

Curriculum Vitae

Jakob Lemvig

Contact Information

Jakob Lemvig, Ph.D.
Department of Applied Mathematics and Computer Science
Technical University of Denmark
Matematiktorvet 303
2800 Kgs. Lyngby

Mobile: (+45) 61 77 60 51
Telephone: (+45) 45 25 30 65
E-mail: jakle@dtu.dk, jlemvig@gmail.com
Webpages: <http://www.hata.compute.dtu.dk>
<http://www.compute.dtu.dk/people/J.Lemvig/>
Born October 15, 1979, in Virum, Denmark
Country of citizenship: Denmark
Married with two children



Education

- 11/2008 Ph.D. degree from DTU Mathematics. Thesis title: Wavelet Frames and Their Duals.
- 08/2005 – 08/2008 Ph.D. student at DTU Mathematics. Supervisor: Ole Christensen.
- 09/1999 – 04/2005 Master of Science of Engineering in Applied Mathematics degree from DTU.

Employment

- 06/2016 – present Associate Professor at DTU Compute.
- 08/2012 – 05/2016 Assistant Professor at DTU Compute.
- 09/2011 – 07/2012 Lecturer at DTU Mathematics.
- 05/2009 – 08/2011 Postdoc at the Institute of Mathematics at Universität Osnabrück (UOS).
- 09/2008 – 05/2009 Research Associate at DTU Mathematics.

Leave

- 03/2016 – 06/2016 13-week paternity leave with my son Karl (born August 15, 2015).
- 08/2017 – 11/2017 13-week paternity leave with my son Wille (born February 6, 2017).

Journal Publications

- 20 *Criteria for generalized translation-invariant frames*, *Studia Mathematica*, DOI: [10.4064/sm180302-30-12](https://doi.org/10.4064/sm180302-30-12), to appear in print (with Jordy van Velthoven).
- 19 *Gabor windows supported on $[-1, 1]$ and construction of compactly supported dual windows with optimal smoothness*, *Journal of Approximation Theory* 249 (2020), 105304 (with Kamilla Haahr Nielsen).
- 18 *System bandwidth and the existence of generalized shift-invariant frames*, *Journal of Functional Analysis* 276 (2019), 563–601 (with Hartmut Führ).
- 17 *On Wilson bases in $L^2(\mathbb{R}^d)$* , *SIAM Journal of Mathematical Analysis* 49 (2017), 3999–4023 (with Marcin Bownik, Mads S. Jakobsen, and Kasso Okoudjou).

- 16 *Wavelets for non-expanding dilations and the lattice counting estimate*, International Mathematics Research Notices **23** (2017), 7264–7291 (with Marcin Bownik).
- 15 *Explicit constructions and properties of generalized shift-invariant systems in $L^2(\mathbb{R})$* , Advances in Computational Mathematics **43** (2017), 443–472 (with Ole Christensen and Marzieh Hasannasab).
- 14 *On some Hermite series identities and their applications to Gabor analysis*, Monatshefte für Mathematik **182** (2017), 899–912.
- 13 *Counterexamples to the B-spline conjecture for Gabor frames*, Journal of Fourier Analysis and Applications **22** (2016), 1440–1451 (with Kamilla Haahr Nielsen).
- 12 *Density and duality theorems for regular Gabor frames*, Journal of Functional Analysis **270** (2016), 229–263 (with Mads S. Jakobsen).
- 11 *Co-compact Gabor systems on locally compact abelian groups*, Journal of Fourier Analysis and Applications **22** (2016), 36–70 (with Mads S. Jakobsen).
- 10 *Reproducing formulas for generalized translation invariant systems on locally compact abelian groups*, Transactions of the American Mathematical Society **368** (2016), 8447–8480 (with Mads S. Jakobsen).
- 09 *Prime tight frames*, Advances in Computational Mathematics **40** (2014), 315–334 (with C. Miller and K. A. Okoudjou).
- 08 *Sparse matrices in frame theory*, Computational Statistics **29** (2014), 547–568 (with F. Krahmer and G. Kutyniok).
- 07 *Sparsity and spectral properties of dual frames*, Linear Algebra and Application **439** (2013), 982–998, (with F. Krahmer and G. Kutyniok).
- 06 *Compactly supported shearlet frames and optimally sparse approximations of functions in $L^2(\mathbb{R}^3)$ with piecewise C^α singularities*, SIAM Journal of Mathematical Analysis, **44** (2012), 2962–3017, (with G. Kutyniok and W.-Q Lim).
- 05 *Oversampling of wavelet frames for real dilations*, Jour. London Math. Soc. **85** (2012), 765–788 (with M. Bownik).
- 04 *Constructing pairs of dual bandlimited frame wavelets in $L^2(\mathbb{R}^n)$* , Appl. Comput. Harmon. Anal. **32** (2012), 313–328.
- 03 *Affine and quasi-affine frames for rational dilations*, Trans. Amer. Math. Soc. **363** (2011), 1887–1924, (with M. Bownik).
- 02 *Constructing pairs of dual bandlimited framelets with desired time localization*, Adv. Comput. Math. **30** (2009), 231–247.
- 01 *The canonical and alternate duals of a wavelet frame*, Appl. Comput. Harmon. Anal. **23** (2007), 263–272, (with M. Bownik).

Refereed Conference Proceedings

- 08 *On the smoothness of dual windows for Gabor windows supported on $[-1, 1]$* , 13th International Conference on Sampling Theory and Applications (Bordeaux, France, 2019), IEEE Xplore, to appear (with Kamilla Haahr Nielsen).
- 07 *On Multivariate Wilson Bases*, 12th International Conference on Sampling Theory and Applications (Tallinn, Estonia, 2017), IEEE Xplore (with Marcin Bownik, Mads S. Jakobsen, and Kasso Okoudjou).

- 06 *Duality results for co-compact Gabor systems*, 11th International Conference on Sampling Theory and Applications (Washington D.C., USA, 2015), IEEE Xplore (2015) (with Mads S. Jakobsen).
- 05 *A characterization of tight and dual generalized translation invariant frames*, 11th International Conference on Sampling Theory and Applications (Washington D.C., USA, 2015), IEEE Xplore (2015) (with Mads S. Jakobsen).
- 04 *Spectral properties of dual frames*, 10th International Conference on Sampling Theory and Applications (Bremen, Germany, 2013), 493-496, Eurasip, 2013 (with F. Kraher and G. Kutyniok).
- 03 *Compactly Supported Shearlets*, Approximation Theory XIII: San Antonio 2010, Springer Proc. Math., 2012, Volume 13, 163–186, (with G. Kutyniok and W.-Q Lim).
- 02 *Optimally Sparse Approximations of Multivariate Functions Using Compactly Supported Shearlet Frames*, 9th International Conference on Sampling Theory and Applications (Singapore, 2011), Springer, 2011 (with G. Kutyniok and W.-Q Lim).
- 01 *Natural stone panels for building facades. Loss of strength caused by temperature cycles*, Proceedings of the 6th Symposium on Building Physics in the Nordic Countries, Trondheim, Norway, 2002 (first author, with J. Rasmussen, J.F. Jensen, M.J. Olsson, J.P. Schultz, K.K. Hansen, B. Grell)

Other Publications (Book Chapters, etc.)

- 01 *Shearlets and Optimally Sparse Approximations*, book chapter in *Shearlets: Multiscale Analysis for Multivariate Data*, edited by D. Labate and G. Kutyniok, Springer, 2012 (with G. Kutyniok and W.-Q Lim).

Submitted

- 2019 *A remark on dilation-and-modulation frames for $L^2(\mathbb{R}_+)$* . [arXiv:1912.01416](https://arxiv.org/abs/1912.01416).

Ph.D. students

- 08/2016 – 11/2019 Kamilla Haahr Nielsen (main supervisor).
- 12/2015 – 12/2018 Marzieh Hasannasab (co-supervisor).
- 10/2013 – 10/2016 Mads Sielemann Jakobsen (co-supervisor).

Grants and Nominations

- 06/2015 Awarded grant of DKK 2.7 million from the Danish Council for Independent Research as co-PI with Ole Christensen (PI).
- 05/2014 Nominated “Lecturer of the year” at the Technical University of Denmark
- 12/2013 Awarded grant of DKK 40.000 from *Carlsbergfondet*
- 10/2013 Awarded grant of DKK 24.000 from *Engineering science and G.A. Hagemann’s memorial fund*
- 05/2012 Nominated “Lecturer of the year” at the Technical University of Denmark

Collaborators

Marcin Bownik (Uni. of Oregon), Ole Christensen, Kamilla H. Nielsen (DTU Compute), Jürgen Friel (OTH Regensburg), Hartmut Führ (Uni. Aachen), Marzieh Hasannasab (Uni. Kaiserslautern), Mads S. Jakobsen (Weibel), Emily King (Colorado State), Felix Kraher (TU Munich), Gitta Kutyniok (TU Berlin), Wang-Q Lim (Fraunhofer Institute for Telecommunications), Christopher Miller, Kasso Okoudjou (Uni. of Maryland), Jordy van Velthoven (Uni. Wien), Felix Voigtländer (Katholische Universität Eichstätt-Ingolstadt).

Refereeing Work

Advances in Computational Mathematics, Annales mathématiques du Québec, AIMS Mathematics, Applied and Computational Harmonic Analysis, Applied Sciences, British Journal of Mathematics & Computer Science, Contemporary Mathematics, Indagationes Mathematicae, Digital Signal Processing, International Journal of Wavelets, Multiresolution and Information Processing, Journal of Approximation Theory, Journal of Complex Analysis, Journal of Fourier Analysis and Applications, Journal of Inequalities and Applications, Journal of Mathematical Imaging and Vision, Journal of Physics A, Linear and Multilinear Algebra, Mathematical Methods in the Applied Sciences, Monatshefte für Mathematik, Numerical Functional Analysis and Optimization, Optica Applicata, Results in Mathematics, Science China Mathematics, SIAM Journal on Mathematical Analysis, SIAM Undergraduate Research Online.

Invited Talks

- 11/2019 Colloquium talk at the Department of Mathematics at Katholische Universität Eichstätt-Ingolstadt, June 12, 2019.
- 04/2019 Plenary speaker at *Workshop on Mathematical Signal and Image Analysis*, April 1–3, 2019, TU Munich, Raitenhaslach, Germany.
- 07/2018 Invited talk in the minisymposium Infinite Dimension Systems and Wavelets at the *International Workshop on Operator Theory and Applications (IWOTA) 2018*, East China Normal University, Shanghai, China
- 05/2018 Invited talk “Criteria for Generalized Translation-Invariant frames” at the *7th International Conference on Computational Harmonic Analysis (ICCHA7)*, Vanderbilt University, Nashville, USA
- 03/2018 Invited talk “System bandwidth and the existence of generalized shift-invariant frames” at the *Workshop on Mathematical Challenges of Structured Function Systems*, ESI, Vienna, Austria
- 07/2017 Invited talk “On Wilson bases in $L^2(\mathbb{R}^d)$ ” at the *12th International Conference on Sampling Theory and Applications*, Tallinn, Estonia.
- 09/2016 Invited talk “Counterexamples to the Gabor Frame Set Conjecture for Hermite functions” at the 4th Dolomite Workshop on Constructive Approximation and Applications, September 8-13, 2016, Alba di Canazei, Italy.
- 07/2016 Invited talk “Counterexamples to the B-spline conjecture for Gabor frames” at the International Workshop on Operator Theory and Applications 2016, July 18-22, 2016, Washington University in St. Louis, U.S.A.
- 06/2015 Invited talk “Reproducing formulas for generalized translation invariant systems” at the workshop Mathematical and Statistical Analysis of Spatial Data, Aalborg University.
- 05/2014 Invited talk “Oversampling of wavelet frames with real dilations” at the 5th International Conference on Computational Harmonic Analysis at Vanderbilt University, USA.
- 05/2014 Seminar talk “Characterizing equations for generalized translation invariant systems on LCA groups” in the Department of Mathematics, University of Oregon, USA.
- 03/2014 Seminar talk “Reproducing formulas for generalized translation invariant systems on locally compact abelian groups” in the Norbert Wiener Center seminar series in the Department of Mathematics at University of Maryland, USA.

- 06/2013 Seminar talk “Spectral properties of dual frames” in the Department of Mathematics at TU Berlin, Germany.
- 12/2012 Talk “Sparse dual frames” at the MATHEON workshop *Sparse Representation of Functions: Analytic and Computational Aspects*, December 10–14, 2012, TU Berlin, Germany.
- 11/2012 Colloquium talk “Affine frames, quasi-affine frames, and oversampling” in the Department of Applied and Numerical Mathematics at Universität Göttingen, Germany.
- 10/2012 Seminar talk “Sparsity and spectral properties of dual finite frames” in the Department of Mathematics, University of Oregon, U.S.A.
- 04/2012 Invited talk “Shearlet frames and sparse approximations” in the Department of Mathematics at the Technical University of Denmark.
- 01/2012 Seminar talk “Shearlet frames and optimally sparse approximations” in the analysis seminar of Department of Mathematics at University of Missouri, USA.
- 01/2012 Seminar talk “Duals of finite frames” in the Department of Mathematics at Uni. of Missouri, USA.
- 12/2011 Colloquium talk “Shearlet frames and optimally sparse approximations” for AG Modellierung, Numerik, Differentialgleichungen in the Department of Mathematics at Technische Universität Berlin, Germany.
- 12/2011 Seminar talk “Sparse dual frames and other structured duals” in the Department of Mathematics at TU Berlin, Germany.
- 08/2011 Talk “Sparse dual frames” at the ILAS conference *Pure and Applied Linear Algebra: The new Generation*, TU Braunschweig, Germany.
- 05/2011 Talk “Optimally sparse approximations of multivariate functions using compactly supported shearlet frames” at the conference *International Conference on Sampling Theory and Applications*, Nanyang Technological University, Singapore.
- 10/2010 Talk “Optimally sparse approximations of functions in $L^2(\mathbb{R}^3)$ with C^α singularities using shearlets” at the *Workshop on Shearlets*, Mathematisches Forschungsinstitut Oberwolfach, Germany.
- 05/2010 Seminar talk “Construction and sparsity of 3D shearlets”, Polska Akademia Nauk, Institute of Mathematics, Gdansk, Poland.
- 04/2010 Seminar talk “Construction of three-dimensional compactly supported shearlets” in the Institute of Mathematics at Universität Osnabrück, Germany.
- 11/2009 Seminar talk “Resolution of wavefront sets using shearlets” in the Institute of Mathematics at Universität Osnabrück, Germany.
- 11/2008 Seminar talk “Affine and quasi-affine frames for rational dilations” in the Institute of Mathematics at Universität Osnabrück, Germany.
- 07/2008 Seminar talk “Wavelet frames and their duals” in the Department of Mathematics, Jacobs University Bremen, Germany.
- 11/2007 Seminar talk “Constructing pairs of dual bandlimited framelets with desired time localization” in the Department of Mathematics, University of Oregon, USA.
- 05/2006 Seminar talk “The canonical and alternate duals of a wavelet frame” in the Department of Mathematics, University of Oregon, USA.

Selected Talks at Conferences

- 09/2015 Conference *Annual meeting of the Deutschen Mathematiker-Vereinigung (DMV)*, September 21–25, 2015, Hamburg University, Germany. **Talk:** "On the frame set conjecture for B-splines in Gabor analysis".
- 09/2015 Conference *Annual meeting of the Deutschen Mathematiker-Vereinigung (DMV)*, September 21–25, 2015, Hamburg University, Germany. **Talk:** "Wavelets for non-expanding dilations and the lattice counting estimate".
- 05/2015 Conference *International Conference on Sampling Theory and Applications*, June 25–29, 2015, American University, Washington D.C., U.S.A. **Talk:** "Duality and density results in Gabor analysis".
- 11/2014 Workshop *ICERM Research Cluster – Computational Challenges in Sparse and Redundant Representations* Nov. 3–15, 2014, Brown University, U.S.A. **Talk:** "Reproducing formulas for generalized translation invariant systems".
- 06/2014 Conference *Strobl14: Modern Time-Frequency Analysis*, University of Vienna, June 2–6, 2014, Strobl, Austria. **Talk:** "Duality results for Gabor frames on LCA groups".
- 03/2014 Conference *Annual meeting of the Gesellschaft für Angewandte Mathematik und Mechanik (GAMM)*, March 10–14, 2014, Erlangen-Nürnberg, Germany. **Talk:** "Characterizing equations for generalized shift-invariant systems on LCA groups".
- 07/2013 Conference *International Conference on Sampling Theory and Applications*, July 1–5, 2013, Jacobs University, Bremen, Germany. **Talk:** "Spectral properties of dual frames".
- 04/2013 Conference *14th International Conference Approximation Theory*, April 7–10, 2013, San Antonio, USA. **Talk:** "Sparse approximations of piecewise C^β functions in $L^2(\mathbb{R}^3)$ with C^α singularities using shearlets".
- 06/2011 Conference *Strobl11: From Abstract to Computational Harmonic Analysis*, University of Vienna, June 13–19, 2011, Strobl, Austria. **Poster:** "Compactly supported shearlet frames and optimally sparse approximations of functions in $L^2(\mathbb{R}^3)$ ".
- 05/2011 Conference *International Symposium in Approximation Theory*, May 17–21, 2011, Nashville, TN, USA. **Talk:** "Shearlets and sparse approximations in $L^2(\mathbb{R}^3)$ ".
- 02/2011 Conference *Ruhr-Rhein Workshop 2011*, February 4–5, 2011, Königswinter, Germany. **Talk:** "Compactly supported shearlets in $L^2(\mathbb{R}^3)$ ".
- 06/2010 Conference *New Trends in Harmonic and Complex Analysis*, June 29 – July 3, 2010, Jacobs University, Bremen, Germany. **Talk:** "Optimally sparse approximations of 3D data using shearlets".
- 06/2010 Conference *NOKO 2010*, 31. Norddeutsches Kolloquium über Angewandte Analysis und Numerische Mathematik, June 11–12, 2010, University of Oldenburg, Germany. **Talk:** "Sparse approximations with compactly supported shearlets in 3D"
- 01/2008 *Meeting with the Industry*, Danish Center for Applied Mathematics and Mechanical Engineering, Department of Mechanics, Aalborg University, Denmark. **Talk:** "Wavelet frames in signal processing".
- 09/2007 Conference *New Trends and Directions in Harmonic Analysis, Approximation Theory, and Image Analysis*, September 17–21, 2007, Inzell, Germany. Centre of Mathematical Sciences, TU Munich. **Talk:** "The canonical and alternate dual of a wavelet frame".

Research Visits (one week or more)

05/2014	Prof. M. Bownik, University of Oregon, USA (3 weeks).
04/2014	Prof. K. Okoudjou, University of Maryland, USA (3 weeks).
06/2013	Prof. E. King, TU Berlin, Germany (1 week).
11/2012	Prof. F. Kraemer, Universität Göttingen, Germany (1 week).
10/2012	Prof. M. Bownik, University of Oregon, USA (2 weeks).
01/2012	Prof. P. Casazza, University of Missouri, USA (3 weeks).
12/2011	Prof. G. Kutyniok, TU Berlin, Germany (1 week).
01/2009	Prof. M. Bownik, University of Oregon, USA (2 weeks).
08/2008	Prof. M. Bownik, Polish Academy of Sciences in Gdansk , Poland (1 week).
10/2007 – 12/2007	Prof. M. Bownik, University of Oregon, USA.
03/2006 – 06/2006	Prof. M. Bownik, University of Oregon, USA.

Committee and Organizational Work, Services, and Other

2019–present	Head of Studies for the BSc programme <i>Mathematics and Technology</i> .
2018–present	Mentor for the BSc programme <i>Mathematics and Technology</i> .
04/2018	Member of committee for PhD defense (Aalborg University).
11/2016	Completed first module on PhD supervision from LearningLab DTU.
04/2016	Completed my pedagogical training <i>Education in University Teaching at DTU</i> at LearningLab DTU.
09/2015	Organized two-day symposium on <i>Applied and Comput. Harmonic Analysis</i> at the <i>Annual meeting for the Deutschen Mathematiker-Vereinigung</i> , Sept. 21–25, 2015, Hamburg, Germany.
2014	Co-founder of the reserach group <i>Harmonic Analysis – Theory and Applications</i> (HATA).
2014–2019	Mentor for the BSc programme <i>Strategic Analysis and Systems Design</i>
2014–2017	Served on the Assessment Committee of DTU Compute’s Strategic Foundation.
08/2013	Organized mini-workshop on <i>Applied harmonic analysis and tomography</i> at DTU Compute.
04/2013	Organized mini-symposium on <i>Anisotropic Function Spaces and Approximations</i> at the conference <i>14th International Conference Approximation Theory</i> , April 7–10, 2013, San Antonio, USA.

Popularizing Science Talks

02–05/2013	Course on linear algebra and wavelets: <i>Compression of digital images</i> for high school students at “Lyngby Tekniske Gymnasium”.
03/2013	High school class talk, Aurehøj Gymnasium. Title: “Data Compression using Wavelets”.
06/2011	Tag der Mathematik (Day of Mathematics), <i>Workshop with Matlab for high school students</i> . Title: “Wie komprimiert man ein digitales Bild?”

- 11/2010 HIT 2010 *High school Information Day at Universität Osnabrück*. Title: “Wie komprimiert man ein digitales Bild?”
- 06/2010 Tag der Mathematik, *Workshop with Matlab for high school students*. Title: “Wie komprimiert man ein digitales Bild?”
- 11/2009 HIT 2009, *High school Information Day at Universität Osnabrück*. Title: “Beyond JPEG: Wavelet image compressing”.
- 04/2009 High school class talk, Aurehøj Gymnasium. Title: “Data Compression with Wavelets”.

Teaching Experience

- 02/2017 – present DTU Course: 01325 Mathematics 4: Real analysis (Course responsible, lecturer & Instructor). 5 ECTS. Three semesters.
- 01/2013 – present DTU Course: 01036 Mathematical Methods in Structural Engineering (Course responsible, lecturer & Instructor). 5 ECTS. Seven semesters.
- 09/2016 – 12/2017 DTU Course: 01005 Advanced Engineering Mathematics 1 (Lecturer). 10 ECTS.
- 09/2012 – 01/2016 DTU Course: 01715 Functional Analysis (Course responsible, lecturer & Instructor). 5 ECTS. Four semesters.
- 09/2011 – 06/2012 DTU Course: 01005 Advanced Engineering Mathematics 1 (Lecturer & Instructor). 17.5 ECTS.
- 04/2011 – 08/2011 Uni. Osnabrück (UOS) Course: Frame Theory and Compressed Sensing (Seminar Course).
- 10/2010 – 02/2011 UOS Course: Linear Algebra (Recitation Session).
- 10/2010 – 02/2011 UOS Course: Signal and Image Processing (Recitation Session).
- 04/2010 – 08/2010 UOS Course: Numerical Analysis (Recitation Session).
- 04/2010 – 08/2010 UOS Course: Mathematical Methods in Image Processing (Seminar Course).
- 10/2009 – 02/2010 UOS Course: Real Analysis (Recitation Session)
- 09/2006 – 10/2007 DTU Course: 01456 Advanced Topics in Applied Functional Analysis: Wavelet Theory (Lecturer). Two semesters.
- 09/2005 – 05/2009 DTU Course: 01005 Advanced Engineering Mathematics 1 (Instructor). Three semesters.
- 08/2002 – 12/2004 DTU Course: 01246 Partial Differential Equations (Teaching Assistant). Three semesters.
- 01/2003 – 02/2004 DTU Course: 01257 Advanced Modelling (Teaching Assistant). Two semesters.
- 02/2002 – 05/2002 DTU Course: 01034 Mathematical Methods in Structural Engineering (Teaching Assistant).

Copenhagen, December 4, 2019