### CURRICULUM VITAE JIANZHONG WANG Professor of Mathematics Department of Mathematics and Statistics Sam Houston State University, Huntsville, TX 77341-2206 Phone: (Office) (936) 294-3521, E-Mail: <u>mth\_jxw@shsu.edu</u> Web Pages: <u>http://www.shsu.edu/</u> ~mth\_jxw

### **EDUCATION**

Bachelor Degree (Mathematics), (1967) Peking University, China Master Degree (Mathematics), (1981) Zhejiang University, China Ph.D. Degree equiv. (Mathematics), (1984) Wuhan University, China

### ACADEMIC CAREER

(In USA)

**08/2003 – current** Professor, Department of Mathematics and Statistics, Sam Houston State University

**08/1998 - 08/2003** Associate Professor, Department of Mathematics and Statistics, Sam Houston State University

**08/1994 - 08/1998** Assistant Professor, Department of Mathematics and Statistics, Sam Houston State University

**08/1993 - 08/1994** Visiting Professor, Department of Mathematics, University of North Carolina at Charlotte

11/1992 - 08/1993 & 09/1989 - 01/1991 Visiting Senior Researcher, Approximation Center in Department of Mathematics, Texas A&M University

**10/1988 – 09/1989:** Visiting Professor, Department of Mathematics, Ohio State University at Columbus

#### (In China)

04/1988 – 08/1994 Full Professor, Department of Mathematics, Wuhan University 08/1984 – 08/1988 Associate Professor/Associate Chair, Department of Mathematics, Wuhan University

02/1982 – 08/1984 Assistant Professor, Department of Mathematics, Wuhan University

**08/1997 – 12/1997** Visiting Professor, Department of Mathematics, Chinese University in Hong Kong

### HONORS AND AWARDS

(In USA)

The 2007 Excellence in Research Award of Sam Houston State University, 2007 (In China)

- 1. The Third Class Award of Advanced Research in Science and Technology, Chinese National Education Committee, 1992 (joint with Professor Jianke Lu at Wuhan University)
- 2. Award of Special Allowance of The State Council of China (the second batch)

- 3. New Outstanding Talent of Wuhan City, 1985
- 4. Awards of "Outstanding Research Papers" issued by Hubei Province and Wuhan City, 1985, 1986, 1987, 1988, 1989, and 1991

## **RESEARCH GRANTS AND CONTRCTS**

(In USA)

- 1. Aug. 2008 July 2011, PI of NSF Grant (USA) DMS-321-20-A380 with total support \$168,645. *Project title*: Adaptive Kernels for Partial Differential Equation Models in Image Processing: Constructions and Algorithms
- 2. May 2007 April 2008. Co-PI of NGA Grant (USA) with total support \$ 487,205. *Project title*: Hyperspectral Data Dimensionality Reduction, De-noising and Coding. *Subcontract from* University of Maryland College Park
- **3.** Aug. 1995 July 1997. PI of NSF Grant (USA) DMS-9503282 with total support \$120,000. *Project title*: Wavelets based on several scaling functions and related applications. *Co-investigators*: P. Massopust, D. Ruch, W. So, and P. Van Fleet
- **4.** June 2015 June 2016. PI of SHSU Enhancement Grant for Research: \$15,000. *Project title*: Autodidactic Iteration Schemes for Image Processing.
- **5.** June 2012 June 2013. PI of SHSU Enhancement Grant for Research: \$15,000. *Project title*: Contraction Kernel Method for Classification of Hyperspectral Images.
- 6. April 2006 March 2007. PI of SHSU Enhancement Grant for Research: \$17,939. *Project title*: On Data-Dependent Multi-Layer Structure of High-Dimensional Data.
- **7.** April 2003 March 2004. PI of SHSU Enhancement Grant for Research: \$17,995. *Project title*: Numerical Implementation of Wavelet-Type Adaptive Methods for One-Dimensional Nonlinear Initial-Boundary Valued Problems.
- 8. May 1998 June 1999. PI of SHSU Faculty Research Grant with total support \$5,000. *Project title*: An adaptive multi-level wavelet interpolation scheme and its application in solving nonlinear anisotropic diffusion equations. *Period*:
- **9.** Nov. 1998 Aug. 1999. Research member of TRIES (Texas Regional Institute for Environmental Studies) at Sam Houston State University. *Project title*: Object detection Module. (Total of TRIES grant: \$1,000,000)

### 10. Summer 2016. FAST

(In China)

**11. Aug. 1983 – July 1992**. Seven grants obtained from the Chinese National Science Foundation and Chinese National High Education Research Foundation.

### **TEACHING EXPERIENCE**

At San Houston State University, the following courses have been taught.

Undergraduate level:

College Algebra (MATH1314), Plane Trigonometry (MATH1316), College Algebra for Business (MATH1324), College Mathematics (MATH1332), Pre-Calculus: Elementary Functions (MATH 1410), Calculus I-III (MATH1420, MATH1430, MATH2420), Business Calculus (MTH1429), Linear Algebra (MATH3377), Numerical Methods (MATH3394 and CS3394), Introductory Analysis (MATH4361), Elementary Analysis (MATH4366), Special Topics in Mathematics: Partial Differential Equations (MATH4370)

Graduate level:

Numerical Linear Algebra (Mth568), Complex Analysis (MTH579), Fourier Analysis (MTH573), Scientific Computing (MTH 594 & CS 594), Foundations of Analysis I (MATH 6333), Foundations of Analysis II (MATH 6334), Applies Mathematics: Wavelet Theory and its Application (MTH570), Special Topics: Advanced Analysis II (MTH 560), Special Topics II: Topology (MTH 560), Research and Thesis (MATH6698 and MATH6699)

At the Chinese University of Hong Kong, the following courses were taught.

Undergraduate level: Numerical Analysis I (MATH 3230)

Graduate level: Wavelets And Filter Banks (MATH 6110)

**At University of North Carolina at Charlotte,** the following courses were taught. *Undergraduate level:* Multivariate Calculus (MATH 2141), Differential Equations

- (MATH 2171), Introduction to Topology (MATH4181)
- Graduate level: Wavelet Theory and Applications (MATH750)

At Wuhan University in China, the following courses were taught.

- *Undergraduate level:* Mathematics Analysis I-IV (2-year courses that equivalent to Calculus I III (MATH 1420, 1430, 2420) plus Introductory Analysis (MATH4361) and Elementary Analysis (MATH4366)
- *Graduate level:* Fourier analysis and approximation, Theory of spline functions. Advances of multivariate approximation. Algebraic curves and Riemannian geometry. Nonlinear singular integral equations. Wavelet analysis and its application.

# **RESEARCH EXPERIENCE**

Current research areas:

- 1. Splines, wavelets, and their applications.
- 2. Mathematical methods in image science.
- 3. High-dimensional data processing and dimensionality reduction.

# JOURNAL AND BOOK EDITORSHIP

- 1. **2015 2016** Gust Editor of special issue "Semi-Supervised Learning and Data Processing in the Framework of Data Multiple One Dimensional Representation CMOC 2013 Symposium" of the International Journal of *Wavelets*, *Multiresolution and Information Processing* (Vol. 14, No. 2, 2016)
- 2. **2015– current** Associate Editor of *Mathematics of Computation and Data Science*, USA
- 3. **2010 current** Associate Editor of the International Journal of Applicable Analysis, USA
- 4. **2008 2010** Chief-editor of special issue "Wavelet Applications in Numerical PDEs and Mathematical Image Processing" on the Journal of *Applicable Analysis* (Vol. **90** No. 8, 2011)
- 5. **1993 1999** Editorial Board of the academic journal *Applied and Computational Harmonic Analysis* (editors-in-chief: C.K. Chui, R. Coifman, and I. Daubechies).

2002 Editor of the proceedings of *Wavelet Analysis and Applications* (with D. Deng, D. Huang, R-Q. Jia, W. Lin) 25 of AMS/IP Studies in Advanced Mathematics, S. T. Yau, Series Editor, International Press.

## PUBLISHED BOOKS

- 1. Research monograph: *Geometric structure of high-dimensional data and dimensionality reduction*, Jianzhong Wang, Springer and High-education Press (China), Feb. 2012. ISBN 978-7-04-031704-6 and ISBN 978-3-642-27496-1
- 2. Graduate Textbook: *Real analysis with an Introduction to Wavelets and Applications*, D. Hong, J.Z. Wang, and R. Gardner, Elsevier Academic Press, 2005.

## PATENTS

C.K. Chui and J.Z. Wang, *Image Clean-up and Pre-coding*, U. S. Patent Application #11/153,461 (filing date: 06/14/2004) and PCT International Application #61586-5000WO (filing date: 06/14/2005).

## PEER-REVIEW PUBLICATIONS

- 1. J.Z. Wang, Elementary matrix decomposition algorithm for symmetric extension of Laurent polynomial matrices and its application in construction of symmetric M-band filter banks, Chapter 11 in *Intelligent Mathematics II: Applied Mathematics and Approximation Theory*, Springer Heidelberg Proceedings, 2016.
- 2. H. Luo, Y.Y. Tang, Y. Wang, C. Li, J.Z. Wang, etc., Hyperspectral image classification using one dimensional manifold embedding with spectral-spatial based affinity metric, *Proceedings*, 2015 IEEE 2<sup>nd</sup> International Conference on Cybernetics, 2015.
- 3. T. Qian and J.Z. Wang, Gradient Descent Method for Best Blaschke-Form Approximation of Function in Hardy Space, submitted to *Advances in Computational Mathematics*, 2016
- 4. H. Luo, Y. Wang, Y.Y. Tang, J.Z. Wang, C. Li, and T. Hu, Hyperspectral Image Classification Based on Spectral-Spatial 1-Dimensional Manifold Embedding, *IEEE Transactions on Geoscience and Remote Sensing*, **54**(9) (2016) 5319-5340.
- 5. J.Z. Wang, Semi-Supervised Learning Using Ensembles of Multiple 1D-Embedding-Based Label Boosting, International Journal of *Wavelets*, *Multiresolution and Information Processing*, **14** (2) (2016).
- 6. J.Z. Wang, Semi-Supervised Learning Using Multiple One-Dimensional Embedding Based Adaptive Interpolation, International Journal of *Wavelets*, *Multiresolution and Information Processing*, **14** (2) (2016).
- 7. Y. Wang, Y.Y. Tang, L. Li, and J.Z. Wang, Face Recognition via Collaborative Representation based Multiple One-Dimensional Embedding, *International Journal of Wavelets, Multiresolution and Information Processing*, **14** (2) (2016).
- 8. Y. Song, H. Li, J.Z. Wang, and K.I. Kou, Multiple One-Dimensional Embedding Based Clustering Scheme for Hyperspectral Image Classification, International Journal of *Wavelets, Multiresolution and Information Processing*, **14** (2) (2016).
- 9. Z. Ye, H. Li, Y. Song, J.Z. Wang, and J.A. Benediktsson, A Novel Semisupervised Learning Framework for Hyperspectral Image Classification,

International Journal of *Wavelets, Multiresolution and Information Processing*, **14** (2) (2016).

- 10. J.Z. Wang, Euclidean Algorithm for Laurent Polynomial Matrix Extension --A note on dual-chain approach to construction of wavelet filters, *Applied and Computational Harmonic Analysis*, Vol. 38, No. 2, (2015), 331-345.
- 11. J.Z. Wang, Approximation of Weighted Local Mean Operators, *Applicable Analysis*, Vol. 93, No. 4 (2014), 823-839.
- 12. C.A. Micchelli, J.Z. Wang, and Yi Wang, On an asymptotic analysis of polynomial approximation to half-band filters, *Advances in Computational Mathematics*, **38** (3) (2013) 601-622.
- C.K. Chui and J.Z. Wang, Nonlinear Method for Dimensionality Reduction, in "Handbook of Geomathematics, 2<sup>nd</sup> Editor," W. Freeden, Z. Nashed and T. Sonar eds. Springer, Berlin, 2013.
- 14. J.Z. Wang, Effective All-Pairs Dijkstra's Algorithm for Computing Undirected Weighted Graph Metrics, in Proceedings of 2012 Spring International Conference on Applied and Engineering Mathematics (AEM-S), A Special Track within Spring World Congress on Engineering and Technology (SCET2012), Xi'an China, 2012.
- J.Z. Wang, Construction of local nonlinear filter without staircase effect in image restoration, special issue "Wavelet analysis in PDE and Mathematical imagery", *Applicable Analysis* **90** (8) (2011) 1257—1273.
- C.A. Micchelli, J.Z. Wang, and Y. Wang, On an asymptotic analysis of polynomial approximation to halfband filters, *Advances in Computational Mathematics*, **38** (3) (2013) 601-622
- 17. C.K. Chui and J.Z. Wang, Dimensionality Reduction of Hyper-Spectral Imagery Data for Feature Classification, in "Handbook of Geomathematics", W. Freeden, Z. Nashed and T. Sonar eds. Springer, Berlin, 2010.
- C.K. Chui and J.Z. Wang, Randomized Anisotropic Transform for Nonlinear Dimensionality Reduction, *International Journal on Geomathematics*, 1(1) (2010) 23-50.
- 19. C. K. Chui and J.Z. Wang, PDE models associate with the bilateral filter, *Advances in Computational Mathematics*, **31** (2009) 131-156.
- 20. J.Z. Wang, Higher Order Difference Schemes for Heat Equation, *Applications and Applied Mathematics*, **4**(2) (2009) 263 272.
- 21. J.Z. Wang, Multiscale Randomized Algorithms for Approximation to Symmetric Matrices, in Proceedings of the 5<sup>th</sup> Asian Mathematical Conference, L.S. Keong and H.K. Haili eds., Malaysia Vol. I ISBN: 978-967-5417-53-5 (2009) 436-441.
- 22. C.K. Chui and J.Z. Wang, Methods and algorithms for dimensionality reduction of HSI data, *The 2nd Workshop on Advancing the Automation of Image Analysis, AAIA Workshop II*, UCLA, Los Angles, July, 29-31, 2008.
- 23. J.Z. Wang, Wavelet approach to numerical differentiation of noisy functions, *Communications on Pure and Applied Analysis*, Vol. 6, No. 3, (2007) 873-897.
- C.K. Chui and J.Z. Wang, Wavelet-Based Minimal-Energy Approach to Image Restoration, *Applied and Computational Harmonic Analysis* Vol. 23 (2007) 114– 130.

- 25. J.Z. Wang, On Spline Wavelets, in the book "Wavelets and Splines—Athens 2005" Ed. by G. Chen and M-J Lai, (2006) 456-483.
- 26. J.Z. Wang, Variational method and wavelet regression, *Journal of Concrete and Applicable Mathematics: the special issue on "Wavelets and Applications"*, **4** (4) (2006) 485-504.
- 27. C.K. Chui and J.Z. Wang, *Image Clean-up and Pre-coding*, U. S. Patent Application #11/153,461 (filing date: 06/14/2004) and PCT International Application #61586-5000WO (filing date: 06/14/2005).
- 28. D. Hong, J.Z. Wang, and R. Gardner, "*Real analysis with an Introduction to Wavelets and Applications*", Elsevier Academic Press, 2005.
- 29. J.Z. Wang, Interpolating cubic spline wavelet packet on arbitrary partitions, *J. of Comput. Anal. And Appl.* **5** (2003) 179-193.
- C.K. Chui and J.Z. Wang, Shannon wavelet approach to sub-band coding, International Journal of Wavelets, Multiresolution and Information Processing, 1 (2003) 233-242.
- R-Q. Jia, J.Z. Wang, and D-X. Zhou, Compactly supported wavelet bases for Sobolev spaces, *Applied and Computational Harmonic Analysis* 15 (2003) 224-241.
- 32. J.Z. Wang, Spline Wavelets in Numerical resolution of Partial Differential Equations, in *Wavelet Analysis and Applications* D.Deng, D. Huang, R-Q. Jia, W. Lin, and J. Wang (eds.) Vol 25 of AMS/IP Studies in Advanced Mathematics, S. T. Yau, Series Editor, International Press, (2002) 257-277.
- 33. J.Z. Wang, On Linear Independence of Generators of FSI Distribution Spaces on R, in *Approximation Theory X, Splines, and Applications,* C.K. Chui, L. L. Schumaker, and J. Stockler (eds.), (2002) 453-472.
- 34. J.Z. Wang, A necessary and sufficient condition for a perfect filter bank, *SPIE Proceedings*, **Vol. 3813** (1999) 682--690.
- 35. D. Ruch and W. So and J.Z. Wang, Global support of a scaling vector, *Applied and Computational Harmonic Analysis* **5** (1998), 493--498.
- 36. D. Ruch and J.Z. Wang, Connection between the support and linear independence of refinable distributions, *J. Approx. Theory* **92** (1998), 472--485.
- 37. J.Z. Wang, Stability and linear independence associated with scaling vectors, *SIAM Mathematical Analysis* **29** (1998), 1140--1156.
- 38. D. Eubank, P. Van Fleet and J.Z. Wang, Moment computation in invariant spaces, *Journal of Applied Mathematics and Stochastic Analysis* **11** (1998), 465--479.
- J.Z. Wang, Study of linear independence and accuracy of scaling vectors via twoscale factors, in "<u>Advances in Wavelets</u>" ed. by K.S. Lau et al., Springer (1998) 229--260.
- 40. C.K. Chui and J.Z. Wang, A study of asymptotically optimal time-frequency windows of scaling functions and wavelets, *Annals of Numerical Mathematics* **4** (1997), 193--216.
- 41. W. So and J.Z. Wang, Estimating the support of a scaling vector, *SIAM J. Matrix Analysis and Applications* **18** (1997), 66--73.
- 42. W. Cai and J.Z. Wang, Adaptive multiresolution collocation methods for initial boundary value problems of nonlinear PDE's, *SIAM Journal of Numerical Analysis* **33** (1996), 937--970.

- 43. J.Z. Wang, Cubic spline wavelet bases for Sobolev space and multilevel interpolation, *Applied and Computational Harmonic Analysis* **3** (1996), 154--163.
- 44. C.K. Chui and J.Z. Wang, High order orthonormal scaling functions and wavelets give poor time-frequency localization, *Journal of Fourier analysis and applications* **2** (1996), 415--426.
- 45. J.Z. Wang, Interpolating spline wavelet packets, in "<u>Approximation theory VIII</u>,
  2." C. K. Chui and L. L. Schumaker (eds.) (1995), 399–406.
- 46. J.Z. Wang and Z. Zhang, On necessary and sufficient conditions for duals of wavelet frames, *Acta Math Scientia* **15** (1995), 6--14
- 47. J.Z. Wang, On solutions of two-scale difference equations, *Chinese Ann. Math.* (*Series B*) **15** (1994), 23--34.
- 48. C.K. Chui and J.Z. Wang, A study of compactly supported scaling functions and wavelets, in "<u>Curve and Surfaces II</u>", P. J. Laurent, A. Le Mehaute, and L. L. Schumaker (eds.), (1994), 121--140.
- 49. C.K. Chui and J.Z. Wang, Quasi-interpolation functional on the space of EP splines, *J. Approx. Theory* **76** (1994), 303--325.
- 50. S. Xiao, J.Z. Wang, and Y. Yang, Image mosaic and its boundary problems, *Pattern Recognition and Artificial Intelligence* **6** (1993), 198--195.
- 51. R-Q. Jia and J.Z. Wang, Stability and linear independence associated with wavelet decompositions, *Proc. Amer. Math. Soc* **117** (1993), 1115--1124.
- 52. C.K. Chui and J.Z. Wang, Computational and algorithmic aspects of cardinal spline wavelets, *Approx. and Its Appl.* **2** (1993), 53--75.
- 53. C.K. Chui and J.Z. Wang, An analysis of cardinal-spline wavelets, *J. Approx. Theory* **72** (1993), 54–68.
- 54. C.K. Chui and J.Z. Wang, A general framework of compactly supported splines and wavelets, *J. Approx. Theory* **71** (1992), 263--304.
- 55. C.K. Chui and J.Z. Wang, On compactly supported spline wavelets and a duality principle, *Trans. Amer. Math. Soc.* **330** (1992), 903--916.
- 56. C.K. Chui and J.Z. Wang, A cardinal spline approach to wavelets, *Proc. Amer. Math. Soc.* **113** (1991), 785--793.
- 57. J.Z. Wang, Wavelet theory and its application to engineering and physics, Math. Advance **2** (1991).
- 58. J.Z. Wang, Approximation of Cauchy principal value integral by cubic spline, *Acta. Math. Scientia* **1** (1991).
- 59. J.Z. Wang, A point-valued dual functional to the B-net basis, *Math. Numer. Sinica* **3**(1991).
- 60. A.K. Chan, C.K. Chui, J.Z. Wang, Q. Liu and J. Zha, Introduction to B-wavelets and applications to signal processing, CAT Report 245, Texas A&M University, 1991.
- 61. C.K. Chui and J.Z. Wang, Computational and algorithmic aspects of cardinalspline wavelets, CAT Report 235, Texas A&M University, 1990.
- 62. C.K. Chui and J.Z. Wang, An Overview of Wavelets, CAT Report 223, Texas A&M University, 1990.
- 63. C.K. Chui and J.Z. Wang, A Cardinal Spline Approach, CAT Report 211, Texas A&M University, 1990.

- 64. C.K. Chui and J.Z. Wang, An analysis of cardinal spline-wavelets, CAT Report 231, Texas A&M University, 1990.
- 65. Y. Chen and J.Z. Wang, A remark on minimal support of bivariate polynomial splines, in "<u>Approximation Theory IV</u>", ed. by C. K. Chui, et al., (1989).
- 66. J.Z. Wang, The null splines of the quadratic box spline space, *Applied Math. Journal of Chinese Univ.* **1** (1988).
- 67. J.Z. Wang, Riemann problem with infinite many numbers of discontinuous points on real axis, *Acta. Math. Scientia* **1** (1988).
- 68. J.Z. Wang, On Cauchy principal value integral in case of kernel with infinite many numbers of discontinuous points, *Acta. Math. Scientia* **3** (1987).
- 69. J.Z. Wang, On dual basis of bivariate box splines, *Approx. theory and Its Appl.* **3** (1987).
- 70. J.Z. Wang, Biorthogonal functional of box splines, Math. Numer. Sinica 1(1986).
- 71. J.Z. Wang, Local quasi-interpolating operators reproducing polynomials, *J. Math. at Wuhan* **1** (1986).
- 72. J.Z. Wang, On multivariate splines interpolations, *Chinese Ann. Math. (Series A)* 2 (1986).
- 73. J.Z. Wang, Interpolation by bivariate splines on a three direction mesh, *Numer*. *Math. Journal of Chinese Univ.* **1** (1986).
- 74. J.Z. Wang, On coefficients of expansion in bivariate box splines, *Chinese Ann. Math.* **2** (1986).
- 75. J.Z. Wang, Representations of box splines by truncated powers, *Math. Numer. Sinica* **1** (1985).
- 76. J.Z. Wang, Exact estimates of remainders of Hermite interpolating splines-- on conjuncture of Lipow and Schoenberg, *J. Wuhan Univ.* **4** (1985).
- 77. J.Z. Wang, Direct method of solution of singular integral equation with complex Hilbert kernel, J. Wuhan Univ. **1** (1984).
- 78. D. Huang and J.Z. Wang, The relation between the boundary condition and the convergence of interpolation splines, *Acta. Math. Appl. Sinica* **7**(1984).
- 79. D. Huang and J.Z. Wang, The asymptotic expansions of quintic lacunary interpolation splines, *Math. Numer. Sinica* **2** (1984).
- 80. J.Z. Wang, On optimal error bounds for interpolating splines and corresponding linear width problems, *J. Math. at Wuhan* **4** (1984).
- 81. D. Huang and J.Z. Wang, Cubic L-spline interpolation at a bi-infinite knot sequence, *J. Math. Research and Exposition* **1** (1983).
- 82. J.Z. Wang, Lacunary polynomial splines with midpoint interpolation conditions, *Chinese Ann. Math. (Series A)* **4** (1983).
- 83. D. Huang and J.Z. Wang, Budan-Fourier theorem of \$L\$-spline and its application, *Chinese Ann. Math. (Series A)* **3** (1983).
- 84. D. Huang and J.Z. Wang, Inequality of Kolmogorov type bearing on selfconjugate differential operators, *Acta. Math. Sinica* **26** (1983).
- 85. J.Z. Wang, On optimal error bounds for interpolating splines, *Scientia Sinica* (*Series A*) **25** (1982).
- 86. D. Huang and J.Z. Wang, On quartic and quintic interpolating splines and their optimal error bounds, *Scientia Sinica* (Series A) **25**(1982).

- 87. J.Z. Wang, Best simultaneous \$L^{1}\$-approximations to n functions, *Math. Numer. Sinica* **1** (1982).
- 88. J.Z. Wang, Optimal error Lp bounds for polynomial interpolating splines, *J. Zhejiang Univ.* **4** (1982).
- 89. J.Z. Wang, Quartic lacunary polynomial spline, J. Zhejiang Univ. 1(1981).

## PRESENTATIONS AND ACADEMIC VISITING

### Presentations on conferences since 1994

- "Semi-supervised learning in the framework of data multiple 1-D representation," The Sixth International Conference on Advances in Information Mining and Management, May 22-26, Valencia, Spain
- "Best Blaschke-Form Approximation of Function in Hardy Space on Unit Disk in Complex Plane," Emerging Trends in Applied Mathematics and Mechanics, May 30-June 3, 2016, Perpignan, France
- 3. "Elementary Matrix Transformation Algorithm for Symmetric Extension of Laurent Polynomial Matrix and its Application in Construction of Symmetric Mband Filter Banks and Multi-Wavelets," 3rd International Conference on Applied Mathematics & Approximation Theory, May 28-31,2015, Ankara, Turkey
- 4. "Manifold Embedding of Image Patched and its Application," SIAM Conference on Image Science, Hong Kong Baptist University, May 12-14, 2014.
- 5. "Directional Diffusion in Image Science," Texas PDE conference in 2014, UNT, Denton, TX, March 11-12, 2014.
- "Application of Weighted Local Mean Integral Operators," International Conference on Approximation Theory and Applications, Hong Kong, May 19-24, 2013.
- 7. "PDEs related to Adaptive Local Mean Integral Operators," International Conference on Partial Differential Equations and Large Scale Scientific Computation, Xuzhou, China, June 7-10, 2013.
- 8. "Data Classification Using Wavelets On Data Trees," SIAM Southeastern Atlantic Section Meeting Knoxville, TN, March 22-24. 2013.
- 9. "Effective All-Pairs Dijkstra's Algorithm for Computing Undirected Weighted Graph Metrics," 2012 Spring International Conference on Applied and Engineering Mathematics, A Special Track within Spring World Congress on Engineering and Technology, Xi'an China, May 2012.
- 10. "Randomized Approximation of Feature Vectors of Large-size Reproducing Kernels," invited talk on Canada-China-USA Conference on Modern Techniques in Computational Mathematics, Edmonton, Alberta, Canada, August 23-23, 2011.
- 11. "Randomized Anisotropic Transformations (RAT) Associated with Isomaps I," plenary talk on The Fourth International Conference on Computational Harmonic Analysis, Hong Kong, May 23-27, 2011. (Joint with C.K. Chui)
- 12. "Randomized Anisotropic Transformations (RAT) Associated with Isomaps II," invited talk on The Fourth International Conference on Computational Harmonic Analysis, Hong Kong, May 23-27, 2011.
- 13. "Randomized Nystrom Approximation in Data Dimensionality Reduction," Workshop on Applied Harmonic Analysis and Approximation Theory, Guangzhou, China, May 21-22, 2011.

- 14. "Local Nonlinear Filters with approximation order 2," International Workshop on Approximation, Hong Kong, Jan. 2011.
- 15. "Construction of Adaptive Filters Based on PDE Models and its Application in Video processing," invited talk on International Conference on Mathematics Methods for Imaging, Guangzhou (China), Aug 2010.
- 16. *Randomized Anisotropic Transformations (RAT) Associated with Isomaps* (I), plenary talk on The Fourth International Conference on Computational Harmonic Analysis, Hong Kong, May, 2011 (Joint with C.K. Chui)
- 17. "Construction of Locally Nonlinear Filters for Image Restoration," invited talk on International Workshop on Approximation Techniques in Dada Analysis, Edmonton, Alberta, Canada, Sept. 2010
- "On Adaptive Kernels for Partial Differential Equation Models in Image Denoising," *The 8<sup>st</sup> Mississippi State-UAB Conference on Differential Equations* and Computational Simulations, Starkville, MS, May 2009.
- 19. "Randomized Diffusion Wavelet Algorithm for Dimensionality Reduction," *Twenty Years of Wavelets*, Chicago, IL, May 2009.
- 20. "Randomized Algorithms for Approximation to Symmetric Matrices," *The* 5<sup>th</sup> *Asian Mathematical Conference*, Kuala Lumpur, Malaysia, June 2009.
- "Methods and Algorithms for Dimensionality Reduction of High Dimensional Image Data," *Computational Harmonic Analysis Conference*, St. Louis, MO, October 2008.
- 22. "The rank revealing approximation of symmetric matrices by randomization," *Workshop on Approximation Theory and Applications*, Huntsville, TX. October 2008.
- 23. "Methods and System for Dimensionality Reduction of Hyperspectral Image Data II," invited Lecture on *the 2<sup>nd</sup> Advancing the Automation of Image Analysis Workshop*, Los Angeles, CA. July 2008.
- 24. "Diffusion PDE associated with Bilateral Filter," *The 31<sup>st</sup> Texas PDE Conference*, Houston, TX. April, 2008.
- 25. "Methods and System for Dimensionality Reduction of Large-scale Hyperspectral Image Data I," Invited Lecture on *Diffusion Geometry Workshop*, Washington D.C., January 2008.
- 26. "Diffusion PDE derived from Bilateral Filtering: Proof of Results," *Trends in Applied Harmonic Analysis*, BIRS at Banff, Canada, September 2007.
- 27. "On Wavelet approach to numerical differentiation of noisy functions," *The Third International Conference on Applicable Harmonic Analysis*, Shanghai, China, June, 2007.
- 28. "Wavelet Approach to Image Demosaicking," *the 12<sup>th</sup> International Conference* of Approximation Theory, March, San Antonio, TX, March, 2007.
- 29. "Bayesian approach to anisotropic diffusion," on *The Second International Conference on Applicable Harmonic Analysis: Approximation and Application*, Beijing, China, June, 2006.
- 30. "Decomposing positive symmetric matrices using diffusion maps," on the 2<sup>nd</sup> International Workshop on Matrix Analysis and Applications, Nova Southeastern University, Fort Lauderdale, FL, Dec. 15-17, 2006.

- 31. "On Spine Wavelets," keynote speaker on *International Conference on the Interactions between Wavelets and Splines*, Athens, Georgia, May 16-19, 2005.
- 32. "Diffusion Maps, Diffusion Distance, and Multiresolution Representation of High-dimensional data, invited talk on *the First International Conference on Applicable Harmonic Analysis*, Hangzhou, China, May 23-27, 2005.
- 33. "Inverse Problems with emphasis on noise reduction," keynote talk on *the International Conference on Applicable Harmonic Analysis*, Hangzhou, China, May 23-27, 2005.
- 34. "Wavelet method for noise reduction and feature extraction," Plenary speaker on Workshop on Mathematical tools and Statistical Techniques for Quantitative Medical Data Analysis, Johnson City, TN, October 13-14, 2005
- 35. "Diffusion Distance and Anisotropic Diffusions," invited speaker on AMS 2005 Fall Southeast Section Meeting, Johnson City, TN, October 15-16, 2005.
- 36. "On diffusion in phase spaces," invited talk on *the Second International Conference on Applied Harmonic Analysis*, Nashville, TN, May 23-30, 2004.
- "Variational method in image procession," invited talk on *the Eleventh* International Conference of Approximation Theory, Gatlinburg, May 17-22, 2004.
- 38. "Adaptive method for numerical resolution of anisotropic diffusion image in image processing," talk on *the Annual Texas PDE conference*, College Station, April 3-4, 2004.
- 39. "Cardinal B-spline Approach to Edge Detectors," invited talk on *the International Workshop on Applicable Harmonic Analysis*, Banff, Canada, June 7-12, 2003.
- 40. "Content Dependent Filter Designing," invited talk on *the International Conference on Numerical Methods in Imaging Science and Information Processing*, Singapore. December 15-19, 2003.
- 41. "Sharon Wavelet Packet and its Application to Non-uniform Sampling," invited talk on *the Great Plans of Operator Theory Symposiums*, Charlotte, North Carolina. May 22-26, 2002.
- 42. "On Anisotropic Diffusion Equation with Wavelet-Kind Coefficients," invited talk on Satellite Conference of International Conference of Mathematics-2002: *Harmonic Analysis and its Applications*, Hangzhou, China. August 14-18, 2002
- 43. "Numerical Methods for Nonlinear PDEs in Image Processing," invited talk on *The Second International Symposium on Computing Science*, Guangzhou, China. Dec. 20-23, 2002.
- 44. "The Cardinality of refinable FSI spaces," invited talk on *the Tenth International Conference on Approximation Theory*, St. Louis, MO, March 26-29, 2001.
- 45. "The redundancies among shifts of a generator of an FSI space," invited talk on *Annual Symposium of Center for Approximation Theory*, at Texas A&M University, College Station, TX. April 20-21, 2001.
- 46. "On Dependence of Shifts of Multivariate Vector-Valued Distributions," invited talk on *International Conference of Computational Harmonic Analysis*, Hong Kong. May 4-8, 2001.
- "Multivariate Splines in Numerical Gradient Operator," talk on 2001 American Mathematics Society Southeastern Section Meeting, Chattanooga, Tennessee. Oct 5-6, 2001.

- 48. "Using Simple Programs on TI-83 to Explore Concepts of Trigonometry and Calculus," talk on *Conference on the Teaching of Secondary Mathematics*, January 28 29, 2000.
- 49. "Analysis of Wavelet Bases in Numerical Resolution of Differential Equations," invited talk on *American Mathematics Society Southeastern Section Meeting*, Birmingham, Alabama. November 10-12, 2000.
- 50. "Numerical Solutions of Anisotropic Diffusion Equation Using Interpolation Spline Wavelets," talk on American Mathematical Society Sectional Meeting, Las Vegas, NV. April 10 – 11, 1999.
- 51. "Adaptive Collocation Method Based on Spline Wavelet and its Application in Solving Diffusion Equations," invited talk on *Annual Symposium of Center of Approximation Theory*, at Texas A & M University, College Station, TX. April 23-24, 1999.
- 52. "A Necessary and Sufficient Condition of Perfect Reconstruction Filter Banks," invited talk on *SPIE Annual Meeting (1999)*, Denver, July 17-21, 1999.
- 53. "Spline Wavelet Bases in Homogeneous Sobolev Spaces and Its Applications," invited talk on *American Mathematical Society Western Section Meeting*, Austin, Texas. October 8-10, 1999.
- 54. "Interpolation Spline Wavelets in Solving Anisotropic Diffusion Equations," invited talk on *International Conference on Wavelet Analysis and Its Applications*, Guangzhou, China. November 15-28, 1999.
- 55. "Linear Independent Generators in a Refinable Space" invited talk on *Annual Symposium of Center of Approximation Theory*, at Texas A & M University, College Station, Texas. April 24-25, 1998.
- 56. "Super-functions in Wavelet subspaces," talk on *NSF-CBMS Regional Research Conference* on <u>Wavelet Analysis as a Tool for Computational and Harmonic</u> <u>Analysis</u>, University of Central Florida, Florida. May 4-8, 1998.
- 57. "On Linearly Independent Property of Scaling Vectors," invited talk on *Joint Mathematics Meeting, Special Session*: Wavelets, Multiwavelets and their Applications, San Diego. January 8-11, 1997.
- 58. "On Two-Scale Factorization of the Symbol of a Scaling Vector," invited talk on Annual Symposium of Center of Approximation Theory, at Texas A & M University, College Station, Texas. April, 1997.
- 59. "On Linear Independence and Support of a Scaling Vector," invited talk on *Workshop on Wavelets and Their Applications*, at Chinese University of Hong Kong, Hong Kong. May 5-8, 1997.
- "Super-function in a Refinable Space," invited talk on Workshop on Approximation Theory, at City University of Hong Kong, Hong Kong. October 1997.
- 61. "Approximation Using Multiwavelets," invited talk on *Workshop on Harmonic Analysis and Wavelet Analysis*, at Zhongshan University, Guangzhou, China. December 23-28, 1997.
- 62. "Operators of Toeplitz Type and Their Application in Wavelet Analysis," invited talk on *Conference on Wavelets, relations with operators and applications*, at University of North Carolina at Charlotte, Charlotte, North Carolina. July 24-28, 1996.

- 63. "Stability and Linear Independence Associated Scaling Vectors," talk on *International Conference on Scientific Computing and Modeling*, at Eastern Illinois University. Illinois. Oct. 12-14, 1995.
- 64. "Construction of Wavelet Packets in Continuous Function Space," invited talk on *Eighth Texas International Conference on Approximation Theory*, at Texas A&M University, College Station, Texas. January 8-12, 1995
- 65. "The local independent property of scaling vectors," invited talk on *Conference on Harmonic Analysis and wavelet Analysis*, at Peking University and Institute of Mathematics, Academia Sinica, Beijing, China. June 14-16, 1995.
- 66. "Spline-wavelet bases on a finite interval," invited talk on *Conference of Fractal and Wavelets*, at Pittsburgh University, Pittsburgh. May, 1994.
- 67. "Spline Wavelet Bases of Sobolev Spaces and Adaptive Approximation Scheme," invited talk on *Canadian Mathematical Summer Meeting*, at University of Alberta, Edmonton, Canada. June 11-13, 1994.

## Invited talks in other institutes since 1998

- 1. "1-D Manifold Embedding of High-Dimensional Data and its Application," invited talk at University of Macau, May 21, 2014
- 2. "Manifold Embedding Model of Image Patches and its Application," invited talk at Sun Yat-sen University, Guangzhou, China, May 26, 2014
- 3. "1-D Manifold Embedding and its Application in Data Classification," invited talk at Huazhong University of Sciences and Technology, May 30, 2014
- 4. "The 1-D Manifold Embedding and its Application," invited talk at Beijing University of Technology, July 9, 2014
- 5. "Data Smooth Sorting and its Application in Semi-Supervised Learning," invited talk at Institute of Computational Mathematics, Chinese Academy of Sciences, Beijing, July 8, 2014
- "Big Data Modeling -- Geometric Structure of Data and Dimensionality Reduction," invited talk at Institute of Software, Chinese Academy of Sciences, Beijing, June 2013
- 7. "On Local Mean Integral Operators and Its Applications," invited talk at Beijing University of Technology, Beijing, China, June 2013
- 8. "Construction of Data-Tree Wavelets," invited talk at Department of Mathematics, Huazhong University of Sciences and Technology, Wuhan, China, May 2013
- 9. "Nonlinear Approximation of Local Mean Integral Operators," invited talk at Hubei University, Wuhan, China, May 2013
- 10. "Randomized Isomaps for Nonlinear Dimensionality Reduction," invited talk at Department of Mathematics, Auburn University at Montgomery, Oct. 2012
- 11. "Asymptotic Properties of Halfband Filters," invited talk at Department of Applied Mathematics, Zhejiang University, Hangzhou, China, May 2012
- 12. "On Spectral Methods for High-Dimensionality Reduction," invited talk at Department of Mathematics, Huazhong University of Sciences and Technology, Wuhan, China, May 2012
- 13. "Randomized Dimensionality Reduction Algorithms in Hyperspectral Image Analysis," invited talk at Department of Mathematics, Xidian University, Xi'an, China, June 2012

- 14. "Randomized Algorithms and Data Classification," invited talk at Institute of Computational Mathematics and Scientific/Engineering Computing, Academy of Mathematics and Systems Science, Chinese Academy of Sciences, Beijing, June 2012
- 15. "On Randomized Algorithm and Its Application in Dimensionality Reduction," at Peking University, Beijing, China, June, 2011
- 16. "High-dimensional Data and its dimensional reduction," at Wuhan University, Wuhan, China, June, 2011
- 17. "On Randomized Anisotropic Transformation," at Beijing University of Technology, Beijing China, June 2011
- 18. "Randomized method in Laplacian Eigenmaps," at Beijing University of Aeronautics and Astronautics, June 2011
- 19. "On the geometric structure of high-dimensional data," at Huazhong University of Science and Technology, Wuhan, China, June 2011
- 20. "Kernel method for Manfold learning," at Hubei University, Wuhan, China, June 2011
- 21. "Mathematical methods in image processing," at Hebei Normal University, Shijiazhuang, China, June 2011
- 22. "Linear Embedding and Principal Component Analysis," at Sam Houston State University, Applied Math Seminar, March, 2011
- 23. "Data structure and dimensionality reduction," at Sun Yat-sen University, Guangzhou, China, 2010
- 24. "On Randomized SDV Algorithm and Its Application," at Hebei Normal University, Shijiazhuang, Hebei, China, July, 2010
- 25. "Diffusion-Maps for Dimensionality Reduction of Large-Scale Data," *Zhejiang University*, Hangzhou, Zhejiang, May 2008.
- 26. "Diffusion kernels for image processing," *Zhejiang University*, Hangzhou, Zhejiang, May 2008.
- 27. "Hyperspectral image data dimensionality reduction," *Prairie-View A&M University*, Prairie View, TX, October 2007.
- 28. "On Diffusion Wavelets," Fudan University, Shanghai, June 2005.
- 29. "Variation Method in Wavelet Spaces," University of Missouri-St. Louis, September 2004.
- 30. "A modification of CCLM nonlinear diffusion model in image processing and its adaptive numerical resolution," *Southern Methodist University*, Dallas, March, 2003.
- 31. "On Spline Wavelet Bases of Sobolev Spaces," *Georgia Southern University*, Statesboro, GA. October, 2003.
- 32. "Degenerate Parabolic Equations in Image Processing and Viscosity Solutions," *West Virginia University*, Morgantown, West Virginia. October 2-5, 2002.
- 33. "Wavelets and its applications in engineering," *the Association of Control Theory*, Shanghai, China. May 2001.
- 34. "Wavelets in defect detection," *The Eastern Normal University*, Shanghai, China. May 2001.
- 35. "The spline wavelets in approximation," *Nanjing University*, Nanjing, China. May 2001.

- 36. "The wavelets in image processing," *Southeastern University*, Nanjing, China. May 2001.
- 37. "The diffusion technique in image processing," *The Chinese University of Hong Kong*, Hong Kong. May 2001.
- 38. "The new advanced of wavelets," *Hong Kong Baptist University*, Hong Kong. June 2000.
- 39. "Multigrid method and wavelet method in numerical PDE," City University of Hong Kong, Hong Kong. June 2000.
- 40. "Difference between local linear independence and global linear independence," *The Chinese University of Hong Kong*, Hong Kong. January 1999.
- 41. "Solving Nonlinear Anisotropic Diffusion Equations by Spline Wavelets," *University of Texas at Arlington*, Arlington, Texas. December 1999.
- 42. "On the linear independence of scaling vectors," *City University of Hong Kong*, Hong Kong. December 1998.
- 43. "Using wavelets in the numerical solutions of PDE's," *Zhongshan University*, Guangzhou, China. December 1998.