelets, with Jianhong Shen, Appl. and Comp. Harmonic Analysis 5 (1998) 312-331.
116. Wavelets from filter banks, The Mathematics of Numerical Analysis AMS-SIAM Park City Symposium, J. Renegar, M. Shub, and S. Smale, eds. (1996), 765-806.
117. Filter banks and wavelets, in Wavelets: Theory and Applications, G. Erlebacher, M. Y. Hussaini, L. Jameson, eds., Oxford Univ. Press (1996).
118. Creating and comparing wavelets, Numerical Analysis: A. R. Mitchell Anniversary Volume, D. Griffiths, ed. (1996).
119. Writing about mathematics, SIAM News , (June 1996).
120. The mathematics of GPS, SIAM News , (June 1997).
121. Wavelets, Iterative Methods in Scientific Computing, pp. 59-110, R. Chan, T. Chan and G. Golub, eds., Springer (1997).

122. The first moment of wavelet random variables, with Y. Ma and B. Vidakovic, preprint (1997).
123. The search for a good basis, Numerical Analysis 1997, D. Griffiths, D. Higham, and A. Watson, eds., Addison Wesley Longman (1997).
124. The asymptotics of optimal (equiripple) filters, with Jianhong Shen, IEEE Trans. on Signal Processing 47 (1999) 1087-1098.
125. Inhomogeneous refinement equations, with Ding-Xuan Zhou, J. Fourier Analysis and Applications 4 (1998) 733-747.
126. Autocorrelation functions in GPS data processing: modeling aspects, with Kai Borre, ION Conference (1997).
127. A linear algebraic representation of the double entry accounting system, with A. Arya, J. Fellingham, J. Glover, and D. Schroeder, Manuscript (1998).
128. The discrete cosine transform, block Toeplitz matrices, and filter banks, Computational Mathematics, Shen, C. Micchelli, J. Xu, eds. Marcel Dekker (1998).
129. The discrete cosine transform, SIAM Review 41 (1999) 135-147.
130. The limits of refinable functions, with Ding-Xuan Zhou, Trans. American Math. Soc 353 (2001) 1971-1984.
131. The potential theory of several intervals and its applications, with J. Shen and A. Wathen, Appl. Math. Opt. 44 (2001) 67-85.
132. Row reduction of a matrix and  $A = CaB$ , with S. Lee, American Mathematical Monthly 107 (2000) 681-688.
133. On wavelet fundamental solutions to the heat equation: Heatlets, with J. Shen, J. Differential Eqns. 161 (2000) 403-421.
134. Compactly supported refinable functions with infinite masks, with V. Strela and Ding-Xuan Zhou, in The Functional and Harmonic Analysis of Wavelets and Frames, L. Baggett and D. Larson, eds., American Math. Soc. Contemporary Mathematics 247 (1999) 285-296.
135. Trees with Cantor eigenvalue distribution, with Li He and Xiangwei Liu, Studies in Applied Mathematics 110 (2003) 123-136.
136. Eigenstructures of spatial design matrices, with D. Gorsich and M. Genton, J. Multivariate Analysis 80 (2002) 138-165.
137. On the factorization of M-channel paraunitary filter banks, with X.Q. Gao and T. Nguyen, IEEE Transactions on Signal Processing 49 (2001) 1433-1446.

138. Detection and short-term prediction of epileptic seizures from the EEG signal by wavelet analysis and gaussian mixture model, with Lingmin Meng, Mark Frei, Ivan Osorio, and Truong Nguyen, *Medical Eng. and Physics* (2004).
139. Laplacian eigenvalues of growing trees, with Li He and Xiangwei Liu, *Proc. Conf. on Math. Theory of Networks and Systems*, Perpignan (2000)
140. Teaching and learning on the Internet, *Mathematical Association of America*, (2001)
141. The joint spectral radius, Commentary on paper # 5 , *Collected Works of Gian-Carlo Rota* (2001).
142. Localized eigenvectors from widely spaced matrix modifications, with Xiangwei Liu and Susan Ott, *SIAM J. Discrete Math* 16 (2003) 479-498.
143. IMACS Matrices, *Proceedings of 16th IMACS World Congress* (2000).
144. Signal processing for everyone, *Computational Mathematics Driven by Industrial Problems* , Springer Lecture Notes in Mathematics 1739 , V. Capasso, H. Engl, and J. Periaux, eds. (2000).
145. A study of two-channel complex-valued filter banks and wavelets with orthogonality and symmetry properties, with X.Q. Gao and T. Nguyen, *IEEE Transactions on Signal Processing*, 50 (2002) 824-833.
146. Binomial matrices, with G. Boyd, C. Micchelli, and D.X. Zhou, *Advances in Computational Mathematics* , 14 (2001) 379-391.
147. Block tridiagonal matrices and the Kalman filter, *Wavelet Analysis: Twenty Years Developments*, D.X. Zhou, ed., World Scientific Press (2002).
148. Smoothing by Savitzky-Golay and Legendre filters, with Per-Olof Persson, in *Mathematical Systems Theory* , IMA Vol. 134, J. Rosenthal and D. Gilliam, eds., Springer (2002).
149. Too Much Calculus, *SIAM Linear Algebra Activity Group Newsletter* (2002); [web.mit.edu/18.06](http://web.mit.edu/18.06).
150. Pascal matrices, with Alan Edelman, *American Math. Monthly*, 111 (2004) 189-197.
151. The Laplacian eigenvalues of a polygon, with Pavel Grinfeld, *Computers and Mathematics with Applications* 48 (2004) 1121-1133.
152. A simple mesh generator in MATLAB, with Per-Olof Persson, *SIAM Review*, 46 (2004). 329-345.
153. The interplay of ranks of submatrices , with Tri Nguyen, *SIAM Review* 46 (2004) 637-646.
154. Circuit simulation and moving mesh generation, with Per-Olof Persson, *Proceedings Int. Symp. Comm. & Inf. Technology (ISCIT)*, Sapporo (2004).

155. Linear algebra: A happy chance to apply mathematics, Proc. Int. Congress on Math. Education (ICME-10), Denmark (2004).
156. Book review: The SIAM 100-digit Challenge, *Science* 307 (2005) 521-522.
157. Peter Lax Wins Abel Prize, *SIAM News* 38 (2005).
158. A Remarkable Eye for Out-of-the-Ordinary Mathematics (interview with L. Mahadevan), *SIAM News* 38 (2005).
159. Matrices with prescribed Ritz values, with B. Parlett, *Linear Algebra and Its Applications* 428 (2008). 1725-1739.
160. Maximum flows and minimum cuts in the plane, *Journal of Global Optimization*, (2008); also in *Advances in Mechanics and Mathematics*, Volume III, D. Gao and H. Sgerlai, eds. (2008).
161. Maximum area with Minkowski measures of perimeter, *Proc. Royal Soc. Edinburgh* 138A (2008) 189-199.
162. Starting With Two Matrices, (2008), *Mathematics Magazine* 82 (2009). 278-283.
163. Optimal stability for trapezoidal-backward difference split-steps, with S. Dharmaraja and Y. Wang, *IMA J. Numerical Analysis* 30 (2010) 141-148.
164. The Four Fundamental Subspaces: 4 Lines
165. QR Decomposition: An Annotated Bibliography, with M.L.R. de Campos, Chapter 1 in *QRD-RLS Adaptive Filtering*, J. Apolinario, ed., Springer (2009).
166. The Jordan forms of  $AB$  and  $BA$ , with Ross Lippert, *Electronic Journal of Linear Algebra* 18 (2009) 281-288.
167. Laplace eigenvalues on regular polygons: A series in  $1/N$ , with Pavel Grinfeld, *J. Math. Analysis and Applications* 385 (2012) 135-148.
168. Green's matrices, with V. Olshevsky and P. Zhlobich, *Linear Algebra and Its Applications*, 432 (2010) 218-241.
169. Random triangle theory with geometry and applications, with Alan Edelman, *Foundations of Computational Mathematics*, submitted.
170. Proofs of the Spectral Theorem, with Alan Edelman, [web.mit.edu/18.06](http://web.mit.edu/18.06)
171. "The Calculus of Friendship", book review, *SIAM News* 12/09.
172. Fast transforms: Banded matrices with banded inverses, *Proc. National Academy of Sciences* 107 (#28) (2010) 12413-12416.
173. Introducing  $\text{ex}$ , in *A Century of Advancing Mathematics*, MAA Centennial Volume, P. Zorn et al, eds. (2015).

174. Groups of banded matrices with banded inverses, Proc. Amer. Math Soc. 139 (2011) 4255-4264.
175. Permutations as products of parallel transpositions, with Chase Albert, Chi-Kwong Li and Gexin Yu, SIAM Journal of Discrete Mathematics 25 (2011) 1412-1417.
176. Banded matrices with banded inverses and  $A = LPU$ , Proc. Fifth Intl. Congress of Chinese Mathematicians : ICCM2010, International Press and Amer. Math. Soc. (2012).
177. Triangular factorizations: The algebra of elimination, in Excursions in Harmonic Analysis vol. 3, J. J. Benedetto et al., eds, Springer (2014).
178. Balanced splitting and rebalanced splitting, with R. L. Speth, W. H. Green, and S. MacNamara, SIAM J. Numerical Analysis 56 (2013) 3084-3105.
179. The main diagonal of a permutation matrix, with M. Lindner, Linear Algebra and Its Applications 439 (2013) 524-537.
180. Symmetric elimination without pivoting, with P. Van Dooren, Linear Algebra and Its Applications 452 (2014) 40-45.
181. Functions of difference matrices are Toeplitz plus Hankel, with S. MacNamara, SIAM Review 56 (2014) 525-546.
182. Three steps on an open road, Inverse Problems and Imaging 7 (2013) 961-966.
183. Operator splitting, with S. MacNamara, in Operator Splitting and Alternating Direction Methods, R. Glowinski, S. Osher and W. Yin, eds., to appear.
184. Master equations, with S. MacNamara, to be submitted to SIAM News.
185. The core ideas in our teaching, Notices of the American Mathematical Society (2014), 61 (10) 1243–1245.
186. Row Rank Equals Column Rank: Four Approaches, Image 53 (Fall 2014), 17.
187. Nice functions, [math.mit.edu/dela](http://math.mit.edu/dela) .
188. Book Review: “Peter Lax, Mathematician: An Illustrated Memoir” SIAM News, May 2015.