

## CURRICULUM VITÆ

### Shidong Li

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#### **Education**

**Ph.D. in Applied Mathematics** May, 1993  
University of Maryland Graduate School, Baltimore  
Dissertation: “The Theory of Frame Multiresolution Analysis and Applications”  
Advisor: Professor **John J. Benedetto**.  
**M.S. in Applied Mathematics** 1989  
University of Maryland Graduate School, Baltimore  
**M.S. in Electrical Engineering** (Digital Communications, Signal Processing) 1985  
Graduate School, Chinese Academy of Science.  
**B.S. in Electrical Engineering** (Automatic Control) 1982  
Hefei University of Technology, China. Graduated with Distinct Honor Certificates.

#### **Experience**

**Professor**, San Francisco State University, 2005–present, Department of Mathematics.  
**Associate Professor**, San Francisco State University, 2000–2005.  
**Assistant Professor**, San Francisco State University, 1996–2000.  
**Chair Professor**, Renmin University of China, 2010 - present.  
**Honorary Professor**, Graduate School of Chinese Academy of Sciences, 2004 - present.  
**Honorary Professor**, Anhui University of Technology, 2002 - present.  
**Visiting Assistant Professor**, University of Maryland, College Park, 1994–1996.  
Department of Mathematics.  
**Visiting Assistant Professor**, Dartmouth College, 1993–1994  
Department of Mathematics and Computer Science  
**Visiting Scholar**, Tokyo Institute of Technology, August, 2004, Oct., 2002, July - Aug.  
of 1998, 1997 (continuing collaboration with Prof. Ogawa).  
**Visiting Scholar**, The Technical University of Denmark, summer, 1999 (collaboration  
with Prof. Christensen).  
**Visiting Scholar**, Recipient of an award of the International Research Foundation, Tokyo  
Institute of Technology, Summer, 1995.  
**Consultant**, Air Force Institute of Technology, Radar signal classification, Sept., 1995–  
June, 1996.  
**Consultant**, Atlantic Aerospace Electronic Corporation, mathematical signal processing  
in communication systems, 1995–July, 1996.  
**Lecturer**, Graduate School, Chinese Academy of Sciences, 1985–1987.

#### **Professional Service**

**Editor** of the *Journal of Sampling Theory in Signal and Image Processing*

**Grants and  
Awards**

NSF grant (U.S.A.) DMS-1313490 (6<sup>th</sup>), Sept, 2013 - Aug, 2016: Title: Development of Sparsity Inducing Dual Frames and Applications

AFOSR grant (U.S.A) (Airforce Office of Scientific Research) FA9550-11-1-0245,  
Aug, 2011 - Aug., 2014: Title: Frames and Compressed Sensing.

NSF grant (U.S.A.) DMS-1010058 (5<sup>th</sup>), July, 2010 - June, 2013: Title: Development of Nonorthogonal Fusion Frames and Applications.

NSF grant (U.S.A.) DMS-0709384 (4<sup>th</sup>), July, 2007 - June, 2010: Title: Development of Frame Extensions and Applications III.

NSF grant (U.S.A.) DMS-0406979 (3<sup>rd</sup>), August, 2004 - July, 2007: Title: Development of Frame Extensions and Applications II.

NSF grant (U.S.A.) DMS-0103762 (2<sup>nd</sup>), August, 2001 - July, 2004: Title: Development of Frame Extensions and Applications.

NSF grant (U.S.A.) DMS-9803679 (1<sup>st</sup>), June, 1998 - May, 2001: Title: Advanced Theories of Frames, Pseudo-frames, and Optimality Issues with Applications.

Affirmative Action Award, SFSU, springs, 1997, 1998, 1999, 2000 and 2001.

Presidential Award, SFSU, fall, 1998.

Vice President Assigning Time Award, SFSU, spring, 1997.

Summer Stipend Award, SFSU, summer, 1997.

**Research  
Articles**

*Sparse frame DOA estimations via rank-one correlation model for low SNR and limited snapshots*, jointly with C. Zeng and G. Liao, submitted to Applied and Computational Harmonic Analysis, 2015.

*Local Sparsity and Recovery of Fusion Frames Structured Signals*, jointly with R. Aceska, J.L. Bouchot, submitted to Applied and Computational Harmonic Analysis, Elsevier, 2015

*Tight and Full Spark Chebyshev frames with real entries and worst-case coherence analysis*, jointly with D. Ellis and E. Hayashi, submitted to Journal of Fourier Analysis and Applications, 2015.

*Tight nonorthogonal fusion frames and classification of positive self-adjoint operators via projections*, jointly with J. Cahill, P. Cassaza, to appear in Contemporary Mathematics, 2015.

*Fast thresholding algorithm with feedbacks for sparse signal recovery*, jointly with T. Mi, and Y. Liu, *Applied and Computational Harmonic Analysis*, Volume 37, Issue 1, pp69-88, July 2014.

*Sparse dual frames and Gabor dual functions of the smallest support*, jointly with Y. Liu and M. Tie, *J. of Fourier Anal. Appl.*, Volume 19, Issue 1, pp 48-76, February 2013.

*Performance analysis of the  $\ell_1$  synthesis approach for compressed sensing*, jointly with Y. Liu and T. Mi, *Proceeding of the IEEE International Symposium on Information Theory*, July 1-6, MIT, Cambridge, MA, 2012.

*Compressed sensing with general frames and an optimal dual-based analysis approach*, jointly with Y. Liu and T. Mi, *IEEE Trans. on Info. Theory*, Vol 58 , Issue 7, pp4201 - 4214, July, 2012.

*Nonorthogonal Fusion Frames and Sparsity of the Fusion Frame Operator*, jointly with P. Casazza, and J. Cahill, *J. of Fourier Anal. Appl.*, **18**:287 - 308, (2012).

*Dimension invariance of finite frames of translates and Gabor frames*, jointly with J. Cahill, *Advances in Comput. Math.*, Volume 37, Issue 4, pp 505-520, Nov., 2012

*Frame fundamental superresolution image fusion from inhomogeneous measurements*, jointly with Z. Yao and W. Yi, *IEEE Trans. Image Proces.*, Vol. 21, No. 9, 4002-4015, 2012

*Parametric optimization of biorthogonal wavelets and filter banks via pseudoframes for subspaces*, jointly with M. Hoffman, in Excursions in Harmonic Analysis, Vol. 2, Ed. John Benedetto, Springer, 2012.

*Fundamental Solutions for Cardinal Interpolation with Reduced Compact Support and Improved Attenuation*, jointly with D. Ellis, E. Hayashi, *Numerical Functional Analysis and Optimization*, Volume 33, Issue 7-9, 951-970, July 2012.

*Sparse dual frames in compressed sensing*, jointly with T. Mi and Y. Liu, *SPIE Proceeding, Conf. on Wavelets and Sparsity XIV*, Vol. 8138, San Diego, Aug., 2011.

*Automating identification of avian vocalizations using time-frequency information extracted from the Gabor transform*, Jointly with Ed. Connor, and Steven Li, *J. Acoust. Soc. Am.*, Volume 132, Issue 1, 507-517, 2012.

*The  $\ell_1$  analysis approach by sparse dual frames for sparse signal recovery represented by frames*, jointly with Y. Liu and T. Mi, *Proceeding of the IEEE International Symposium on Information Theory*, July 1-6, MIT, Cambridge, MA, 2012.

**Research  
Articles  
(cont'd)**

- On sampling related properties of B-spline Riesz sequences, jointly with Z. Tong and D. Yan, J. Sampling Theory in Signal and Image Processing, 9 (2010), No. 1C3, 199-222.
- Frame fundamental sensor modeling and stability of one-side frame perturbation, jointly with D. Yan, Acta Applicandae Mathematicae, 107 (2009), 91 - 108.
- Fusion frames and distributed processing, jointly with P. Casazza and G. Kutyniok, Journal of Applied and Computational Harmonic Analysis, 25 (2008) 114-132.
- Optimal noise suppression: a geometric nature of pseudoframes for subspaces, jointly with H. Ogawa, Journal of Advances in Computational Mathematics, 28(2008),141-155.
- Density results on frames of exponentials, jointly with P. Casazza, O. Christensen and A. Linder, in Harmonic Analysis and Applications, C. Heil ed., Birkhauser, Boston, 2006.
- Gabor duality characterizations, jointly with E. Hayashi, and T. Sorrells, in Harmonic Analysis and Applications, C. Heil ed., Birkhauser, Boston, 2006.
- Pseudoframes for subspaces with applications, jointly with H. Ogawa, in Journal of Fourier Analysis and Applications, vol. 10, no. 4 (2004), 409-431.
- Iterative irregular sampling for a generic subspace, in Journal of Sampling Theory in Signal and Image Processing, vol 3, no. 2 (2004), 101-117.
- Proportional nonuniform multi-Gabor expansions, in Journal of Applied Signal Processing, vol 17, Dec. 2004.
- On Riesz-Fisher sequences and lower frame bounds, jointly with P. Casazza, O. Christensen and A. Linder, in Zeitschrift fuer Analysis und ihre Anwendungen, Vol. 21 (2002)2, 305-314.
- A theory of generalized multiresolution structure and pseudoframes of translates, in Journal of Fourier Analysis and Applications, Vol. 7, Issue 1 (2001), 23 - 40.
- Pseudo-duals of frames with applications, jointly with H. Ogawa, in Applied and Computational Harmonic Analysis, 11 (2001), 289-304.
- Discrete Multi-Gabor Expansions, IEEE Trans. on Infor., Vol 45, No.6 (1999), 1954 - 1967.
- The theory of multiresolution analysis frames and applications in filter banks, jointly with John J. Benedetto, in Applied and Computational Harmonic Analysis, 5 (1998), 389-427.
- A parametric class of discrete Gabor expansions, IEEE trans. on Signal Processing, jointly with Dennis M. Healy, vol. 44, no. 2 (1996), 201-211.
- On general frame decompositions, Numerical Functional Analysis and Optimization, 16(9&10) (1995), 1181-1191.
- A discrete Gabor expansion with rational oversampling rate, jointly with S. Qian, in IEEE Trans. Signal Processing letters, Feb. (1995), 42-45.
- Optimal biorthogonal sequences for finite discrete Gabor expansion, jointly with S. Qian and K. Chen, in Signal Processing, vol. 27 (1992), 177-185.
- Analysis of a multilevel quantized digital phase-locked loop, Journal of China Institute of Communications, Vol.7, No.5, September, 1986, 25-34,42.

**Invited  
Lectures**

- Frame and pseudoframe approach to signal and image processing (a 20 hour graduate seminar series), Graduate School of the Chinese Academy of Sciences, Summers, 2012, 2011, 2010, 2009, 2008.
- Advances of frames and pseudoframes with applications (a 20 hour graduate seminar series), Graduate School of the Chinese Academy of Sciences, Summers, 2007, 2006, 2005, 2004.

## ***Invited Talks***

- A sparse-dual-frame approach to compressed sensing with sparse frame representations, University of Central Florida, Nov. 29, 2012.
- A sparse-dual-frame-based analysis approach in compressed sensing with coherent frames, DARPA mathematics summit, Feb. 9, Lake Tahoe, Nevada, 2012.
- A notion of sparse dual frames for sparse representation and compressed sensing, SPIE Conference on Wavelets and Sparsity, XIV, San Diego, Aug. 21 - 24, 2011.
- Compressed sensing SAR imaging, Beijing Institute of Technology, July 22, 2011.
- A fast sparse recovery algorithm and compressed sensing SAR imaging, 60 min talk at the Workshop on Compressed Sensing and Applications, Tianjing University, July 4, 2011.
- Sparse dual frames in compressed sensing, Nankai University, June 24, 2011.
- Sparsity of the fusion frame operator and the non-orthogonal fusion frames, 40 min talk at the Workshop on Applied Harmonic Analysis and Approximation Theory, Sun Yat-Sat University, May 21-22, 2011.
- A sparse dual frame approach to compressed sensing with general frames, 40 min talk at the Fourth International Conference on Computational Harmonic Analysis, City University of Hongkong, May 23-27, 2011.
- Reflective sensing and non-orthogonal fusion frames, 30 min talk at Shanks Conference and Lecture in Approximation Theory, Vanderbilt University, May 17-21, 2011.
- Fusion frames in action: high resolution image fusion, 30 min talk at FFT (February Fourier Talks) 2011, Norbert Wiener Center for Harmonic Analysis and Applications, University of Maryland, Feb. 17-18, 2011.
- Sparsity of the fusion frame operator and nonorthogonal fusion frames. 30 min invited talk at AMS Special Session on Wavelets, Tilings, and Iterated Function Systems, II, Jan. 7, 2011.
- Nonorthogonal fusion frames, 30 min talk at the workshop on Harmonic Analysis and Integral Geometry, Louisiana State University, Baton Rouge, January 4 - 5, 2011.
- Fusion frames and high resolution image fusion, 40 min talk at the special session on Mathematical Imaging, AMS regional meeting, Syracuse University, Oct. 2-3, 2010.
- A fusion frame approach to high resolution image fusion from inhomogeneous measurements, 40 min talk at the International Conference on Mathematical Methods for Imaging, Sun Yat-Sun University, China, Aug. 4-6, 2010.
- Non-orthogonal fusion frames and applications, Nankai University, China, March 8, 2010.
- Frames, pseudoframes, fusion frames and applications to signal processing, University of Electronics and Technology of China, March 12, 2010.
- Frames, pseudoframes, fusion frames and applications to signal processing, Xidian University, China, March 18, 2010.
- Image fusion, one-sided frame perturbation and a dimension invariance principle, BIRS International Workshop on "Frames from the first principle", Banff, Alberta, Canada, March 15-20, 2009.
- Dual and pseudo-dual frames in various systems, Intern. Conf. on Harmonic Analysis and Applications, joint meeting with the 8th Encuentro Nacional de Analistas, A.P. Calderon, Villa de Merlo, San Luis, Argentina, July 30 - August 5th, 2006.
- Frame and pseudoframe applications, Intern. Conf. on Applicable Harmonic Analysis: Approximation and Application, Beijing, China, June 17 -21, 2006.
- Case studies of pseudoframe applications, BIRS International Workshop on "Coarsely Quantized Redundant Representations of Signals", Banff, Alberta, Canada, March 11-16, 2006.
- Extensions of frames and applications, University of Alberta, Canada, March 17, 2006.
- Pseudoframes and Applications, Nankai University, Tianjing, China, July, 2005
- Frames and Signal Processing, Graduate School, Chinese Academy of Science, Oct., 2002.
- Theory of Frames and Signal Processing, Hefei University of Technology, Oct., 2002.

- Invited Talks** Theory of Frames and Applications, Anhui University of Technology, Oct., 2002.
- (cont'd)** Frames and Signal Processing, Institute of Acoustic and Speech, Chinese Academy of Science, June., 2002.
- Wavelet Basics and Applications, Stanford University, Linear Acceleration Center, July, 2000.
- Wavelets and Applications, Sonoma State University, Feb, 1998.
- Multi-Gabor Time-frequency Analysis, Princeton University, March, 1996.
- A Theory of Pseudo Wavelet-frames and Generalized Multiresolution Structures with Applications, George Mason University, Department of Mathematical Sciences, Feb., 1995.
- A General Theory of Discrete Gabor Expansions and A Parametric Algorithm, The LNK Inc., Maryland, March, 1995.
- A Theory of Multiresolution Frames and Applications, National Institute of Health, Mathematics Group of Biomedical Engineering Instrument Program (BEIP), May, 1993.
- Conference Research Presentations** A null space tuning algorithm for sparse representations, jointly with T. Mi and Y. Liu, The fourth international conference on computational harmonic analysis, City U of Hongkong, May 23 - 27, 2011.
- Modelling sensor networks with fusion frames, jointly with P. Casazza, G. Kutyniok and C. Rozell, in *Proced. of SPIE'2007*, conference on Wavelets XIII, San Diego, Aug., 2007.
- Biorthogonal wavelets with maximum coding gain, jointly with M. Herman, in *Proced. of SPIE'2006*, conference on Advanced Signal Processing, San Diego, Aug., 2006.
- Compactly supported smooth duals of B-spline Riesz sequences of translates: a simple formula and the calculus, AMS regional conf., Eugene, Oregon, Nov. 11-13, 2005.
- Biorthogonal wavelets via pseudoframes for subspaces, jointly with M. Hoffman, in *Proced. of SPIE'2005*, conference on Wavelets XI, San Diego, July 31 - Aug. 3, 2005.
- Efficient image compression by optimized biorthogonal wavelets, jointly with M. Hoffman, in *Proced. of SPIE'2005*, conference on Mathematics of Data/image Coding, Compression, and Encryption VIII, with Applications, San Diego, July 31-Aug. 3, 2005.
- Optimal noise suppression: A nonorthogonal geometric nature of pseudoframes for subspaces, third workshop on Non-orthogonal Expansions and Greedy Algorithms, ESI(The Erwin Schrödinger Institute), Vienna, Austria, June 6-11, 2005.
- A nonorthogonal approach through pseudoframes for subspaces and applications, Intern. Conf. Modern Methods of Time-frequency Analysis, Strobl, Austria, May 23 -28, 2005.
- New biorthogonal wavelets and filterbanks via the theory of pseudoframes, SampTA03 (the 3rd sampling application symposium), Vienna, Austria, May 26 - 30, 2003.
- Pseudoframes for subspace: geometric properties and applications, SampTA03 (the 3rd sampling application symposium), Vienna, Austria, May 26 - 30, 2003.
- Filterbank constructions via the theory of pseudoframes, International congress on industrial and applied mathematics, Sydney, Australia, July 6-11, 2003.
- Applications of nonuniform multi-Gabor expansions in time-frequency analysis, jointly with M. Hoffman, in *Proced. of SPIE'2003*, conference on Advanced Signal Processing, San Diego, Aug. 3, 2003.
- Incorporating Multiple Orientations and Localizations in Multi-Gabor Frames for Image Processing, First SIAM Conference on Imaging Science, Boston, March 3-6, 2002.
- Some practices of irregular samplings, jointly with M. Begonia, in *Proced. of SPIE'2001*, conference on Advanced Signal Processing, San Diego, Aug. 1, 2001.
- An irregular sampling algorithm for general subspaces, in *Proced. of SPIE'2000*, conference on Wavelet Applications and Mathematical Imaging VIII, San Diego, July 31, 2000.
- Pseudoframes and thoughts on its applications, presented at D. Gabor Centenary Conference, Vienna, Austria, May 29-31, 2000.

**Conference  
Presentations  
(cont'd)**

- Irregular sampling conditions, presented at the Conf. on Harmonic Analysis and Applications, Oct. 7-9, College Park, Maryland, 1999.
- Subspace signal expansions with off-the-space sequences and applications, presented at the Intern. Congress of Indust. and Applied Math., July 5-9, Edinburgh, Scotland, 1999.
- An irregular sampling formulation via the theory of pseudoframes, presented at the SIAM annual meeting, May 15, Atlanta, Georgia, 1999.
- Multi-Gabor Representations with Nonuniform Time and Frequency Shifts with Applications, Proced. of CISS'98, 32nd Annual Conference on Information Sciences and Systems, Princeton University, March 18 - 20, 1998.
- Pseudoframes for subspaces with applications, in Proced. of SPIE'98, conference on Wavelet Applications and Mathematical Imaging VI, San Diego, July 22, 1998.
- Image representation and compression through adaptive multi-Gabor representations, in Proced. of SPIE'98, conference on Mathematics of Data/Image Coding, Compression, and Encryption, San Diego, July 21, 1998.
- Two Dimensional Multi-Gabor Representations, Proced. of SPIE'97, conference on Wavelet Applications and Mathematical Imaging, San Diego, July, 1997.
- On pseudo frames, talk given at American Mathematical Regional Meeting, College Park, MD, April, 1997.
- Time-frequency analysis via multi-Gabor expansions, talk given at the 46<sup>th</sup> SIAM Annual Meeting, Stanford University, July, 1997.
- Scaled Gabor Representations: A new approach of time-frequency decompositions, Proced. of SPIE'96, conference on Wavelet Applications, Denver, Aug, 1996.
- On the construction of wavelet-frames with filter-bank-structured fast algorithm and applications, presented at Conf. on Inform. Sci. and Systems, Johns Hopkins University, Baltimore, March, 1995.
- Theory of discrete Gabor expansions: a parametric formula for all Gabor analysis waveforms and optimality issues, presented at Conf. on Inform. Sci. and Systems, Johns Hopkins University, Baltimore, March, 1995.
- Wavelet-frames with fast algorithm and its applications to data compression and noise suppression, Proced. of SPIE'95 Conference on Wavelet Applications, San Diego, July, 1995.
- A fast and parametric algorithm for discrete Gabor expansions and the role of various dual windows, Proced. of SPIE'95 Sympo. on Wavelet Applications for Dual Use, Orlando, April, 1995.
- Subband coding and noise reduction in multiresolution analysis frames, jointly with John J. Benedetto, Proced. SPIE'94 Mathematical Imaging: Wavelet Application conference, San Diego, July, 1994.
- Applications of time-frequency bases to multiple access fiber optic communication systems, Proceeding of SPIE Internl. Symp. on Opt. Eng. in Aerospace Sensing: Wavelet Applications, Orlando, April 4-8, 1994, jointly with T. Olson, D. Healy, U. Osterberg, pp42-53.
- Narrow band frame multiresolution analysis with perfect reconstruction, jointly with John J. Benedetto, Proced. IEEE-SP Internl. Symp. TF-TS, Philadelphia, Oct, 1994.
- A general theory to discrete Gabor expansion, Proced. of SPIE'94 Mathematical Imaging: Wavelet Application Conference, San Diego, July, 1994, also in preprint.
- A generalized multiresolution structure and associated multirate systems, Proced. IEEE-SP Internl. Symp. TF-TS, Philadelphia, Oct, 1994.
- A generalized non-separable 2-D discrete Gabor expansion for image representation and compression, Proced. of the 1st IEEE Internl. Conf. on Image Processing, Austin, Texas, November, 1994.

**Conference Presentations (cont'd)** On a class of discrete Gabor expansions, Proceeding of SPIE Internl. Symp. on Opt. Engir. in Aerospace Sensing: Wavelet Applications, Orlando, April 4-8, 1994, jointly with D. Healy, pp830-841.  
Multiresolution analysis frames with applications, Proce. of IEEE internl. conf. ASSP, Minnesota, April, 1993, Vol. 3, jointly with John J. Benedetto, pp. 304-307.  
On frames and filter banks, Proce. Conf. on Inform. Sci. and Systems, Johns Hopkins University, Baltimore, March, 1993, jointly with John J. Benedetto.  
An optimized backpropagation with minimum norm weights, Proce. of Intern. Joint Conf. on Neural Networks. San Diego, 1990, pp 697-702.

**Other Professional Services** Served on the US NSF Applied Mathematics CAREER Panel, 2005.  
Served as a reviewer for US NSF Applied Mathematics grant proposals, 2011.  
Served as a reviewer for US ARMY Research Office grant proposals, 2012.  
Served as a reviewer for the following journals:

Applied and Computational Harmonic Analysis  
Journal of Fourier Analysis and Applications  
IEEE Transactions on Signal Processing  
Signal Processing  
Journal of Applied Signal Processing  
International Journal of Wavelets and Applications  
Advances in Computational Mathematics  
Journal of Operators and Matrices

**Professional Membership** Member of Mathematical Association of America.  
Member of the International Society of Optical Engineering.  
Member of Institute of Electrical and Electronics Engineering (IEEE)