REN-CANG LI

Department of Mathematics · University of Texas at Arlington · Arlington · Texas 76019

`http://www.uta.edu/faculty/rcli`

Academic Rank Professor of Mathematics

Education

Ph.D. Applied Mathematics, University of California, Berkeley, January, 1992–December, 1995.

M.S. Matrix Computations, the Chinese Academy of Sciences, P. R. China, September 1985–January, 1988

B.S. Computational Mathematics, Xiamen University, Fujian, P. R. China, September 1981–July, 1985

Awards

- NSF/CAREER award, 1999
- Friedman memorial prize in Applied Mathematics, University of California at Berkeley, 1996
- 1995 Householder Fellow in Scientific Computing, Oak Ridge National Laboratory

Grants

- (with C. Douglas) High Performance Multi-Scale Ocean Modeling, NSF, $211,517, 08/1998–07/2001.
- MSRI Travel Grant for participating *Introductory workshop on Foundations of computational mathematics and Symbolic computation in geometry and analysis*, $1,500, August 17–26, 1998.
- NSF Travel Grant for attending Householder Symposium XIV (Chateau Whistler, Whistler, B.C., Canada), $1,200, June 14 – 18, 1999.
- CAREER: Fast and Accurate Computations of Applied Eigenproblems, NSF, $205,000, 09/1999–08/2005.
- Structural preserving algorithms for eigenvalue problems, NSF, $240,160, 07/2005–07/2009.
- Marching Over Poles: Innovative Ways to Solve Matrix Differential Riccati Equations, NSF, $262,256, 09/2008-08/2012.

- Collaborative Research: Efficient Solvers for Nonlinear Eigenvalue Problems and Applications, NSF, $169,941, 09/2011-08/2014.

Editorial Service

- **Associate Editor**
  - SIAM Journal on Matrix Analysis and Applications (12/2006 –)
  - Mathematical Communications (12/2007 –)
  - Numerical Algebra, Control and Optimization (01/2011 –)
- **Member of Editorial Board**
  - Operators and Matrices (12/2011 –)

Graduate and Postdoctoral Advisors

- Ph.D. Advisor: William Kahan (University of California at Berkeley)
- Postdoctoral Advisor: Esmond Ng (Oak Ridge National Laboratory, and now Lawrence Berkeley National Laboratory)

Dissertation

Raising the Orders of Unconventional Schemes for Ordinary Differential Equations, 1995

Experience

1995-1996	Householder Fellow in Scientific Computing, Oak Ridge National Laboratory
1997	(summer) Visiting Assistant Professor, Laboratory for Computer Science, MIT
1995-2001	Assistant Professor, University of Kentucky
2001-2002	On research leave at HP's compiler group for Itanium
2001-2006	Associate Professor, University of Kentucky
2003	(summer) Visiting Associate Professor, Department of Computer Science, Stanford University
2003	(spring) Consultant to HP Calculator Division, Idaho
2006-	Professor, University of Texas at Arlington
2007	(6/14-7/12) Visiting Professor, Laboratoire ELIAUS, University of Perpignan, France
2008	(6/05-7/04) Visiting Professor, National Center for Theoretical Sciences Mathematics Division, National Tsing Hua University, Taiwan.
2010	(6/12-7/11) Visiting Professor, Department of Mathematics, Peking University.

Ph.D. students:

- Leonard Hoffnung (co-supervised with Qiang Ye, graduated Summer, 2004)
- Wei Zhang (graduated Summer 2007)
- Weichao Wang, Charles Kristopher Garrett
- Xin Liang (Peking University, 9/2011-8/2013)
- Zhongming Teng (Xiamen University, 9/2011-8/2012)

Short-term Visitors:

- Dr. Ninoslav Truhar, Department of Mathematics, J.J. Strossmayer University of Osijek, Croatia, May 2005 and Fall 2007.
- Dr. Rajendra Bhatia, Indian Statistical Institute, New Delhi 110 016, India, March 2007.
- Dr. Shufang Xu, Department of Mathematics, Peking University, March and April 2009.
- Dr. Weiguo Wang, School of Mathematical Sciences, Ocean University of China, September 2010 – August 2011.

Research Interest

- High Performance Computing
- Numerical Solution of Ordinary Differential Equations
- Numerical Linear Algebra, Reduced Order Modelling
- System Support for Scientific Computations
- Elementary Function Computations

Journal Publications

J1 A converse to the Bauer-Fike type theorem, *Linear Algebra and its Applications*, **109**(1988), 167–178.

J2 On perturbation theorems for the generalized eigenvalues of regular matrix pencils, *Math. Numer. Sinica*, **11**:1 (1989), 10–19 (Chinese). English transl. *Chinese J. Numer. Math. Appl.*, **11**:2 (1989), 24–35.

J3 Perturbation bounds for generalized eigenvalues. I, *Math. Numer. Sinica*, **11**:1 (1989), 196–204 (Chinese). English transl. *Chinese J. Numer. Math. Appl.*, **11** (1989), 1–9.

J4 Perturbation bounds for generalized eigenvalues. II, *Math. Numer. Sinica*, **11** (1989), 239–247 (Chinese). English transl. *Chinese J. Numer. Math. Appl.*, **11** (1989), 34–43.

J5 QR decomposition and nonlinear eigenvalue problems, *Math. Numer. Sinica*, **11**:4 (1989), 374–385. (Chinese).

J6 On the variations of the spectra of matrix pencils, *Linear Algebra and its Applications*, **139**(1990), 147–164.

J7 Computing the Critical Points of a Stability Problem, *Math. Numer. Sinica*, **12**:3 (1990), 250-258 (Chinese).

J8 On eigenvalues of a Rayleigh quotient matrix, *Linear Algebra and its Applications*, **169**(1992), 249–255.
The argument that led to Theorem 3 *is flawed, namely* (13) *in general incorrect because* Γ *and* Σ *may not commute. But the attacked problem is recently solved by* Andrew V. Knyazev and Merico E. Argentati (*SIAM Journal on Matrix Analysis and Applications*, **31**:3 (2010), 1521-1537.)

J9 Compute multiple nonlinear eigenvalues, *J. Comp. Math.*, **10**:1 (1992), 1–20.

J10 Algorithms for inverse eigenvalue problems, *J. Comp. Math.*, **10**(1992), 97–111.

J11 Solution of linear matrix equation $AXD - BXC = S$ and perturbation of eigenspaces of a matrix pencil, *J. Comp. Math.*, **10**(1992), Supplementary Issue, pp. 93–109.

J12 A perturbation bound for definite pencils, *Linear Algebra and its Applications*, **179**(1993), 191–202.

J13 A perturbation bound for the generalized polar decomposition, *BIT*, **33**(1993), 304–308.

J14 Norms of certain matrices with applications to variations of the spectra of matrices and matrix pencils, *Linear Algebra and its Applications*, **182**(1993), 199–234.

J15 Bounds on perturbations of generalized singular values and of associated subspaces, *SIAM J. Matrix Anal. Appl.*, **14**(1993), 195–234.

J16 On eigenvalue variations of Rayleigh quotient matrix pencils of a definite pencils, *Linear Algebra and its Applications*, **208/209** (1994), 471–483.

J17 On perturbations of matrix pencils with real spectra, *Math. Comp.*, **62**(1994), 231–265.

J18 New perturbation bounds for the unitary polar factor, *SIAM J. Matrix Anal. Appl.*, **16**(1995).

J19 (with Z.-H. Cao and J.-J. Xie) A sharp version of Kahan's theorem on clustered eigenvalues, *Linear Algebra and its Applications*, **245**(1996), 147–156.

J20 (with R. Bhatia) On perturbations of matrix pencils with real spectra, II. *Math. Comp.*, **65**(1996), 637–645.

J21 Relative perturbation bounds for the unitary polar factor, *BIT*, **37** (1997), 67–75.

J22 (with R. Bhatia and F. Kittaneh) Some inequalities for commutators and an application to spectral variation. II, *Linear and Multilinear Algebra*, **43**(1997), 207–219.

J23 (with W. Kahan) Unconventional schemes for a class of ordinary differential equations—with applications to the Korteweg-de Vries (KdV) equation, *J. Computational Physics*, **134**(1997), 316–331.

J24 (with W. Kahan) Composition constants for raising the orders of unconventional schemes for ordinary differential equations, *Math. Comp.*, **66**(1997), 1089–1099.

J25 (with R. Bhatia and F. Kittaneh) Eigenvalues of Symmetrizable Matrices, *BIT*, **38**(1998), 1-11.

J26 Spectral variations and Hadamard products: some problems, *Linear Algebra and its Applications*, **278** (1998), 317–326.

J27 Relative perturbation theory: I eigenvalue and singular value variations, *SIAM J. Matrix Anal. Appl.*, **19** (1998), 956–982.

J28 Relative perturbation theory: II eigenspace and singular space variations, *SIAM J. Matrix Anal. Appl.*, **20** (1999), 471–492.

J29 Relative perturbation theory: (III) more bounds on eigenvalue variation, *Linear Algebra and its Applications*, **266**(1997), 337–345.

J30 Relative perturbation theory: IV $\sin 2\theta$ Theorems, *Linear Algebra and its Applications*, **311** (2000), 45–60.

J31 A bound on the solution to a structured Sylvester equation with an application to relative perturbation theory, *SIAM J. Matrix Anal. Appl.*, **21** (1999), 440–445.

J32 (with G. W. Stewart) A new relative perturbation theorem for singular value problem, *Linear Algebra and its Applications*, **313** (2000), 41–51.

J33 (with W. Kahan and R. Bhatia) Pinchings and norms of scaled triangular matrices, *Linear and Multilinear Algebra*, **50** (2002), 15–21.

J34 On perturbations of matrix pencils with real spectra, a Revisit, *Mathematics of Computation*, **72** (2003), 715–728.

J35 (with Ninoslav Truhar) A theorem for graded indefinite hermitian matrices, *Linear Algebra and its Applications*, **359** (2003), 263–276.

J36 (with Qiang Ye) A Krylov subspace method for quadratic matrix polynomials with application to constrained least squares problems, *SIAM J. Matrix Anal. Appl.*, **25**:2 (2003), 405–428.

J37 (with Ernie Croot and Hui June Zhu) The ABC conjecture and correctly rounded reciprocal square roots, *Theoretical Computer Science*, **315** (2004), 405–417.

J38 Near optimality of Chebyshev interpolation for elementary function computations, *IEEE Transactions on Computers*, **53** (2004), 678–687.

J39 Accuracy of computed eigenvectors via optimizing a Rayleigh quotient, *BIT*, **44**:3 (2004), 585–593.

J40 (with Chi-Kwong Li) A note on eigenvalues of perturbed Hermitian matrices, *Linear Algebra and its Applications*, **395** (2005), 183–190.

J41 (with Z. Bai) Structure-preserving model reduction using a Krylov subspace projection formulation, *Communications in Mathematical Sciences*, **3**:2 (2005), 179–199.

J42 Relative perturbation bounds for positive polar factors of graded matrices, *SIAM J. Matrix Anal. Appl.*, **27**(2005), 424–433.

J43 (with L. Hoffnung and Q. Ye) Krylov type subspace methods for matrix polynomials, *Linear Algebra and its Applications*, **415**(2006), 52–81.

J44 Lower bounds for the condition number of a real confluent Vandermonde matrix, *Mathematics of Computation*, **75**(2006), 1987–1995.

J45 Asymptotically optimal lower bounds for the condition number of a real Vandermonde matrix, *SIAM J. Matrix Anal. Appl.*, **28**:3 (2006), 829–844.

J46 (with Chi-Kwong Li and Qiang Ye) Eigenvalues of An Alignment Matrix in Nonlinear Manifold Learning, *Communications in Mathematical Sciences*, **5**:2 (2007), 313–329.

J47 Convergence of CG and GMRES on a Tridiagonal Toeplitz Linear System, *BIT*, **47** (2007), 577–599.

J48 (with Qiang Ye and Hongyuan Zha) Analysis of An Alignment Algorithm for Nonlinear Dimensionality Reduction, *BIT*, **47** (2007), 873–885.

J49 (with Nicholas J. Higham and Françoise Tisseur) Backward Error of Polynomial Eigenproblems Solved by Linearization, *SIAM Journal on Matrix Analysis and Applications*, **29**:4 (2007), 1218-1241.

J50 On Meinardus' Examples For the Conjugate Gradient Method, *Mathematics of Computation*, **77** (2008), 335–352.

J51 Hard Cases For Conjugate Gradient Method, *International Journal for Information & Systems Sciences*, **4**:1 (2008), 15-29.

J52 Vandermonde Matrices with Chebyshev Nodes, *Linear Algebra and its Applications*, **428** (2008), 1803-1832.

J53 (with W. Zhang) The Rate of Convergence of GMRES on a Tridiagonal Toeplitz Linear System, *Numerische Mathematik*, **112** (2009), 267–293.

J54 (with S. Boldo and M. Daumas) Formally Certified Argument Reduction with a Fused-Multiply-Add, *IEEE Transactions on Computers*, **58**:8 (2009), 1139–1145.

J55 (with W. Zhang) The Rate of Convergence of GMRES on a Tridiagonal Toeplitz Linear System, II. *Linear Algebra and its Applications*, **431** (2009), 2425–2436.

J56 (with P. Benner and N. Truhar) On the ADI Method for Sylvester Equations, *Journal of Computational and Applied Mathematics*, **233** (2009), 1035-1045.

J57 Sharpness in Rates of Convergence For Symmetric Lanczos Method, *Mathematics of Computation*, **79**:269 (2010), 419–435.

J58 (with Ninoslav Truhar, Zoran Tomljanovic) Analysis of the solution of the Sylvester equation using Low Rank ADI with exact shifts, *Systems & Control Letters*, **59**:3-4 (2010), 248-257.

J59 (with W.-W. Lin and C.-S. Wang) Structured Backward Error for Palindromic Polynomial Eigenvalue Problems, *Numerische Mathematik*, **116**:1 (2010), 95–122.

J60 (with Yunkai Zhou) Bounding the Spectrum of Large Hermitian Matrices, *Linear Algebra and its Applications*, **435** (2011), 480-493.

J61 (with Zhaojun Bai, Roger Lee, and Shu-fang Xu) Stable Solutions of Linear Systems Involving Long Chain of Matrix Multiplications, *Linear Algebra and its Applications*, **435** (2011), 659-673.

J62 (with Xiao-Wen Chang) Multiplicative Perturbation Analysis for QR Factorizations, *Numerical Algebra, Control and Optimization*, **1**:2 (2011), 301-306.

J63 (with Yuji Nakatsukasa, Ninoslav Truhar, and Shufang Xu) Perturbation of Partitioned Hermitian Generalized Eigenvalue Problem, *SIAM Journal on Matrix Analysis and Applications*, **32**:2 (2011), 642-663.
Corrections: all $\widetilde{\lambda}_j$ *in the right-hand sides of* (2.23), (2.24), *and* (2.25) *should be replaced by* $\lambda_j^{(\mathrm{b})}$.

J64 (with W. Kahan) A Family of Anadromic Numerical Methods for Matrix Riccati Differential Equations, *Mathematics of Computation*, **81**:277 (2012), 233-265. Electronically published on May 6, 2011.

J65 (with Jungong Xue and Shu-fang Xu) Accurate Solutions of M-Matrix Sylvester Equations, *Numerische Mathematik*, OnlineFirst, October 11, 2011.

J66 (with Jungong Xue and Shu-fang Xu) Accurate Solutions of M-Matrix Algebraic Riccati Equations, *Numerische Mathematik*, OnlineFirst, October 11, 2011.

J67 (with R. Bhatia) An Interpolating Family of Means, *Communications on Stochastic Analysis*, to appear.

J68 (with Wei-Guo Wang and Wei-Chao Wang) ADDA: Alternating-Directional Doubling Algorithm for M-Matrix Algebraic Riccati Equations, *SIAM Journal on Matrix Analysis and Applications*, to appear.

J69 (with Dario Rocca, Zhaojun Bai, and Giulia Galli) A block variational procedure for the iterative diagonalization of non-Hermitian random-phase approximation matrices, *The Journal of Chemical Physics*, to appear

Refereed Conference Proceedings

C1 (with S. Boldo and M. Daumas) Theorems on efficient argument reductions, *Proceedings of the 16th IEEE Symposium on Computer Arithmetic*, pp.129–136, 2003.

C2 (with Zhaojun Bai) Structure-Preserving Model Reduction, Proceedings of PARA'04, J. Dongarra, K. Madsen, and J. Waśniewski (eds.), Lecture Notes in Computer Science, 3732 (2006), 323–332, Springer.

Book Sections

B1 (with Z. Bai) Stability and Accuracy Assessments (4 sections), in *Templates for the Solution of Algebraic Eigenvalue Problems: A Practical Guide*, Z. Bai, J. Demmel, J. Dongarra, A. Ruhe and H. van der Vorst eds, SIAM, 2000.

B2 Matrix Perturbation Theory, in *Handbook of Linear Algebra*, L. Hogben, R. Brualdi, A. Greenbaum and R. Mathias (editors), Chapman & Hall/CRC, New York, 2007.

B3 (with Z. Bai and Y. Su) A Unified Krylov Projection Framework for Structure-Preserving Model Reduction, in *Model Order Reduction: Theory, Research Aspects and Applications*, Series: Mathematics in Industry, Subseries: The European Consortium for Mathematics in Industry, Vol. 13, Schilders, Wilhelmus H.A.; van der Vorst, Henk A.; Rommes, Joost (Eds.), Springer, pp.75–93, 2008.

Submitted Papers

S1 (with Zhaojun Bai) Minimization Principle for Linear Response Eigenvalue Problem, I: Theory

S2 (with Zhaojun Bai) Minimization Principle for Linear Response Eigenvalue Problem, II: Computation

S3 (with Wei-Guo Wang and Wei-Chao Wang) Deflating Irreducible Singular M-Matrix Algebraic Riccati Equations

S4 (with Yuji Nakatsukasa, Ninoslav Truhar, and Wei-guo Wang) Perturbation of Multiple Eigenvalues

Selected Technical Reports (Unpublished)

R1 (with Huan Ren) An efficient tridiagonal eigenvalue solver on CM 5 with Laguerre's iteration, *Technical Report* UCB//CSD-94-848, Computer Science Division, University of California at Berkeley, 1994.

R2 Relations between the field of values of a matrix and those of its Schur complements, *Technical Report* UCB//CSD-94-849, Computer Science Division, University of California at Berkeley, 1994.

R3 Reciproot algorithm–correctly rounded? *Technical Report* UCB//CSD-94-850, Computer Science Division, University of California at Berkeley, 1994.

R4 Solving secular equations stably and efficiently, *LAPACK working notes # 89*, (1993). Also *Technical Report* UCB//CSD-94-851, Computer Science Division, University of California at Berkeley, 1994.

R5 Linear systems with coefficient matrices having fields of values not containing the origin, *Technical Report* UCB//CSD-94-853, Computer Science Division, University of California at Berkeley, 1994.

R6 A multi-resolution approach for calculating primary eigenvectors of a large set of images, *Technical Report*, 98-13, Department of Mathematics, University of Kentucky, June 1998.

R7 Unconventional reflexive numerical methods for matrix differential riccati equations, *Technical Report*, 2000-36, Department of Mathematics, University of Kentucky, November 2000.

R8 Test positive realness of a general transfer function matrix, *Technical Report*, 2000-20, Department of Mathematics, University of Kentucky, April 2000.

R9 Structural preserving model reductions, *Technical Report*, 2004-02, Department of Mathematics, University of Kentucky, January 2004.

R10 Sharpness in Rates of Convergence For CG and Symmetric Lanczos Methods, *Technical Report*, 2005-01, Department of Mathematics, University of Kentucky, January 2005.

R11 (with W. Kahan) *Modifying implicit midpoint rules for linear ordinary differential equation*, Tech. Report 2010-02, Department of Mathematics, University of Texas at Arlington, 2010. Available at `http://www.uta.edu/math/preprint/`.

R12 (with Kris Garrett) *GIP Integrators for Matrix Riccati Differential Equations*, Tech. Report 2011-05, Department of Mathematics, University of Texas at Arlington, 2011. Available at `http://www.uta.edu/math/preprint/`.

Problems

1. (with David Day) A bound on the eigenvalue gaps,
   Problem 10499, *The American Mathematical Monthly*, **103**: 1 (1996), p.75;
   Solution, *The American Mathematical Monthly*, **105**: 1 (1998), p.71.

Conference Talks

1. Bounds on perturbations of generalized singular values and of associated subspaces, *invited* Plenary talk, Householder Symposium XI, Sweden, 1990. (invited but was not able to attend.)

2. Relative perturbation theory for eigenvalue problem, *invited* Plenary talk, Householder Symposium XIII, Switzerland, June 17–21, 1996. (delivered by Professor W. Kahan.)

3. Eigenvalues of symmetrizable matrices, *invited* Minisymposium talk, ILAS '96 meeting, Germany, August 14–17, 1996. (invited but was not able to attend.)

4. Sensitivity analysis for polar decompositions, *Contributed*, SIAM 1996 Annual meeting, Kansas City, Missouri, July 22–26, 1996.

5. Raising the orders of unconventional schemes for ordinary differential equations, *Contributed*, SIAM 1996 Annual meeting, Kansas City, Missouri, July 22–26, 1996.

6. Unconventional schemes for ordinary differential equations, *ODE to Linear Algebra and Rational Approximation*, *invited* talk, a conference in honor of William B. Gragg on his 60th birthday, Monterey, CA, November 1-2, 1996.

7. Unconventional reflexive numerical methods for matrix differential riccati equations, *Contributed*, SIAM 1997 Annual meeting, Stanford, CA, July 13-18, 1997.

8. Spectral variation for diagonalizable matrices, *invited* Minisymposium talks, Sixth SIAM Conference on Applied Linear Algebra, Snowbird Ski & Summer Resort, Snowbird, UT, October 29-November 1, 1997.

9. A multi-resolution approach for calculating primary eigenvectors of a large set of images, *invited* Minisymposium talk, CAMS/SCMA -CSFD98, Canadian Applied Mathematics Society, Vancouver, British Columbia, Canada, May 28-31, 1998.

10. Unconventional reflexive numerical methods for matrix differential riccati equations, *invited* Minisymposium talk, MATHEMATICAL THEORY OF NETWORKS AND SYSTEMS (MTNS 98), Padavo, Italy, July 6-10, 1998.

11. A multi-resolution approach for calculating primary eigenvectors of a large set of images, *invited* Plenary talk, Householder Symposium XIV, Chateau Whistler, Whistler, B.C., Canada, June 14 – 18, 1999.

12. (with William Rayens) Trilinear decomposition and its applications, *invited* Minisymposium talk, SIAM 2000 Annual meeting, Puerto Rico, July 10–14, 2000.

13. (with William Rayens) Kronecker canonical forms and the $I \times J \times 2$ trilinear model, *Invited*, International Conference on Trilinear Models in Chemistry and Psychology (TRICAP). July 2000. Denmark.

14. (with William Rayens, Anders Andersen, Lee Blonder) Mathematical problems in the application of multilinear models to facial emotion processing experiments, *Contributed*, The International Society for Optical Engineering's International Symposium on Optical Science and Technology. August 2000. San Diego.

15. The abc conjecture and correctly rounded reciprocal square roots, *invited* talk, IFIP workshop on Mathematics of Mathematical Software, Portland, Oregon, USA, June 1 – 4, 2002.

16. Krylov type subspace methods for quadratic matrix polynomials, *contributed* talk, Householder Symposium XV, Peebles, Scotland, June 17 – 21, 2002.

17. Krylov type subspace methods for quadratic matrix polynomials, *invited* talk, Eighth SIAM Conference on Applied Linear Algebra, Williamsburg, 2003.

18. Structural preserving methods for large eigenvalue problems, *invited* mini-symposium talk, 75th Annual meeting of Gesellschaft für Angewandte Mathematik und Mechanik e.V. (GAMM), Dresden, Germany, March 21-27, 2004.

19. Structural preserving model reductions, (also co-organizer of the mini-symposium), PARA'04 workshop on state-of-the-art in Scientific Computing, Technical University of Denmark, Copenhagen, Denmark, June 20-23, 2004.

20. Rectangular Vandermonde Matrices and Convergence of Krylov Subspace Methods, *Invited* Plenary talk, 12th meeting of the International Linear Algebra Society, Regina, Canada, June 26-29, 2005.

21. Accurate Computations of Positive Polar Factors of Graded Matrices, *Invited* Plenary talk, Sixth International Workshop on Accurate Solution of Eigenvalue Problems, Pennsylvania State University, University Park, May 22-25, 2006.

22. Eigenvalues of a Perturbed Hermitian Matrix, The Bay Area Scientific Computing Day 2008, celebratimg of the many decades of accomplishments and the 75th birthdays of Prof. William (Velvel) Kahan and Prof. Beresford Parlett, March 30, 2008.

23. Integrate Matrix Differential Riccati Equations Whose Solutions May Have Singularities, mini-symposium talk, 7th AIMS International Conference on Dynamical Systems, Differential Equations and Applications, May 18 – 21, 2008, The University of Texas at Arlington.

24. Bounds on Solutions of Certain Structured Sylvester Equations, 3rd International Workshop on Matrix Analysis and Applications, Zhejiang Forestry University, Hangzhou/Lin'An, China July 9 – 13, 2009.

25. Perturbation of Partitioned Hermitian Generalized Eigenvalue Problem, AMS Sectional Meeting, Lexington, KY, March 27–28, 2010.

Seminars

1. Relative Perturbation Theory for Eigenvalue Problems, Mathematics and Computer Science Division, Argonne National Laboratory, March 21, 1995.

2. An Efficient Parallel Tridiagonal Eigenvalue Solver Using Laguerre's Iteration, Computer Science Department, Louisiana State University, March 28, 1995.

3. High Performance Eigensolvers for Symmetric Matrices, Mathematical Science Section, Oak Ridge National Laboratory, April 22, 1995.

4. Fast Eigenvector Computations in Image Processing,

   (a) Fudan University, Shanghai, P. R. China, May 7, 1999.

   (b) University of Science and Technology of China, Hefei, P. R. China, May 7, 1999.

5. Relative Perturbation Theory, Fudan University, Shanghai, P. R. China, May 10, 1999.

6. Krylov Type Subspace Methods for Quadratic Matrix Polynomials,

   (a) SCCM, Stanford, April 8, 2002.

   (b) Peking University, Beijing, P. R. China, November 2002.

   (c) University of Science and Technology of China, Hefei, P. R. China, November 2002.

   (d) Fudan University, Shanghai, P. R. China, November 2002.

   (e) The Chinese University of Hong Kong, Hong Kong, November 2002.
   (f) NERSC, Lawrence Berkeley National Laboratory, December 9, 2002.

7. Structure-Preserving Model Reductions, KTH - the Royal Institute of Technology, Sweden, March 29, 2004.
8. Structure-Preserving Model Reductions, Technische Universität Hamburg-Harburg, Hamburg, Germany, June 18, 2004.
9. Conditioning of Vandermonde Matrices and Convergence of Krylov Subspace Methods, College and William & Mary, March 18, 2005.
10. Eigenvalues of An Alignment Matrix in Nonlinear Manifold Learning, Peking University, September 8, 2005.
11. Structural Preserving Numerical Methods for Model Reduction And Eigenvalue Problems, UTA, Texas, February 10, 2005.
12. Always Chebyshev Interpolation For Elementary Function Computations, University of Perpignan, June 19, 2007.
13. Structure-Preserving Model Reductions, National Tsing Hua University, Taiwan, June 12, 2008.
14. Nonlinear Manifold Learning, National Tsing Hua University, Taiwan, June 17, 2008.
15. Vandermonde Matrices and Convergence of Krylov Subspace Methods, National Tsing Hua University, Taiwan, June 18, 2008.
16. Nonlinear Manifold Learning, Hong Kong Baptist University, July 3, 2008.
17. Eigenvalues of a Perturbed Hermitian Matrix, East China Normal University, Shanghai, July 23, 2008.
18. Vandermonde Matrices and Convergence of Krylov Subspace Methods, Shanghai University, Shanghai, August 10, 2009.
19. Integrate Matrix Differential Riccati Equations Whose Solutions May Have Singularities,
   (a) National Cheng Kung University, Taiwan, June 9, 2008.
   (b) Fudan University, July 7, 2009.
   (c) South Methodist University, November 12, 2009.
   (d) Purdue University, March 25, 2010.
20. ADI Method for Sylvester Equations
   (a) Fudan University, Shanghai, June 14, 2010.

(b) Tsinghua University, Beijing, June 21, 2010.

(c) Shanghai University, Shanghai, July 8, 2010.

21. Stable Solutions of Linear Systems from Quantum Monte Carlo Simulation of Interacting Electrons

    (a) Institute for Applied Physics and Computational Mathematics, Beijing, June 24, 2010.

    (b) Shanghai University, Shanghai, July 8, 2010.

22. Perturbation of Partitioned Hermitian Generalized Eigenvalue Problem, Peking University, Beijing, June 28, 2010.

23. ADI Method for Sylvester Equations, Institute for Applied Mathematics and Computational Science, Texas A & M University, January 28, 2011.

24. Minimization Principles for Linear Response Eigenvalue Problem and Applications

    (a) Fudan University, Shanghai, June 27, 2011.

    (b) Xiamen University, Xiamen, Fujian, China, July 12, 2011.

    (c) South Methodist University, October 12, 2011.

Conference Organized

- (with Z. Bai) Mini-symposium – Substructuring, Dimension Reduction and Applications, PARA'04 workshop on state-of-the-art in Scientific Computing, Technical University of Denmark, Copenhagen, Denmark, June 20-23, 2004.
- (Program Committee) the 8th Conference on Real Numbers and Computers (RNC8), Santiago de Compostela, Spain, July 7-9, 2008.
- (with Z. Bai) The 3rd International Summer School on Matrix Eigenvalue Problem, sponsored by State Key Laboratory of Scientific and Engineering Computing (LSEC), Chinese Academy of Science, Beijing, 7/20-8/1/2009.

Grant Proposal Review

- NSF Grant Review panel, CCR, NSF (2002)
- Computational Mathematics, DMS, NSF
- NSF/KY EPSCoR Research Enhancement Grant Review panel, Spring 2000
- DOE Advanced Scientific Computing Research (ASCR), Fall 2009.

Journal Review

- ACM Transactions on Mathematical Software
- Acta Mathematica Sinica (English Series)
- Advances in Computational Mathematics
- Applied Mathematics Letters
- BIT
- *An International Journal* Computers & Mathematics with Applications
- Communications in Mathematical Science
- IEEE Transactions on Computers
- Integral Equations and Operator Theory
- Journal of Computational and Applied Mathematics
- Journal of Computational Mathematics
- Journal of Inequalities in Pure and Applied Mathematics
- Linear Algebra and Its Applications
- Mathematics of Computation
- Numerical Linear Algebra with Applications
- Numerical Methods for Partial Differential Equations
- Numerische Mathematik
- SIAM Journal on Matrix Analysis and Applications
- SIAM Journal on Scientific Computing
- Transactions on Parallel and Distributed Systems
- Computational Statistics and Data Analysis

Memberships in Professional Societies

Society for Industrial and Applied Mathematics
American Mathematical Society