

# CURRICULUM VITAE

## PD Peter Massopust, Ph.D.

Centre of Mathematics

Research Unit M15

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### EDUCATION

Habilitation in Mathematics	Technical University of Munich (TUM)	2011
Habilitation Thesis:	<i>The Multiscale Structure of Fractal Functions and Wavelets</i>	
Ph.D. Mathematics	Georgia Institute of Technology, U.S.A.	1986
Ph.D. Thesis:	<i>Space Curves Generated by Iterated Function Systems</i>	
Ph.D. Advisor:	Michael F. Barnsley	
M.S. Mathematics	Georgia Institute of Technology, U.S.A.	1985
M.S. Physics	Georgia Institute of Technology, U.S.A.	1981
B.S. Mathematics (Vordiplom)	Ludwig-Maximilians-Universität München, Germany	1980
B.S. Physics (Vordiplom)	Ludwig-Maximilians-Universität München, Germany	1980

### PROFESSIONAL EXPERIENCE

#### Academic Environment

2016 –	Privatdozent, Centre of Mathematics, Technical University of Munich, Germany
2011 – 2013	Deputy Director, Institute of Biomathematics and Biometry, Helmholtz Zentrum München, Germany
2009 – 2015	Senior Research Scientist, Institute of Biomathematics and Biometry/Institute of Computational Biology, Helmholtz Zentrum München, Germany
2006 – 2009	Senior Research Scientist on the Marie Curie Excellence in Research Team MAMEBIA (Mathematical Methods in Biological Image Analysis), Institute of Biomathematics and Biometry, Helmholtz Zentrum München, Germany
1993 – 1996	Professor, Sam Houston State University, U.S.A.
1990 – 1993	Professor, Vanderbilt University, U.S.A.
1988 – 1990	Professor, University of West Georgia, U.S.A.
1986 – 1988	Professor, LaGrange College, U.S.A.

#### Industrial Environment

1999 – 2006	Senior Research Scientist, Tuboscope Pipeline Services, U.S.A.
1997 – 1999	Senior Research Mathematician, Sandia National Laboratories, U.S.A.

## AREAS OF SPECIALIZATION

- Efficient Representations of Multidimensional Data via Frames, Wavelets, and Fractals
- Theory of Wavelets and Frames and their Applications to Signal and Image Analysis
- Harmonic and Functional Analysis
- Splines and Approximation Theory
- Fractal Geometry and Analysis

## GRANTS AND SPONSORED RESEARCH

1. Bayerische Forschungsallianz (BayFor): Multichannel Image and Signal Analysis: Phase and Geometry, Jan.–Dec. 2017.
2. Bayerische Forschungsallianz (BayFor): Efficient Representations of Multidimensional Signals, Jan.–Dec. 2015.
3. DFG (German Research Foundation) Grant: Splines of Complex Order, Fractional Operators, and Applications in Signal and Image Processing, 2014–2016.
4. Start-Up Grant for Cooperation between EuroTech Universities, Technische Universität München, 2012–2014.
5. VolkswagenStiftung: Summer School on New Trends and Directions in Harmonic Analysis, Approximation Theory, and Image Analysis, 2007.
6. Research Grant: Function Spaces and Numerical Approximations with Wavelets, Sandia National Laboratories, 1998–1999.
7. Co-Principal Investigator: An Investigation of Wavelet Bases for Grid-Based Multi-Scale Simulation, Sandia National Laboratories Internal Grant (LDRD), 1997–1998.
8. Co-Principal Investigator: Wavelets Based on Several Scaling Functions and Related Applications, National Science Foundation Grant, DMS, 1995–1998.
9. Principal Investigator: Summer Faculty Research Program, AFOSR, 1995.
10. Principal Investigator: Summer Faculty Research Program, AFOSR, 1994.
11. Principal Investigator: Summer Faculty Research Program, AFOSR, 1993.
12. NATO Travel Grant: Advanced Research Workshop: Shape in Picture, The Netherlands, 1992.
13. Faculty Research Grant: State University of West Georgia, 1989–1990.

## **SCHOLARSHIPS AND FELLOWSHIPS**

- Fulbright Scholarship (1980-1981)
- Visiting Fellowship, Institute of Mathematical Sciences, Australian National University, Canberra, Australia (February 2008)
- Visiting Fellowship, Institute of Mathematical Sciences, Australian National University, Canberra, Australia (July/August 2012)
- Visiting Fellowship, Institute of Mathematical Sciences, Australian National University, Canberra, Australia (May/June 2013)
- GIAN (Global Initiative for Academic Network) Award, Republic of India (July 2016)
- GIAN (Global Initiative for Academic Network) Award, Republic of India (July/August 2017)

## **EDITORIALSHIPS**

- Frontiers in Applied Mathematics and Statistics
- Journal of Mathematics (Hindawi Publishing Corporation)
- International Journal of Advances in Mathematics
- International Journal on Wavelets and Multiresolution Processing (IJWMIP)

## **DISCOVERY DISCLOSURE**

GHM (Geronimo-Hardin-Massopust) Scaling Vector and DGHM (Donovan-Geronimo-Hardin-Massopust) Multiwavelet, Georgia Tech Research Institute, Atlanta, U.S.A., 1995. (with G. Donovan, D. Hardin and J. Geronimo)

## **RESEARCH COLLABORATIONS**

- Universidad de Zaragoza, Spain
- Tel Aviv University, Israel
- University of Newcastle, Australia
- Universidade Aveiro, Portugal
- Technical University Denmark (DT), Denmark
- Universität Passau, Germany
- The Australian National University, Australia
- University of St. Thomas, U.S.A.
- DePaul University, U.S.A.

- Vanderbilt University, U.S.A.

## **TEACHING EXPERIENCE**

### **Germany:**

- Differential- und Integralrechnung (MSE) (Sommersemester 2018)
- Grundlagen der Mathematik (MSE) (Wintersemester 2017/18)
- Vector Analysis (Winter Semester 2016/2017)
- Fourier and Laplace Transforms (Summer Semester 2016 and 2017)
- Elements of the Theory of Distributions (Winter Semester 2014/2015)
- Higher Mathematics 3 for Electrical Engineers (Winter Semester 2013/2014)
- Lie Groups and Algebras (Summer Semester 2012)
- Splines (Summer Semester 2011)
- Fractal Geometry (Winter Semester 2010/2011, Summer Semester 2013)
- Function Theory II (Winter Semester 2009/2010, 2012/2013, 2015/2016, 2017/18)
- Meromorphic Functions and Riemann Surfaces (Summer Semester 2009)
- Topology (Summer Semester 2008)
- Differential Forms (Winter Semester 2007/2008, Summer Semester 2010, Winter Semester 2011/2012, Summer Semester 2015, Winter Semester 2016/2017, Summer Semester 2018)
- Interpolation and Approximation with Splines and Fractals (Summer Semester 2007)

### **U.S.A.:**

- Finite and Discrete Mathematics
- Calculus I–IV
- Ordinary Differential Equations
- Real Analysis
- Partial Differential Equations
- Probability Theory
- Complex Analysis
- Fractal Geometry
- Numerical Analysis
- Numerical Methods for Ordinary and Partial Differential Equations
- Mathematical Physics
- Physics I + II

**Students Supervised:**

- Gahr Constantin, Bachelor Thesis: Iterated Function Systems - Deterministic and Stochastic Aspects (2017)
- Matthias Lauber, Mathematics Master Thesis: Fractional Derivations and Differential Forms (2017)
- Ludwig Bayer, Mathematics Master Thesis: Holomorphic Properties of Complex B-Splines (2017)
- Stefan Held, Ph.D. Thesis: Hypercomplex Wavelets for the Analysis of Image Data (2012)
- Andreas Schindele, Mathematics Master Thesis: Curvature Profiles in Black and White Images (2012)
- Kristof Schröder, Mathematics Master Thesis: Reconstruction of Band-Pass Signals from Zero Sets (2012)
- Andreas Hangauer, Mathematics Diploma Thesis: Construction of Coiflets Associated with Multiwavelets (2009)
- Susanne Schmalkalt, Mathematics Diploma Thesis: Directional Filtering in Images Demonstrated in the Case of Nerve Fibres (2009)
- Florian Drechsler, Mathematics Diploma Thesis: Wavelet-Sets and Reflection Groups (2007)

**External Reviewer for Ph.D. Theses:**

- Saurabh Kumar Katiyar, IIT Madras (India), June 2017
- Srijanani Anurag Prasad, IIT Kanpur (India), May 2011
- Elena Babace, University of Skopje (Macedonia), April 2009
- Robert Scealy, The Australian National University (Australia), October 2008
- Arya Kumar Bedabrata Chand, IIT Kanpur (India), May 2005

**TEACHING AWARD**

Third prize for Advanced Lecture "Complex Function Theory II" (Winter Semester 2015/16)

**SERVICE TO THE UNIVERSITY**

- Academic counsellor for the study program "Mathematics in Data Science."
- Aptitude assessment for the study program "Mathematics in Data Science."

## PUBLICATIONS

### Research Monograph

- Fractal Functions, Fractal Surfaces, and Wavelets, Academic Press, 2nd ed., 2016, 426 pp.
- Fractal Functions, Fractal Surfaces, and Wavelets, Academic Press, 1995, 383 + xi pp.

### Text Books

- Signalanalyse, Birkhäuser Verlag, in preparation (with Brigitte Forster)
- Interpolation and Approximation with Splines and Fractals, Oxford University Press, January 2010, 336 pp.
- Four Short Courses in Harmonic Analysis, Applied and Numerical Harmonic Analysis (ANHA), Birkhuser Verlag, November 2009, 249 pp., (with B. Forster. Contributors: O. Christensen, K. Grchenig, D. Labate, P. Vandergheynst, G. Weiss, Y. Wiaux)

### Edited Books

- Frames and Operator Theory in Analysis and Signal Processing, Contemporary Mathematics, AMS Book Series, Vol. 451, 291 pp., 2008. (With D. Larson, M. Nguyen, M. Papadakis, Z. Nashed, and A. Zayed.)
- Radon transforms, geometry, and wavelets, Contemporary Mathematics, AMS Book Series, Vol. 464, 264 pp., 2008. (with E. Grinberg, D. Larson, P.E.T. Jorgensen, G. Ólafsson, E.T. Quinto, and B. Rubin.)

### Special Issues Edited

- Numerical Functional Analysis and Optimization: Special Issue on *Operator Algebras and Representation Theory: Frames, Wavelets, and Fractals*, Vol. 33, Issue 7–9, 2012 (with P. G. Casazza, Palle E. T. Jorgensen, Keri A. Kornelson, Gitta Kutyniok, David R. Larson, Gestur Ólafsson, Judith A. Packer, Sergei D. Silvestrov and Qiyu Sun).
- Sampling Theory in Signal and Image Processing: Special Issue SampTA 2013, Proceedings of the International Conference on Sampling Theory and its Applications held at Jacobs-University Bremen, Germany, Vol. 13, Nos. 1–4, 2014 (with Götz Pfander and Holger Rauhut).

### Peer-Reviewed Articles

1. The capacity for a class of fractal functions, *Commun. Math. Phys.*, 105 (1986), 455–460 (with D. P. Hardin)
2. Dynamical systems, fractal functions, and dimension, *Topology Proceedings*, 12 (1987), 93–110.
3. Fractal modeling of biological structures, *Ann. NY Acad. Sci.*, 504 (1987), 179–194 (with M. F. Barnsley, H. Strickland, and A. D. Sloan)

4. Fractal Peano curves, *J. of Geometry*, 34 (1989), 127–138.
5. Hidden variable fractal interpolation functions, *SIAM J. Math. Anal.*, 20(5) (1989), 1218–1248 (with M. F. Barnsley, J. Elton, and D. P. Hardin)
6. Fractal surfaces, *J. Math. Anal. and Appl.*, 151(1) (1990), 275–290.
7. Vector-valued fractal interpolation functions and their box dimension, *Aequationes Mathematicae*, 42 (1991), 1–22.
8. The exact Hausdorff dimension for a class of fractal functions, *J. Math. Anal. and Appl.*, 168 (1992), 171–183 (with S. Gibert)
9. Multiresolution analyses based on fractal functions, *J. Approx. Theory*, 71(1) (1992), 104–120 (with D. Hardin and B. Kessler)
10. Fractal interpolation functions from  $\mathbb{R}^n$  to  $\mathbb{R}^m$  and their projections, *Zeitschrift für Analysis u. i. Anwend.*, 12 (1993), 535–548 (with D. P. Hardin)
11. Smooth interpolating curves and surfaces generated by iterated function systems, *Zeitschrift für Analysis u. i. Anwend.* 12 (1993), 201–210.
12. Characterization of all solutions to a perturbed Laplace equation II, *Rocky Mountain J. Math.*, 24, No. 2 (1994), 549–562 (with J. Kelingos).
13. Fractal surfaces, multiresolution analyses, and wavelet transforms, *NATO ASI Series F*, Vol. 106 (1994), 275–290 (with J. S. Geronimo and D. P. Hardin).
14. An application of Coxeter groups to the construction of wavelet bases in  $\mathbb{R}^n$ , *Lecture Notes in Pure and Applied Mathematics: Fourier Analysis - Analytic and Geometric Theory*, Vol. 157 (1994), 187–196 (with J. S. Geronimo and D. P. Hardin).
15. Fractal functions and wavelets expansions based on several scaling functions, *J. Approx. Th.*, 78(3) (1994), 373–401 (with J. S. Geronimo and D. P. Hardin).
16. A Characterization of solutions to a radially perturbed Laplace equation in the unit  $n$ -ball, *J. Math. Anal. and Appl.*, 199 (1996), 728–747 (with J. Kelingos).
17. Construction of orthogonal wavelets using fractal interpolation functions, *SIAM J. Math. Anal.*, 27(4) (1996), 1158–1192 (with G. Donovan, J. Geronimo, and D. Hardin).
18. On the support properties of scaling vectors, *Applied and Computational Harmonic Analysis*, 3 (1996), 229–238 (with D. Ruch and P. Van Fleet).
19. Fractal functions and multiwavelets, *Proceedings of Fractals in Engineering 97*, Arcachon, France, June 1997.
20. Fractal functions and their applications, *Chaos, Solitons, and Fractals*, 8(2) (1997), 171–190.
21. Generalized multiresolution schemes, *J. Math. Anal. and Applications*, 221 (1998), 574–594.
22. A multiwavelet based on piecewise  $C^1$ - fractal functions and related applications to differential equations, *Bol. Soc. Mat. Mexicana*, (3), Vol 4 (1998), 249–283.

23. Divergence-free multiwavelets, *Approximation Theory IX* (C. K. Chui and L. L. Schumaker, eds.), 2(1998), 161–168 (with J. Lakey and C. Pereyra).
24. Translation invariant multiwavelet transforms, Technical Report, CML TR 98-06, Computational Mathematics Laboratory, Rice University, 1998 (with Kathrin Berkner).
25. On angularly perturbed Laplace equations in the unit ball of  $\mathbb{R}^{n+2}$  and their distributional boundary values, in *Analysis of Divergence*, (W. O. Bray and C. V. Stanojevic, eds.) (1999), 359–378.
26. Hierarchical rule based classification of MFL signals obtained from natural gas pipeline inspection, *IEEE-INNS-ENNS International Joint Conference on Neural Networks*, Vol. 5, 71–76, 2000 (with J. Y. Lee, M. Afzal, S. Udpa, and L. Udpa).
27. Multisensor fusion for 3-D characterization using wavelet basis neural networks, *Review of Progress in Quantitative Nondestructive Evaluation*, D. O. Thompson and D. E. Chimenti, Eds, Vol. 20A, American Institute of Physics, 679–694, 2001 (with J. Lim, S. Udpa, L. Udpa, and M. Afzal).
28. Fractal functions and wavelets: Examples of multiscale theory, in *Abstract and Applied Analysis, Proceedings of the International Conference, Hanoi, Vietnam, 13 - 17 August, 2002*, , (N. M. Chuong, L. Nirenberg, W. Tutschke, eds.), World Scientific Press, Singapore, 2004.
29. Fractal functions, splines, and Besov and Triebel-Lizorkin spaces, in *Fractals in Engineering: New trends and applications* (J. Lévy-Véhel , E. Lutton, eds.), 21–32, Springer Verlag, London, 2005.
30. Inverse problems in pipeline engineering, in *The Radon Transform, Inverse Problems, and Tomography*, (G. Ólafsson, E. T. Quinto, eds.), AMS Proceedings on Symposia in Applied Mathematics 63, 93–128, Providence, Rhode Island, 2006.
31. A class of solutions to Maxwell’s equations in matter and associated special functions, in *Advances in Deterministic and Stochastic Analysis*, (N. M. Chuong, P. G. Ciarlet, P. Lax, D. Mumford and D. H. Phong, Eds.), 131–175, World Scientific Publishing Co., 2007.
32. Multiwavelets: Some approximation-theoretic properties, sampling on the interval, and translation invariance, in *Harmonic, Wavelet and  $p$ -Adic Analysis*, (N. M. Chuong et al. Eds.), 37–57, World Scientific Publishing Co., 2007.
33. Multivariate complex B-splines, *Proceedings of SPIE, Wavelets XII*, Vol. 6701, 670109-1–670109-9, 2007 (with B. Forster).
34. Coxeter groups and wavelets sets, *Contemporary Mathematics*, Vol. 451 (2008), 187–218 (with D. Larson).
35. Some remarks about the connection between fractional divided differences, fractional B-splines, and the Hermite-Genocchi formula, *International Journal of Wavelets, Multiresolution and Information Processing*, Vol. 6, No. 2, 2008, 279–290 (with. B. Forster).
36. Statistical encounters with complex B-splines, *Constr. Approx.* 29 (2009), 325–344 (with B. Forster).



37. Multivariate complex B-splines, Dirichlet averages and difference operators, Proceedings of SampTA 2009 (with B. Forster).M
38. Double Dirichlet averages and complex B-splines, Proceedings of SampTA 2009.
39. Three-way tiling sets in two dimensions, Acta Applicandae Mathematicae 108 (2009), 529–546 (with D. Larson and G. Ólafsson).
40. Mathematical Aspects of Time Frequency Analysis, in: Four Short Courses in Harmonic Analysis, Applied and Numerical Harmonic Analysis (ANHA), Birkhuser Verlag (2009), 1–49.
41. Multivariate complex B-splines and Dirichlet averages, J. Approx. Theory 162 (2010), 252–269 (with B. Forster).
42. Isotropic wavelet frames based on the Riesz transform, IEEE Transactions on Image Processing, Volume 19, Issue 3 (2010), 653–667 (with B. Forster, S. Held, and M. Storath).
43. Interpolation with fundamental splines of fractional order, Proceedings of SampTA 2011 (with B. Forster).
44. Splines of complex order: Fourier, filter, and fractional derivatives, Sampling Theory in Signal and Image Analysis, Vol. 10, No. 1–2 (2011), 89–109 (with B. Forster).
45. Short Communication: Multivariate Interpolation with Fundamental Splines of Fractional Order, Proc. Appl. Math. Mech., 11 (2011), 857–858 (with B. Forster).
46. Moments of complex B-splines, Commun. Math. Anal., Vol. 12, No. 2 (2012), 58–70.
47. Periodic splines of complex order, Numerical Functional Analysis and Optimization 33 (7-9) (2012), 989–1004 (with B. Forster and T. Übelacker).
48. Splines of complex order: An introduction, AIP Conference Proceedings, Vol. 1479 (2012), 991–994.
49. Exponential B-splines and the partition of unity property, Adv. Comput. Math. 37(3)(2012), 301–318 (with O. Christensen).
50. Complex B-Splines and Hurwitz Zeta Functions, London Math. Soc. Journal of Computation and Mathematics 16(2013), 61–77 (with B. Forster, Ramūnas Garunkštis, and Jörn Steuding).
51. Wavelet Signs: A New Tool for Signal Analysis, Proceedings of the 10th International Conference on Sampling Theory and Applications, EUROSIP, (2013), 45–48 (with M. Storath and L. Demaret).
52. Numerics and fractals, Bulletin of the Institute of Mathematics, Academica Sinica (N.S.), Vol. 9(3)(2014), 389–430 (with M. F. Barnsley and M. Hegland).
53. Exponential splines of complex order, Contemporary Mathematics, Vol. 676(2014), 87–106.
54. Local fractal functions and function spaces, Springer Proceedings in Mathematics & Statistics: Fractals, Wavelets and their Applications, Vol. 92(2014), 245–270.

55. Fractional operators, Dirichlet averages, and splines, *Applied and Numerical Harmonic Analysis: New Perspectives on Approximation and Sampling Theory (Festschrift in Honor of Paul Butzer's 85th Birthday)* (2014), 399–422.
56. Bilinear fractal interpolation and box dimension, *Journal of Approximation Theory*, 192 (2015), 362–378 (with Michael F. Barnsley).
57. On local fractal functions in Banach spaces, *AIP Conf. Proc.*, 1648 (2015), 640002-01–640002-04.
58. Directional time frequency analysis via continuous frames, *Bull. Aust. Math. Soc.* **92** (2015), 268–281 (with O. Christensen and B. Forster).
59. On the Invalidity of Fourier Series Expansions of Fractional Order, *Fract. Calc. Appl. Anal.*, Vol. 15, No 6 (2015), 1507–1517 (with Ahmed I. Zayed).
60. Local fractal functions in Besov and Triebel-Lizorkin spaces, *J. Math. Anal. Appl.* **436** (2016), 393–407.
61. Fractal hypersurfaces, wavelet sets, and affine Weyl groups, invited lecture notes, *International Conference on Fractals and Wavelets, Kerala, India*, <http://arxiv.org/abs/1309.0241>, 2013.
62. A new method to measure complexity in binary or weighted networks and applications to functional connectivity in the human brain, *BMC Bioinformatics* (2016), 17–87 (with K. Hahn and S. Prigarin).
63. Signal analysis based on complex wavelet signs, *Appl. Comput. Harmon. Anal.* **42** (2) (2017), 199–223 (with M. Storath and L. Demaret).
64. Multigrid convergence for the MDCA-curvature estimator, *Journal of Mathematical Imaging and Vision*, **57** (3) (2017), 423–438 (with A. Schindele and B. Forster).
65. Fractional and Complex Pseudo-Splines and the Construction of Parseval Frames, *Applied Mathematics and Computation*, **314** (2017), 12–24. (with B. Forster and O. Christensen).
66. Fractional Cone Splines and Hex Splines, *Rocky Mountain J. Math.* **47**(5) (2017), 1655–1691 (with P. J. Van Fleet).
67. Quaternionic B-Splines, *J. Approx. Th.* **224** (2017), 43– 65. (with J. Hogan).
68. Local Fractal Interpolation on Unbounded Domains, *Proc. Edinb. Math. Soc.* (2) 61 (2018), no. 1, 151–167.
69. Self-Referential Functions, submitted 2016, <https://arxiv.org/abs/1610.01369> (with M. Barnsley and M. Hegland)
70. Quaternionic Fundamental Cardinal Splines: Interpolation and Sampling, submitted 2018, <http://arxiv.org/abs/1804.06638> (with Jeff Hogan)
71. Fractal Convolution: A New Operation Between Functions, submitted 2018, <http://arxiv.org/abs/1805.11316> (with M. A. Navascués)

## Non-refereed Articles

### *Industrial and Technical Reports*

Some reports in the following collection contain novel but unpublished material due to proprietary constraints.

1. A study of Wavelet-Galerkin methods for numerical solutions of differential equations using multigrid relaxation methods, Technical Report, AFOSR Faculty Summer Research Program, July 1993, 14 pp.
2. A wavelet-multigrid approach to solving partial differential equations based on fractal functions, Technical Report, AFOSR Faculty Summer Research Program, August 1994, 17 pp.
3. Multiresolution schemes for solving conservation laws, Technical Report, AFOSR Faculty Summer Research Program, August 1995, 19pp.
4. Scaling vectors and multiwavelets in numerical differential equations – Some approximation-theoretic and numerical issues, Sandia Technical Report, SAND97-2133, UC-405, September 1997, 51 pp.
5. Local stable splittings and wavelet packets, Technical Report for Sandia National Laboratories, May 1998, 15 pp.
6. Nonlinear approximation, wavelet packets, and interpolation, Technical Report for Sandia National Laboratories, July 1998, 20pp.
7. On magnetic fields generated by Cartesian, cylindrical, spherical, and parabolic defects. Part I: Analytical solutions, Tuboscope Technical Report TR-1999-01, 1999, 52pp.
8. Circumferential sensor evaluation, Tuboscope Technical Report TR-1999-02, 1999, 18pp.
9. Fourier and Wavelet analysis of defects, Tuboscope Technical Report TR-2000-01, 2000, 13pp.
10. MFL signal enhancement via wavelet-based denoising, Tuboscope Technical Report TR-2000-05, 2000, 32pp. (with A. Belanger)
11. Axial and circumferential local curvature calculations for strain estimation and their error analyses, Tuboscope Technical Report TR-2000-06, 2000, 30pp.
12. Two-dimensional wavelet-based denoising, Tuboscope Technical Report TR-2001-02, 2001, 21 pp.
13. Knot removal and knot insertion for two-dimensional mechanical damage data, Tuboscope Technical Report TR-2001-03, 2001, 17 pp.
14. Computation of the strain tensor field for mechanical damage data, Tuboscope Technical Report TR-2001-04, 2001, 14 pp.
15. Modified exact solutions, Tuboscope Technical Report TR-2002-02, 2002, 14 pp.
16. Pipeline integrity assessment algorithms: Statistical foundations, Tuboscope Technical Report TR-2002-04, 2002, 15 pp.

17. A short note on hysteresis and odd harmonics, Tuboscope Technical Report TR-2002-05, 2002, 5 pp.
18. Compression of ILI data using wavelet packets, Tuboscope Technical Report TR-2002-07, 2002, 42 pp.
19. A short note on ILI data correction due to pipe deformation, Tuboscope Technical Report TR-2002-08, 2002, 2 pp.
20. Mathematical analysis of ILI data, Tuboscope Technical Report TR-2003-02, 2003, 12 pp.
21. Signal enhancement via B-Spline representations, Tuboscope Technical Report TR-2003-07, 2003, 11 pp. (with A. Belanger)
22. Reconstruction of clipped MFL signals via B-spline approximation and Hermite interpolation, Tuboscope Technical Report TR-2004-04, 2004, 16 pp.
23. Removal of seamless pipe noise via curvelets, Tuboscope Technical Report, TR-2006-01, 2006, 22 pp.

***Other Writings***

1. Fractals and their geometry, The Georgia Mathematics Newsletter, Issue No. 13, Fall 1989. [6 pp.]
2. An introduction to fractal functions and fractal surfaces and their connection to wavelet theory, Lecture notes for a three-day minicourse sponsored by the MAA, 1995. [56 pp.]
3. Multiwavelets and their applications, Lectures notes for a week-long minicourse sponsored by the MAA, 1997. [51 pp.]
4. The benefits of combining technologies for in-line inspection, 3R International, (42) Heft 7, (2003) (with M. Slaughter and C. Torres) [4 pp.]

**INVITED PRESENTATIONS [Recent Years]:**

1. 15th International Conference on Mathematics and its Applications, Plenary speaker, Jaca, Spain, September, 2018.
2. International Workshop on Operator Theory and Its Applications (IWOTA 2018), Special Session on "Spectral Theory and Differential Operators," Shanghai, China, July 2018.
3. 11 International Conference on Clifford Algebras and Their Applications in Mathematical Physics (ICCA11), Minisymposium on "New Frontiers in Harmonic Analysis and Geometry over Non-Commutative Structures," Ghent, Belgium, August 2017.
4. 18th Workshop on Applications and Generalizations of Complex Analysis, Aveiro, Portugal, March 2017.
5. IM-Workshop on "Applied Approximation, Signals and Images," Bernried, Germany, February 2017.

6. Centre International de Rencontres Mathématiques (CIRM), "Multivariate Approximation and Interpolation with Applications," Marseille, France, September 2016.
7. 4th Dolomites Workshop on "Constructive Approximation and Applications," Alba di Canazei, Italy, September 2016.
8. IM-Workshop on "Applied Approximation, Signals and Images," Bernried, Germany, February 2016.
9. AMS Special Session "Ergodic Theory and Dynamical Systems," AMS Annual Meeting, San Antonio, U.S.A., January 2015.
10. International Conference on New Directions in Fractal Geometry, The Australian National University, Canberra, Australia, November 2014.
11. International Conference Numerical Analysis and Applied Mathematics 2014, Minisymposium on Fractal Analysis and Harmonic Analysis, Rhodes, Greece, September 2014.
12. International Conference on Computational Harmonic Analysis, Nashville, Tennessee, May 2014.
13. International Conference on Fractals and Wavelets, Rajagiri School of Engineering & Technology, Kakkanad Cochin, Kerala, India, November 2013 (two invited workshop lectures and one plenary talk).
14. CIMPA 2013, New Trends in Harmonic Analysis, Mar del Plata, Argentina, August 2013.
15. AMS Special Session on "Harmonic Analysis of Frames, Wavelets, and Tilings," University of Colorado, Colorado, April 2013.
16. Gesellschaft für Angewandte Mathematik und Mechanik (GAMM 2013), Mathematical Image and Signal Processing, Novi Sad, Serbia, March 2013.
17. European Intensive Course on Complex Analysis, its Generalizations and Applications, Universidade de Aveiro, Portugal, March 2013 (three two-hour lectures).
18. International Conference on Advances on Fractals and Related Topics, Chinese University of Hong Kong, China, December 2012.
19. International Conference Numerical Analysis and Applied Mathematics 2012, Kos, Greece, September 2012 (two presentations).
20. International Workshop on Operator Theory and Applications, University of New South Wales, Sydney, Australia, July 2012.
21. International Conference on Sampling Theory and Applications (SampTA 2011), Singapore, May 2011.
22. Gesellschaft für Angewandte Mathematik und Mechanik (GAMM 2011), Mathematical Image Processing, Graz, Austria, March 2011.
23. Workshop on Operator Algebras and Representation Theory: Frames, Wavelets, and Fractals, Oberwolfach, Germany, March 2011.

24. Workshop on Operator Algebras and Representation Theory: Frames, Wavelets, and Fractals, Banff, Canada, October 2010.
25. International Conference on Wavelets and Applications, Euler International Mathematical Institute, St. Petersburg, Russia, June 2009.
26. International Conference on Sampling Theory and Applications (SampTA 2009), Marseille, France, May 2009.
27. Research Mini-Workshop on Coxeter Groups and Wavelet Sets, Texas A & M University, Texas, March 2009.
28. NeuWave Imaging Workshop, Technische Universität München, Germany, April 2008.
29. Wavelets XII, SPIE Meeting, San Diego, California, August 2007.
30. 7th Workshop Approximationstheorie, Universität Erlangen–Nürnberg, Germany, February 2007.
31. Workshop on Operator Methods in Fractal Analysis, Wavelets, and Dynamical Systems, Banff, Canada, December 2006.
32. Industrial Problems Seminar, IMA and University of Minneapolis, Minneapolis, Minnesota, March 2006.
33. Workshop on Harmonic Analysis and Fractal Geometry, Louisiana State University, Baton Rouge, Louisiana, February 2006 (one-hour tutorials on Coxeter Groups and Wavelet Sets) (with D. Larson).
34. Invited One-hour Break-out Session Leader on Denoising, IMA Workshop on New Mathematics and Algorithms for 3-D Image Analysis, University of Minnesota, Minneapolis, Minnesota, January 2006.
35. International Conference on Fractals in Engineering V, Tours, France, June 2005.
36. International Conference on Abstract and Applied Analysis 2005, Qui Nhon, Vietnam, June 2005
37. First International Summer School on Harmonic, Wavelet, and p-Adic Analysis, Qui Nhon University, Qui Nhon, Vietnam, June 2005 (two one-hour lectures).
38. Special Session on The Radon Transform and Inverse Problems, Annual Meeting of the AMS, Atlanta, Georgia, January 2005.
39. Workshop on Functional and Harmonic Analyses of Wavelets and Frames, Institute of Mathematical Sciences, National University of Singapore, Singapore, August 2004.
40. Workshop on New Mathematics and Algorithms for 3D Image Analysis, Louisiana State University, Baton Rouge, Louisiana, September, 2003 (Invited participant to discuss 3D imaging problems with leaders in the field.)
41. Special Session on Wavelets, Frames, and Tomography, Southeastern Sectional Meeting of the AMS, Baton Rouge, Louisiana, March 2003.

42. International Conference on Abstract and Applied Analysis, a satellite conference of the International Congress of Mathematics, Hanoi, Vietnam, August 2002.

### **SHORT AND MINI-COURSES, INVITED LECTURE SERIES**

1. Fractal Geometry: Foundations to Frontiers, three-week long GIAN (Global Initiative of Academic Networks) lecture series, IIT Madras, India, August 2017, sponsored by the Government of India.
2. Splines and Fractals in Approximation and Interpolation Theory, two-week long GIAN (Global Initiative of Academic Networks) lecture series, IIT Madras, India, July 2016, sponsored by the Government of India.
3. Fractal Hypersurfaces, Wavelet Sets and Affine Weyl Groups, invited lectures at the International Conference on Fractals and Wavelets, Rajagiri School of Engineering & Technology, Cochin, Kerala, India, November 2013
4. Wavelet Sets, Affine Weyl Groups, and Fractal Surfaces (three two-hour invited lectures), 18<sup>th</sup> European Intensive Course on Complex Analysis, its Applications and Generalizations, Universidade de Aveiro, Portugal, March 2013.
5. Inverse Problems in Pipeline Inspection (one-hour invited lecture), AMS Short Course The Radon Transform and Applications to Inverse Problems, organized by G. Ólafsson und T. Quinto, sponsored by the American Mathematical Society, Atlanta, Georgia, January 2005.
6. Multiwavelets and their Applications (five-day mini-course), invited and sponsored by the Alleghany Section of the Mathematical Association of America, Meadville, Pennsylvania, Juni 1997.
7. An Introduction to Fractal Functions and Fractal Surfaces and Their Connection to Wavelet Theory (three-day course), invited and sponsored by the Mathematical Association of America, San Francisco, California, January 1995).

### **CONFERENCE AND SCIENTIFIC COMMITTEES [Recent Years]**

1. Symposium on Higher Dimensional Splines: Variations of a Theme, International Conference on Numerical Analysis and Applied Mathematics (ICNAAM 2014), Rhodes, Greece, September 2014.
2. International Conference on Fractals and Wavelets, Rajagiri School of Engineering & Technology, Kakkanad Cochin, Kerala, India, November 2013.
3. Sampling Theory and its Applications (SampTA) 2013, Biennial Meeting at the Jacobs-University Bremen, Germany, July 2013.
4. Summer School on New Directions in Harmonic Analysis, Fractional Operator Theory and Image Analysis, Inzell, Germany, September 2012.

5. Minisymposium on Phase Information in Signals and Images, Annual Meeting of the Deutsche Mathematiker Vereinigung (DMV), Munich, Germany, March 2010.
6. Summer School on New Trends and Directions in Harmonic Analysis, Approximation Theory, and Image Analysis, Inzell, Germany, September 2007.
7. Special Session on Frames and Operator Theory in Analysis and Signal Processing, Annual Meeting, AMS in San Antonio, Texas, January 2006.
8. Second International Conference on Applied and Abstract Analysis, Qui Nhon, Vietnam, June 2005.
9. First International Summer School on Harmonic, Wavelet and  $p$ -adic Analysis, Qui Nhon, Vietnam, June 2005.
10. Invited Special Session on Design and Applications of Multidimensional Wavelets and MRAs, Wavelets XI, SPIE, 2005.
11. International Symposium on Optical Science and Technology, SPIE 50th Annual Meeting, San Diego, California, July/August 2005.
12. Special Session on Designing Frames and Wavelets: From Theory to Digitization, Sixth Joint Meeting of the American Mathematical Society and the Sociedad Matemática Mexicana, Houston, Texas, May 2004.
13. International Conference on Abstract and Applied Analysis 2002, A satellite conference of the International Congress of Mathematicians (ICM) 2002, Hanoi, Vietnam, August 2002.

**MEMBERSHIPS AND OTHER SCHOLARLY ACTIVITIES:**

- Member of Phi Mu Epsilon (National Honorary Mathematics Fraternity).
- Member of Sigma Pi Sigma (Physics Honor Society).
- Invited member of IAG (International Association of Geodesy) Special Study Group IAG-SSG 4.195, Fractal Geometry in Geodesy.
- Member of the American Mathematical Society (AMS)
- Refereed for more than 60 international journals.
- Reviewer for *Mathematical Reviews*.
- Reviewer for *Zentralblatt Mathematik*.
- National Science Foundation Panel Judge.

**INVITED COLLOQUIA AND SEMINAR TALKS:**

- Universidad de Zaragoza, Spain



- VIT University Chennai, India
- B. S. Abdur Rahman Crescent University, Chennai, India
- IIT Madras, Tamil Nadu, India (several occasions)
- University College Dublin, Ireland
- University of Connecticut, Storrs, CT, U.S.A.
- DePaul University, Chicago, IL, U.S.A.
- University of Passau, Germany
- Imperial College, London, United Kingdom
- Jacobs-University, Bremen, Germany
- Technical University of Denmark (DTU), Lyngby, Denmark (several occasions)
- The Australian National University, Canberra, Australia (several occasions)
- Helmholtz Zentrum München, Insitute for Biomathematics and Biometry, Munich, Germany
- Technische Universität München, Munich, Germany
- University of North Texas, Denton, Texas, U.S.A.
- Texas A & M University, College Station, Texas, U.S.A. (several occasions)
- University of Houston, Houston, Texas, U.S.A. (several occasions)
- Tuboscope Pipeline Services, Houston, Texas, U.S.A. (several occasions)
- Iowa State University, Ames, Iowa, U.S.A.
- University of St. Thomas, St. Paul, Minnesota, U.S.A. (several occasions)
- Rice University, Houston, Texas, U.S.A.
- Center of Approximation Theory, Texas A & M University, College Station, Texas, U.S.A. (several occasions)
- Vanderbilt University, Nashville, Tennessee, U.S.A. (several occasions)
- New Mexico Institute of Mining and Technology, Socorro, New Mexico, U.S.A.
- Sandia National Laboratories, Albuquerque, New Mexico, U.S.A.
- Sam Houston State University, Huntsville, Texas, U.S.A. (several occasions)
- University of Central Florida, Orlando, Florida, U.S.A.
- Arnold Engineering and Development Center (AEDC), Tullahoma, Tennessee, U.S.A.
- Bradley University, Peoria, Illinois, U.S.A.

- University of Tennessee Space Institute, Tullahoma, Tennessee, U.S.A.
- University of Louisville, Louisville, Kentucky, U.S.A.
- Georgia Institute of Technology, Atlanta, Georgia, U.S.A. (several occasions)
- State University of West Georgia, Carrollton, Georgia, U.S.A.
- LaGrange College, LaGrange, Georgia, U.S.A.
- North Harris College, Houston, Texas, U.S.A. (several occasions)