

December 20, 2011

CURRICULUM VITAE

Morten Nielsen

Department of Mathematical Sciences

Aalborg University

Fredrik Bajers Vej 7G

DK-9220 Aalborg East, Denmark

Phone (work): +45 9940 8864

Fax: +45 9815 8129

Email: mnielsen@math.aau.dk

Homepage: <http://people.math.aau.dk/~mnielsen>

Personal

Born: Sept. 10, 1972, Denmark

Nationality: Danish citizen

Marital status: Married.

Education

- Dr. scient., Aalborg University, Denmark, March 2009
- Ph.D. in mathematics, Washington University in St. Louis, USA, May 1999
- A.M., Washington University in St. Louis, USA, 1997
- M.Sc. (mathematics/physics), Aalborg University, Denmark, 1996.

Academic positions held

- Professor, June 2010–present, Aalborg University
- Associate Professor, Aug. 2002–May 2010, Aalborg University (on leave July 2006–Aug. 2007)
- Postdoctoral Research Associate, University of South Carolina, Columbia, Aug. 1999–July 2002.

Administrative positions held

- Vice Head of Department, Nov. 2010–present, Department of Mathematical Sciences, Aalborg University, Denmark
- Interim Head of Department, Sept. 2011–Jan. 2012, Department of Mathematical Sciences, Aalborg University.

Visits abroad

- Visiting scientist, IRISA-INRIA, Rennes, France, July 1–30, 2004.
- Visiting Associate Professor, Washington University in St. Louis, Aug. 2006–Aug. 2007.

Research interests

Harmonic analysis with wavelets and their generalizations. Approximation theory, in particular problems related to nonlinear approximation with redundant systems. Constructive algorithms for sparse data representation.

Research Prizes

- The Spar Nord Foundation's Research Prize, 2010 (honoured by 250,000 DKK).

Teaching Prizes

- Teacher of the Year 2008, Basic Year of Science, Engineering and Medicine Study Board, Aalborg University.

PUBLICATIONS

REFEREED JOURNAL ARTICLES

- [1] Walsh-type wavelet packet expansions. *Appl. Comput. Harmon. Anal.*, 9(3):265–285, 2000.
- [2] On the construction and frequency localization of finite orthogonal quadrature filters. *J. Approx. Theory*, 108(1):36–52, 2001.
- [3] (with R. Gribonval), Some remarks on non-linear approximation with Schauder bases. *East J. Approx.*, 7(3):267–285, 2001.
- [4] (with R. Gribonval), Approximate weak greedy algorithms. *Adv. Comput. Math.*, 14(4):361–378, 2001.
- [5] Highly nonstationary wavelet packets. *Appl. Comput. Harmon. Anal.*, 12(2):209–229, 2002.
- [6] On convergence of wavelet packet expansions. *Approx. Theory Appl. (N.S.)*, 18(1):34–50, 2002.
- [7] (with D.-X. Zhou), Mean size of wavelet packets. *Appl. Comput. Harmon. Anal.*, 13(1):22–34, 2002.
- [8] Size properties of wavelet packets generated using finite filters. *Rev. Mat. Iberoamericana*, 18(2):249–265, 2002.
- [9] (with L. Borup), Fast adaptive expansions in local trigonometric bases. *Signal Processing*, 83(2):445–451, 2003.
- [10] (with L. Borup), Approximation with brushlets. *J. Approx. Theory*, 123(1):25–51, 2003.
- [11] (with R. Gribonval), Sparse representations in unions of bases. *IEEE Trans. Inform. Theory*, 49(12):1320–1325, Dec. 2003.
- [12] (with R. Gribonval), On approximation with spline generated framelets. *Constr. Approx.*, 20(2):207–232, 2004.
- [13] (with R. Gribonval), Nonlinear approximation with dictionaries. I. Direct estimates. *J. Fourier Anal. Appl.*, 10(1):51–71, 2004.
- [14] (with R. Gribonval), On a problem of Gröchenig about nonlinear approximation with localized frames. *J. Fourier Anal. Appl.*, 10(4):433–437, 2004.
- [15] Nonseparable Walsh-type functions on \mathbb{R}^d . *Glas. Mat. Ser. III*, 31(1):111–138, 2004.
- [16] (with L. Borup and R. Gribonval), Bi-framelet systems with few vanishing moments characterize Besov spaces. *Appl. Comput. Harmon. Anal.*, 17(1):3–28, 2004.
- [17] (with L. Borup and R. Gribonval), Tight wavelet frames in Lebesgue and Sobolev spaces. *J. Function Spaces Appl.*, 2(3):227–252, 2004.
- [18] (with L. Borup), Approximation with wave packets generated by a refinable function. *Proc. Amer. Math. Soc.*, 133(8):2409–2418, 2005.
- [19] (with L. Borup), On the equivalence of wavelet and brushlet bases. *J. Math. Anal. Appl.*, 309(1):117–135, 2005.
- [20] (with L. Borup), Approximation with general wave packets. *Anal. Theory Appl.*, 21(3):201–215, 2005.
- [21] (with L. Borup), Nonlinear approximation in α -modulation spaces. *Math. Nachr.*, 279(1-2):101–120, 2006.
- [22] (with L. Borup), Banach frames for multivariate α -modulation spaces. *J. Math. Anal. Appl.*, 321(2):880–895, 2006.
- [23] (with R. Gribonval), Nonlinear approximation with dictionaries. II. Inverse estimates. *Constr. Approx.*, 24(2):157–173, 2006.
- [24] (with L. Borup), Boundedness for pseudodifferential operators on multivariate α -modulation spaces. *Ark. Mat.*, 44(2):241–259, 2006.
- [25] On polynomial symbols for subdivision schemes. *Adv. Comput. Math.*, 27(2):195–209, 2007.

- [26] (with R. Gribonval), Highly sparse representations from dictionaries are unique and independent of the sparseness measure. *Appl. Comput. Harmon. Anal.*, 22(3):335-355, 2007.
- [27] (with L. Borup), Frame Decomposition of Decomposition Spaces. *J. Fourier Anal. Appl.*, 13(1):39-70, 2007.
- [28] (with H. Šikic), Schauder bases of integer translates. *Appl. Comput. Harmon. Anal.*, 23(2):259-262, 2007.
- [29] An example of an almost greedy uniformly bounded orthonormal basis for $L_p(0,1)$, *J. Approx. Theory*, 149(2):188-192, 2007.
- [30] (with R. Gribonval), Beyond sparsity: recovering structured representations by ℓ^1 minimization and greedy algorithms. *Adv. Comput. Math.*, 28(1):23-41, 2008.
- [31] (with L. Borup and R. Gribonval) Beyond coherence: recovering structured time-frequency representations. *Appl. Comput. Harmon. Anal.*, 24(1):120-128, 2008.
- [32] (with L. Borup), On anisotropic Triebel-Lizorkin type spaces, with applications to the study of pseudo-differential operators. *J. Function Spaces Appl.*, 6(2):107-154, 2008.
- [33] (with H. Šikic), Quasi-greedy systems of integer translates. *J. Approx. Theory*, 155(1):43-51, 2008.
- [34] Trigonometric quasi-greedy bases for $L_p([0,1])$. *Rocky Mountain J. Math.*, 39(4):1267-1278, 2009.
- [35] Orthonormal bases for α -modulation spaces. *Collect. Math.*, 61(2):173-190, 2010.
- [36] Trigonometric bases for matrix weighted L_p -spaces. *J. Math. Anal. Appl.*, 371:784792, 2010.
- [37] On stability of finitely generated shift-invariant systems. *J. Fourier Anal. Appl.*, 16(6):901-920, 2010.

ARTICLES IN PROCEEDINGS WITH PEER REVIEW

- [38] (with L. Borup), Nonseparable wavelet packets. In *Approximation theory X: Wavelets, splines, and applications (Nashville, TN, 2002)*, Innov. Appl. Math., pages 51–61. Vanderbilt Univ. Press, Nashville, TN, 2002.
- [39] (with R. Gribonval), Sparse decompositions in “incoherent” dictionaries. Proc. IEEE Intl. Conf. on Image Proc. (ICIP’03), Barcelona, Spain, September 2003.
- [40] (with R. Gribonval), Approximation with Highly Redundant Dictionaries Wavelets: Applications in Signal and Image Processing, Proc. SPIE’03 Vol. 5207:216-227, San Diego, USA, August 2003.
- [41] (with R. Gribonval), On the strong uniqueness of highly sparse expansions from redundant dictionaries. Proc. Int. Conf. Independent Component Analysis (ICA’04), September 2004. Springer-Verlag LNCS series.
- [42] (with L. Borup and R. Gribonval) Nonlinear approximation with bi-framelets. In *Approximation theory XI: Gatlinburg 2004*, Mod. Methods Math., pages 93–104. Nashboro Press, Brentwood, TN, 2005.

PAPERS ACCEPTED FOR PUBLICATION

- [43] On transference of multipliers on matrix weighted L_p -spaces. *J. Geom. Anal.*, accepted 2010.
- [44] (with H. Šikic), Maximal functions, product condition and its eccentricity. *Collect. Math.*, accepted 2011.
- [45] (With K. Rasmussen) Compactly supported frames for decomposition spaces. *J. Fourier Anal. Appl.*, accepted 2011.
- [46] (with H. Šikic), Maximal functions, product condition and its eccentricity. *Collect. Math.*, accepted 2011.
- [47] (With K. Rasmussen) Compactly supported curvelet type frames. *J. Funct. Spaces Appl.*, accepted 2011.

OTHER WRITINGS

- [48] (with R. Gribonval), Sparse approximations in signal and image processing (editorial). *Signal Processing*, 86(3):415–416, 2006.

Invited talks

1. Oct. 1997. Washington University in St. Louis, Wavelet seminar (1 hour): *Pointwise convergence of wavelet packet expansions.*
2. Apr. 1998. University of Copenhagen, Analysis seminar (1 hour): *Size Properties of wavelet packet expansions.*
3. Apr. 1998. Aalborg University, Denmark, Colloquium (1 hour): *Pseudo-differential operators and time-frequency analysis.*
4. Dec. 1998. Royal Institute of Technology, Stockholm, Colloquium (1 hour): *Size Properties of wavelet packet expansions.*
5. May 1999. University of Aarhus, Denmark, Analysis seminar (1 hour): *Convergence of wavelet packet expansions.*
6. Sept. 1999. University of South Carolina-Columbia, Analysis seminar (1 hour): *Wavelet packet expansions.*
7. Nov. 1999. City University of Hong Kong, Workshop on Wavelets (45 min.): *Wavelet packet expansions.*
8. June 2000. Chinese University, Hong Kong, Analysis seminar (1 hour): *Some new results on wavelet packet expansions.*
9. June 2000. City University of Hong Kong, Colloquium (1 hour): *Some new results on wavelet packet expansions.*
10. Sept. 2000. University of Wisconsin-Madison, IDR workshop, (2x45 min): *Greedy algorithms.*
11. Nov. 2000. AMS 2000 Southeastern Section Meeting, Birmingham, Alabama (25 min): *Approximate weak greedy algorithms.*
12. Mar. 2001. AMS 2001 Southeastern Section Meeting, Columbia, South Carolina (25 min): *On the construction of finite orthogonal quadrature filters.*
13. Mar. 2001. 10th International Conference on Approximation, St. Louis, Missouri (20 min): *Frequency localization of finite orthogonal quadrature filters.*
14. Mar. 2001. University of South Carolina-Columbia, Analysis seminar (1 hour): *Nonlinear approximation with Schauder bases.*
15. Aug. 2002. Wavelet workshop, Aalborg University (50 min): *Nonlinear approximation with redundant dictionaries.*
16. Apr. 2003. Analysis seminar, Technical University of Denmark (50 min): *Nonlinear approximation with redundant dictionaries.*
17. June 2003. Workshop "Applicable Harmonic Analysis", Banff, Canada (50 min): *Nonlinear approximation with framelet systems.*
18. Aug. 2003. Workshop on wavelets and their generalizations Aalborg University (50 min): *Nonlinear approximation with general MRA wavelet frames.*
19. May 2004. 11th International Conference on Approximation, Gatlinburg, Tenn. (20 min): *On nonlinear approximation with localized frames.*
20. Oct. 2004. Workshop "Data representation using redundant systems", Aalborg University (50 min): *Sparse data representation using redundant dictionaries.*
21. June 2005. Workshop "Modern Methods of Time-Frequency Analysis", ESI, Vienna (50 min): *Banach frames for multivariate α -modulation spaces.*
22. Sept. 2006. Washington University in St. Louis, Wavelet seminar (50 min): *Frame decomposition of decomposition spaces.*

23. Oct. 2006. University of South Carolina, IMI seminar (50 min): *Frame decomposition of function spaces*.
24. Nov. 2006. Saint Louis University, seminar (50 min): *Sparse representation of Data*.
25. Jan. 2007. Louisiana State University, Baton Rouge, Wavelet workshop (30 min): *Uniformly Bounded Quasi-greedy systems*.
26. Mar. 2007. Washington University in St. Louis, Wavelet seminar (50 min): *Greedy bases*.
27. Nov. 2007. University of Zagreb, Colloquium (50 min): *Sparse Representation of Data*.
28. April 2010. IRISA/INRIA, Rennes, Seminar (50 min): *Decomposition of Smoothness Spaces*.

Teaching Experience

- Fall 1999 *Vector calculus* (Univ. South Carolina, 35 students)
- Fall 2000 *Elementary differential equations* (Univ. South Carolina, 37 students)
- Spring 2001 *Elementary differential equations* (Univ. South Carolina, 34 students)
- Fall 2002 *Calculus and differential equations* (Aalborg University, 130 students)
- Spring 2003 *Linear Algebra* (Aalborg University, 130 students)
Gabor analysis (Aalborg University, 10 students)
- Fall 2003 *Calculus and differential equations* (Aalborg University, 132 students)
- Spring 2004 *Linear Algebra* (Aalborg University, 132 students)
Time-frequency analysis with dictionaries (Aalborg University, 14 students)
- Fall 2004 *Modern mathematical analysis* (Aalborg University, 40 students)
- Spring 2005 *Introduction to functional analysis* (Aalborg University, 6 students)
- Fall 2005 *Advanced calculus* (Aalborg University, 19 students)
Modern mathematical analysis (Aalborg University, 24 students)
Introduction to generalized functions (Aalborg University, 3 students)
- Spring 2007 *Elementary differential equations* (Washington University in St. Louis, 9 students)
Calculus II (Washington University in St. Louis, 14 students)
- Fall 2007 *Calculus* (Aalborg University, 125 students)
- Spring 2008 *Linear Algebra* (Aalborg University, 125 students)
- Fall 2008 *Calculus* (Aalborg University, 128 students)
- Spring 2009 *Linear Algebra* (Aalborg University, 120 students)
- Fall 2009 *Calculus* (Aalborg University, 110 students)
Advanced Graduate Math. for Engineering Students (Aalborg University, 40 students)
- Spring 2010 *Linear Algebra* (Aalborg University, 110 students)

Ph.D. students

- Kenneth Niemann Rasmussen, Feb. 2008–Feb. 2012 (expected).
- Chr. Robert Jacobsen, Jan. 2009–2012 (expected)

Ph.D. committees

- PhD reading committee: Lorenzo Granai (EPFL, Switzerland, Nov. 2005).

Graduate Students Directed

- Henry Bertelsen, M.Sc., June 2006, Aalborg University
- Hanne Lyngby Laursen, M.Sc., June 2006, Aalborg University
- Kenneth Niemann Rasmussen, M.Sc., June 2006, Aalborg University
- Helene Pilgaard Larsen, M.Sc., June 2006, Aalborg University
- Linda Østervig Jensen, M.Sc., June 2006, Aalborg University.
- Anders G. Aaen, M.Sc., June 2009, Aalborg University.

Administrative experience

- Manager of the workpackage “Application of Wavelet (Packet) Techniques to Feature Identification in Signals” under the WAVES project co-sponsored by the Danish Technical Research Council, June 2003–July 2005.
- Main organizer of the international workshops on wavelets and their generalizations, August 2002 and August 2003 at Aalborg University.
- Guest editor, EURASIP Signal Processing Journal, Volume 86, Issue 3, Pages 415-638 (March 2006), special issue on “Sparse Approximations in Signal and Image Processing.”

External Grants

- Grant #9701481: “Application of Wavelet (Packet) Techniques to Feature Identification in Signals”. Workpackage under the WAVES project co-sponsored by the Danish Technical Research Council. Aug. 2002-Aug. 2005.
- Grant: “Partial Differential Equations - Analysis, Modelling, and Applications” sponsored by the Danish Science Foundation. Jan. 2003-Jan. 2006.
- Danish Research Council’s special grant for graduate studies abroad, 1996-1999.

Professional Affiliations

- American Mathematical Society
- European Mathematical Society
- Danish Mathematical Society

Other activities

- Reviewer for Mathematical Reviews (30+ reviews)
- Referee for:
 - Appl. Comput. Harm. Anal.
 - Constr. Approx.
 - J. Approx. Theory
 - J. Fourier Anal. Appl.
 - J. Math. Anal. Appl.
 - East J. Approx.
 - EURASIP Signal Processing Journal
 - Glasnik matematicki
 - IEEE Trans. Inform. Th.
 - Int. J. Wavelets Multiresolut. Inf. Process.