

# KARIN SCHNASS

## CURRICULUM VITAE

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### PERSONAL DETAILS

Address: Technikerstraße 13, 6020 Innsbruck, Austria  
Email: karin.schnass@uibk.ac.at  
Date of Birth: May 3, 1980  
Nationality: Austrian  
Homepage: <https://www.uibk.ac.at/mathematik/personal/schnass/index.html.en>

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### EDUCATION

March 2009 PhD in computer, communication and information sciences, Swiss Federal Institute of Technology Lausanne (EPFL), CH, no grades are awarded, the thesis was proposed for the EPFL PhD-thesis prize by the jury.  
Thesis: Sparsity & Dictionaries - Algorithms & Design,  
Advisor: Pierre Vanderghenst.

April 2004 Master in mathematics with distinction (mit Auszeichnung), University of Vienna, AT.  
Thesis: Gabor Multipliers - A Self-Contained Survey,  
Supervisor: Hans G. Feichtinger.

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### CURRENT AND FORMER POSITIONS (INCLUDING CAREER BREAKS)

since 07/20 Full professor, Department of Mathematics, University of Innsbruck, AT.

09/19 - 06/20 Associate professor, Department of Mathematics, University of Innsbruck, AT.

03/16 - 08/19 Tenure track assistant professor (Laufbahnstelle), Department of Mathematics, University of Innsbruck, AT. (part-time 80%, 03/16 - 12/18).

06/15 - 02/16 University assistant, Department of Mathematics, University of Innsbruck, AT.

12/14 - 05/15 Erwin Schrödinger Research Fellow (return phase), Department of Mathematics, University of Innsbruck, AT.

10/12 - 09/14 Erwin Schrödinger Research Fellow, Computer Vision Laboratory, University of Sassari, IT.

06/11 - 09/12 Maternity leave.

01/10 - 05/11 Postdoc, Johann Radon Institute for Computational and Applied Mathematics (RICAM), Linz, AT. (part-time 50% until 09/10 then 70%)

06/09 - 01/10 Maternity leave.

04/05 - 06/09 Research Assistant, Signal Processing Laboratory 2, Swiss Federal Institute of Technology Lausanne (EPFL), CH.

05/04 - 01/05 Leonardo da Vinci Industrial Internship at Philips Research, Eindhoven, NL.

10/03 - 01/04 Mathematics teaching assistant at the University of Vienna and the University of Natural Resources and Applied Life Sciences Vienna (BOKU), AT.

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### GRANTS

2014 START-programme, grant Y760, €1.167.000 for 6 years, FWF (Austrian Science Fund), project: *Optimisation Principles, Models & Algorithms for Dictionary Learning*.

2012 Erwin Schrödinger Fellowship, grant J3335, €120.000 for 2.5yrs, FWF (Austrian Science Fund) Marie Curie cofunded, project: *Dictionary Learning for Biometric Data*.

## HONOURS

2019 Shortlisted for a Professorship for Data Science at the University of Zurich, CH.  
 2015 Offer of (first-listed for) a Rudolf Mößbauer Tenure Track Professorship at the Technical University of Munich, DE, *declined*.  
 2014 Shortlisted for a tenure track W2-professor position in *Optimization and Data Analysis* at the Technical University of Munich, DE.  
 2013 Best Video Abstract at SPARS13.  
 2011 Offer of a postdoctoral position at Duke University, US, with Ingrid Daubechies, *declined*.  
 2010 Offer of a postdoctoral position at Stanford University, US, with Yonina Eldar and Andrea Goldsmith, *declined*.  
 2009 Nomination of the doctoral thesis for the EPFL PhD-thesis prize by the jury.

## TEACHING

WS21 Linear Algebra 1 (VO&PS), together with Tim Netzer, University of Innsbruck, AT.  
 SS20 Stochastics 1 (VO&PS), together with Ecaterina Sava-Huss, University of Innsbruck, AT.  
 SS19 Signal Processing & Learning (VU), together with M. Haltmeier, University of Innsbruck, AT.  
 WS18/19/20 Linear Algebra 1 (PS), University of Innsbruck, AT.  
 WS17 Stochastics 2 (PS), University of Innsbruck, AT.  
 WS16 Selected Statistical Methods (VU), together with T. Hell, University of Innsbruck, AT.  
 SS16 Time Frequency Analysis, Wavelets and Signal Processing (VU), together with M. Haltmeier, University of Innsbruck, AT.  
 WS15/SS17/18 Channel Coding (SE), University of Innsbruck, AT.  
 SS15 Randomness, matrices and random matrices (SE), University of Innsbruck, AT.  
 SS13 Informatica Grafica - Introduzione a Blender (PS), University of Sassari, IT.  
 WS06/07/08 Advanced Signal Processing (PS, English/French), EPFL, CH.  
 WS03 Lineare Algebra und Geometrie (Workshop), University of Vienna, AT.  
 WS03 Mathematik für Landwirte (PS), BOKU Vienna, AT.

## MENTORING

Elisabeth Schneckenreiter, PhD, University of Innsbruck, since 2020.  
 Simon Ruetz, PhD, University of Innsbruck, since 2019.  
 Marie-Christine Pali, PhD, University of Innsbruck, since 2017.  
 Flavio Teixeira, Postdoc, University of Innsbruck, 2016-2018.  
 Michael Sandbichler, PhD, University of Innsbruck, 2015-2018.

## COMMUNITY SERVICE

**Referee** for Information and Inference; Linear Algebra and its Applications; Applied and Computational Harmonic Analysis; Constructive Approximation; SIAM Journal on Imaging Sciences; SIAM Journal on Mathematics of Data Science; IEEE Transactions on Information Theory; IEEE Transactions on Signal Processing; IEEE Transactions on Computational Imaging; IEEE Signal Processing Letters; ICASSP; EUSIPCO; SampTA; SPARS; COLT;

**Technical Committees:** Technical Program Committee for *Signal Processing with Adaptive Sparse Structured Representations* (SPARS) workshop, Technical Area Committee *Signal and Data Analytics for Machine Learning* of the European Association for Signal Processing, 2015-2019.

**Public Outreach:** Organisation of the annual *Girls' Day* at the mathematics institute since 2017; annual participation in the high school programmes *Sommertechnikum MINT* and *VWA- und Diplomarbeitentag*<sup>1</sup> since 2017; lecturer in *Mathe auf Abruf - math on demand*, (homepage & pictures) with four workshops held since 2018.

**University Committees:** Hiring committees for professorships in Optimization (2020), Partial Differential Equations and Variational Methods (2020), Stochastics (2016), habilitation committees for Tijana Levačkovic (2020) and Martin Scheicher (2019) at University of Innsbruck, and doctoral thesis committees for Nicolas Keriven (2017) and Luc Le Magoarou (2016) at IRISA Rennes (FR).

**Workshop Organisation** *Workshop Donau-Isar-Inn (WDI2) - Approximation Theory and Applications* together with M. Sandbichler, March 10, 2017, Innsbruck, AT.

## PERSONAL PUBLICATIONS

all publications and - where applicable - toolboxes to reproduce numerical results are available at: <https://www.uibk.ac.at/mathematik/personal/schnass/publications.html.en>.

## Preprints

- S. Ruetz and K. Schnass, *Submatrices with non-uniformly selected random supports and insights into sparse approximation*, arXiv:2012.02082, 2020.
- K. Schnass, *Dictionary learning - from local towards global and adaptive*, arXiv:1804.07101, 49 pages, 2018.

## Journal publications

- K. Schnass and F. Teixeira, *Compressed dictionary learning*, Journal of Fourier Analysis and Applications 26, Art. Nr. 33, 2020.
- M. Sandbichler and K. Schnass, *Online and stable learning of analysis operators*, IEEE Transactions on Signal Processing, 67(1):41–53, 2019.
- K. Schnass, *Average performance of Orthogonal Matching Pursuit (OMP) for sparse approximation*, IEEE Signal Processing Letters, 25(12):1865–1869, 2018.
- K. Schnass, *Convergence radius and sample complexity of ITKM algorithms for dictionary learning*, Applied and Computational Harmonic Analysis, 45(1):22–58, 2018.
- V. Naumova and K. Schnass, *Fast dictionary learning from incomplete data*, EURASIP Journal on Advances in Signal Processing, 2018(12), 21 pages, 2018.
- K. Schnass, *Local identification of overcomplete dictionaries*, Journal of Machine Learning Research, 16(Jun):1211–1242, 2015.
- K. Schnass, *On the identifiability of overcomplete dictionaries via the minimisation principle underlying K-SVD*, Applied and Computational Harmonic Analysis, 37(3):464–491, 2014.
- M. Fornasier, K. Schnass and J. Vybiral, *Learning functions of few arbitrary linear parameters in high dimensions*, Foundations of Computational Mathematics, 12(2):229–262, 2012.
- R. Gribonval and K. Schnass, *Dictionary identification - sparse matrix-factorisation via  $\ell_1$ -minimisation*, IEEE Transactions on Information Theory, 56(7):3523–3539, 2010.
- R. Gribonval, H. Rauhut, K. Schnass and P. Vandergheynst, *Atoms of all channels, unite! Average case analysis of multi-channel sparse recovery using greedy algorithms*, Journal of Fourier Analysis and Applications, 14(5):655–687, 2008.
- H. Rauhut, K. Schnass and P. Vandergheynst, *Compressed sensing and redundant dictionaries*, IEEE Transactions on Information Theory, 54(5):2210–2219, 2008.

<sup>1</sup>The feedback from the *VWA- und Diplomarbeitentag* 2017 was overwhelmingly positive. The workshop with relatively dry topic *channel coding* received as many positive mentions as *gaming* and *free food*.

- K. Schnass and P. Vandergheynst, *Dictionary preconditioning for greedy algorithms* IEEE Transactions on Signal Processing, 56(5):1994–2002, 2008.
- K. Schnass and P. Vandergheynst, *Average performance analysis for thresholding*, IEEE Signal Processing Letters, 14(11):828–831, 2007.

### Refereed conference proceedings - full papers only

- V. Naumova and K. Schnass, *Dictionary learning from incomplete data for efficient image restoration*, EUSIPCO17, Kos island, GR, 2017.
- K. Schnass, *Dictionary identification results for  $K$ -SVD with sparsity parameter 1*, SampTA13, Bremen, DE, 2013.
- M. Fornasier, K. Schnass and J. Vybiral, *Learning functions of few arbitrary linear parameters in high dimensions*, SampTA11, Singapore, 2011.
- K. Schnass and J. Vybiral, *Compressed learning of high-dimensional sparse functions*, ICASSP11, Prague, CZ, 2011.
- K. Schnass and P. Vandergheynst, *A union of incoherent spaces model for classification*, ICASSP10, Dallas, US, 2010.
- R. Gribonval and K. Schnass, *Basis identification from random sparse samples*, SPARS09, St. Malo, FR, 2009.
- R. Gribonval and K. Schnass, *Dictionary identifiability from few training samples*, EUSIPCO08, Lausanne, CH, 2008.
- R. Gribonval and K. Schnass, *Some recovery conditions for basis learning by  $\ell_1$ -minimization*, ISCCSP08, St. Julian's, Malta, 2008.
- K. Schnass and P. Vandergheynst, *Dictionary learning based dimensionality reduction for classification*, ISCCSP08, St. Julian's, Malta, 2008.
- R. Gribonval, B. Mailhe, H. Rauhut, K. Schnass and P. Vandergheynst, *Multichannel thresholding with sensing dictionaries* (with ), CAMSAP07, St. Thomas, US Virgin Islands, 2007.
- R. Gribonval, B. Mailhe, H. Rauhut, K. Schnass and P. Vandergheynst, *Average case analysis of multichannel sparse approximations using  $p$ -thresholding*, SPIE Optics and Photonics, Wavelets XII, San Diego, US, 2007.
- R. Gribonval, B. Mailhe, H. Rauhut, K. Schnass and P. Vandergheynst, *Average case analysis of multichannel thresholding*, ICASSP07, Honolulu, US, 2007.

### Theses

- K. Schnass, *Dictionary learning & related topics*, habilitation thesis (venia docendi), University of Innsbruck, 2019.
- K. Schnass, *Sparsity & Dictionaries - Algorithms & Design*, PhD-Thesis, n. 4349, Swiss Federal Institute of Technology Lausanne (EPFL), 2009.
- K. Schnass, *Gabor Multipliers - A Self-Contained Survey*, Master's Thesis, University of Vienna, Austria, 2004.

### Other

- K. Schnass, *A personal introduction to theoretical dictionary learning*, Internationale Mathematische Nachrichten, 228:5–15, 2015.

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### CONFERENCES, WORKSHOPS AND TALKS

Invited talks are listed with a  $\star$ , keynote/plenary talks and lectures at season schools with a  $\blacklozenge$ . Workshops/conferences without a presentation are only listed if participation is by personal invitation.

$\blacklozenge$  *iTWIST20*, December 2-4, 2020, Nantes (virtual), FR.

$\star$  *Machine Learning Seminar*, LCSL - University of Genova, February 11, 2020, Genova, IT.

- ✪ *Chemnitz Summer School on Applied Analysis*, September 23-27, 2019, Chemnitz, DE.
- *SPARS 2019 - Signal Processing with Adaptive Sparse Structured Representations*, July 1-4, 2019, Toulouse, FR.
- ★ *OSA Imaging and Applied Optics Congress*, June 24-27, 2019, Munich, DE.
- *Oberwolfach Workshop - Statistical and Computational Aspects of Learning with Complex Structure*, March 5-11, 2019, Oberwolfach, DE.
- ✪ *Workshop on Signal and Image Analysis*, April 1-3, 2019, Raitenhaslach, DE.
- ★ *Strobl18 - Harmonic Analysis and Applications*, June 4-8, 2018, Strobl, AT.
- ★ *Oberwolfach Workshop - Applied Harmonic Analysis and Data Processing*, March 25-31, 2018, Oberwolfach, DE.
- ✪ *SpaRTaN-MacSeNet Workshop on Sparse Representations and Compressed Sensing*, March 23, 2018, Paris, FR.
- ★ *Foundations of Computational Mathematics (FoCM)*, July 10-19, 2017, Barcelona, ES.
- *SPARS17 - Signal Processing with Adaptive Sparse Structured Representations*, June 5-8, 2017, Lisbon, PT.
- ★ *Dagstuhl Seminar - Foundations of Unsupervised Learning*, September 18-23, 2016, Wadern, DE.
- ✪ *iTWIST16*, August 24-26, 2016, Aalborg, DK.
- ★ *Workshop on Low Complexity Models* within the Hausdorff Institute Trimester Program: Mathematics of Signal Processing, February 15-24, 2016, Bonn, DE.
- ★ *Seminar*, Acoustic Research Institut, OEAW, February 11, 2016, Vienna, AT.
- ★ *Matheon Conference on Compressed Sensing and its Applications*, December 7-11, 2015, Berlin, DE.
- ★ *Dagstuhl Seminar - Mathematical and Computational Foundations of Learning Theory*, August 16-22, 2015, Wadern, DE.
- ★ *Oberwolfach Workshop - Applied Harmonic Analysis and Sparse Approximation*, August 30 - September 4, 2015, Oberwolfach, DE.
- *SPARS15 - Signal Processing with Adaptive Sparse Structured Representations*, July 6-9, 2015, Cambridge, UK.
- ★ *AIP15 - Applied Inverse Problems Conference*, May 25-29, 2015, Helsinki, FI.
- ★ *Seminar*, Team Panama, INRIA Rennes, July 7, 2014, Rennes, FR.
- ★ *Seminar*, Chair of Mathematics C, RWTH Aachen, May 5, 2014, Aachen, DE.
- ★ *Telecommunications Forum*, Telecommunications Research Center Vienna (FTW)/ Vienna University of Technology, April 25, 2014, Vienna, AT.
- *Matheon Conference on Compressed Sensing and its Applications*, December 9-13, 2013, Berlin, DE, **Young Researcher Travel Grant**.
- ★ *ENUMATH13 - European Conference on Numerical Mathematics and Advanced Applications*, August 26-30, 2013, Lausanne, CH.
- ★ *Seminar*, Institute of Telecommunications, Vienna University of Technology, August 21, 2013, Vienna, AT.
- *SPARS13 - Signal Processing with Adaptive Sparse Structured Representations*, July 8-11, 2013, Lausanne, CH, **Best Video Abstract**.
- ★ *SampTA13 - International Conference on Sampling Theory and Applications*, July 1-5, 2013, Bremen, DE.
- *Oberwolfach Workshop - Applied Harmonic Analysis and Sparse Approximation*, June 10-16, 2012, Oberwolfach, DE, **Young Researcher Travel Grant**.
- *ICASSP11 - International Conference on Acoustics, Speech, and Signal Processing*, May 23-27, 2011, Prague, CZ.
- ★ *SMALL Workshop on Dictionary Learning*, January 6-7, 2011, London, GB.
- ★ *Oberseminar Numerische Mathematik*, University of Jena, November 17, 2010, Jena, DE.
- ★ *Curves and Surfaces*, June 24-30, 2010, Avignon, FR.
- ★ *Workshop - Sparsity and Computation*, Hausdorff Center for Mathematics, June 7-11, 2010, Bonn, DE.

- ★ *NuHAG Seminar*, University of Vienna, May 5, 2010, Vienna, AT.
  - ★ *Seminar*, Acoustic Research Institute, May 4, 2010, Vienna, AT.
  - *SPARS09 - Signal Processing with Adaptive Sparse Structured Representations*, April 6-9, 2009, Saint-Malo, FR.
  - ★ *NuHAG Seminar*, University of Vienna, October 30, 2008, Vienna, AT.
  - *AIM Workshop - Frames for the Finite World: Sampling, Coding and Quantization*, August 18-22, 2008, Palo Alto (CA), US, **Travel Grant**.
  - *ISCCSP08*, March 12-14, 2008, St. Julian's, MT.
  - ★ *Von Neumann Symposium on Sparse Representation and High-Dimensional Geometry*, July 8-12, 2007, Snowbird (UT), US.
  - *Strobl07 - Trends in Harmonic Analysis*, June 18-22, 2007, Strobl, AT.
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## LANGUAGES

German, English, Italian and intermediate French.