Jan Vybíral

Curriculum Vitae

Personal data:

Born: September 2, 1979 in Hranice, Czechoslovakia

Address: Department of Mathematics
Faculty of Nuclear Sciences and Physical Engineering
Czech Technical University
Trojanova 13
12000 Praha
Czech Republic

Phone: +420 778 546 165

WWW: `https://kmlinux.fjfi.cvut.cz/~vybirja2/`

Email: `jan.vybiral(here comes the AT sign)fjfi.cvut.cz`

Citizenship: Czech Republic

Education:

2024: Full professor, Czech Technical University in Prague, Czech Republic

2011: Habilitation at Friedrich-Schiller University Jena, Germany
Academic degree: Dr. rer. nat. habil.
Habilitation thesis: *Decomposition methods and their applications in the theory of function spaces*
Lehrprobe: *Zufällige Matrizen: Lemma von Johnson und Lindenstrauss*

2005: Graduated at Friedrich-Schiller University, Jena, Germany
Academic degree: Dr. rer. nat., *summa cum laude*
Dissertation: *Function spaces with dominating mixed smoothness*
Supervisors: Prof. Hans-Jürgen Schmeisser and Prof. Winfried Sickel

2002: Graduated at the Charles University, Prague, Czech Republic
Academic degree: Mgr.
Diploma thesis: *Optimality of function spaces for boundedness of integral operators and Sobolev embeddings*
Supervisor: Prof. Luboš Pick.

Professional experience:

July 2024 – now: Full Professor, Department of Mathematics
Faculty of Nuclear Sciences and Physical Engineering

	Czech Technical University, Prague
April – September 2022:	Guest Professor, Fakultät für Mathematik Technische Universität München, Garching, Germany
October 2017 – July 2024:	Associate Professor, Department of Mathematics Faculty of Nuclear Sciences and Physical Engineering Czech Technical University, Prague
January 2017 – September 2017:	Associate Professor, Department of Mathematical Analysis Faculty of Mathematics and Physics, Charles University, Prague
July 2014 – December 2016:	Research Assistant, Department of Mathematical Analysis Faculty of Mathematics and Physics, Charles University, Prague
April 2012 – June 2014:	*Leader of the Young Research Group "Applied Functional Analysis"*, MATHEON, TU Berlin, Germany.
October 2009 – March 2012:	Research Assistant, RICAM, Linz, Austria in the FWF Start Project *Sparse Approximation and Optimization in High Dimensions* supervised by Prof. Massimo Fornasier.
April 2006 – September 2009:	Research Assistant, Friedrich–Schiller University, Jena Supervisor: Prof. Erich Novak.
October 2005 – March 2006:	Research Assistant in the project DFG Hi 584/2-2 Supervisor: Prof. Aicke Hinrichs.

Awards:

2019	*Joseph F. Traub Prize for Achievement in Information-Based Complexity*
2017–	Three *"Best Teacher's awards"* of the Dean of the Faculty of Nuclear Sciences and Physical Engineering, Czech Technical University
2015–17	Four *"Best Teacher's awards"* of the Dean of the Faculty of Mathematics and Physics, Charles University
2015	*Research grant of the private Neuron Foundation.*
2013	*Travel grant of Institute for Pure and Applied Mathematics (IPAM), UCLA.*
2013	*Elected into Postdoctoral Faculty of Berlin Mathematical School.*
2008	*Information-Based Complexity Young Researcher Award.*
2005	*Promotionspreis* of the Friedrich-Schiller University.

Grants and third-party funding:

Investigator:
January 2023 – now: P202/23/04720S of the Grant Agency of the Czech Republic, co-investigator, principal investigator: Prof. Luboš Pick
January 2016 – December 2018: Neuron research grant: Reconstruction of structured data – theory and applications
November 2012 – June 2015: Project of the DFG Research Center MATHEON: *A23: Tractable recovery of multivariate functions from limited number of samples*
2013: DFG-Conference Support for MATHEON Workshop "Compressed Sensing and its Applications", December 2013, Berlin

Member of the team:
March 2020 – December 2021: Time-Frequency Representations for Function Spaces (TIFREFUS – multilateral project)

January 2018 – June 2021: P201/18/00580S of the Grant Agency of the Czech Republic, Prof. Luboš Pick
January 2017 – December 2018: Time-Frequency Analysis, Methods for Operators and Function Spaces (TIFMOFUS – multilateral project)
July 2014 – August 2017: ERC CZ LL1203 of the Czech Ministry of Education, Prof. Stanislav Hencl
October 2009 – March 2012: FWF Start Project *Sparse Approximation and Optimization in High Dimensions*, Prof. Massimo Fornasier
October 2005 – March 2006: DFG Hi 584/2-2 of Prof. Aicke Hinrichs

Students:

Anton Komaristyi - Bachelor, 10/2023 – 9/2024, Czech Technical University, Prague
Matěj Trödler - Master, 10/2023 – now, Czech Technical University, Prague
Matěj Trödler - Bachelor, 10/2022 – 9/2023, Czech Technical University, Prague
Daniel Khol - Bachelor, 10/2020 – 9/2022, Czech Technical University, Prague
Adam Šumník - Master, 10/2021 – now, Czech Technical University, Prague
Adam Šumník - Bachelor, 10/2020 – 09/2021, Czech Technical University, Prague
Jan Trödler - Master, 10/2020 – 06/2022, Czech Technical University, Prague
Jiří Chmel - Master, 09/2019 – 06/2022, Czech Technical University, Prague
Jan Trödler - Bachelor, 09/2019 – 09/2020, Czech Technical University, Prague
Anna Doležalová - Master, 09/2018 – 09/2019, Charles University, Prague
Marta Kossaczká - Master, 09/2016 – 08/2016, Charles University, Prague
Marta Kossaczká - Bachelor, 01/2016 – 09/2016, Charles University, Prague
Ekkehard Schnoor - Master, 09/2015 – 06/2016 (jointly with Prof. Dr. Gitta Kutyniok, TU Berlin)
Anton Kolleck - PhD, 01/2013 – 03/2017 (since 2015 jointly with Prof. Dr. Gitta Kutyniok, TU Berlin)

Publications:

Research profiles:
Google Scholar: `http://scholar.google.com/citations?user=tYNedUYAAAAJ&hl=en`
ResearcherID: `http://www.researcherid.com/rid/L-6190-2014`
MathSciNet: `https://mathscinet.ams.org/mathscinet/author?authorId=786842`

Theses:

4. *Decomposition methods and their applications in the theory of function spaces*, Habilitation Thesis, Friedrich-Schiller University, Jena, 2011.
3. *Fine properties of Sobolev embeddings*, Dissertation, 2008, Prague, (cf. the papers [2,4,6,7,8])
2. *Function Spaces with Dominating Mixed Smoothness*, Dissertation, 2005, Jena (cf. the paper [1])
1. *Optimality of Function Spaces for Boundedness of Integral Operators and Sobolev Embeddings*, Diploma Thesis, 2002, Prague.

Book chapters:

1. with H. Boche, R. Calderbank, and G. Kutyniok, *A Survey of Compressed Sensing*, First chapter in Compressed Sensing and its Applications, Birkhäuser, Springer, 2015

Refereed journal papers:

58. with J. Prochno and M. Sonnleitner, *Entropy numbers of finite-dimensional Lorentz space embeddings*, submitted
57. with J. Haškovec, *Robust network formation with biological applications*, Networks and Heterogeneous Media 19(2) (2024), 771–799
56. with M. Trödler and J. Volec, *A tight lower bound on the minimal dispersion*, Eur. J. Combin. 120 (2024), 103945
55. with C. Schneider, *Multivariate Riesz basis of ReLU neural networks*, Appl. Comput. Harmonic Anal. 68 (2024), 1016054
54. with D. Krieg, *New lower bounds for the integration of periodic functions*, J. Fourier Anal. Appl. 29, 41 (2023)
53. with H. Kempka and C. Schneider, *Path regularity of Brownian motion and Brownian sheet*, Constr. Appr. 59 (2024), 485–539
52. with A. Hinrichs, D. Krieg, and E. Novak, *Lower bounds for integration and recovery in L_2*, J. Compl (72), October 2022, 101662
51. with A. Hinrichs and J. Prochno, *Gelfand numbers of embeddings of Schatten classes*, Math. Ann. 380 (2021), 1563–1593
50. with A. Hinrichs, D. Krieg, and E. Novak, *Lower bounds for the error of quadrature formulas for Hilbert spaces*, J. Compl. (65), August 2021, 101544
49. *A variant of Schur's product theorem and its applications*, Adv. Math. 368 (2020), 107140
48. with A. Doležalová, *On the volume of unit balls of finite-dimensional Lorentz spaces*, J. Appr. Theory 255 (2020), 105407
47. with M. Ullrich, *Deterministic constructions of high-dimensional sets with small dispersion*, Algorithmica 84 (2022), 1897–1915
46. with A. Hinrichs, J. Prochno, and M. Ullrich, *The minimal k-dispersion of point sets in high-dimensions*, J. Compl. 51 (2019), 68–78
45. with M. Fornasier and I. Daubechies, *Robust and resource efficient identification of shallow neural networks by fewest samples*, Information and Inference: A journal of IMA, 10(2), June 2021, 625–695
44. with M. Kossaczká, *Entropy numbers of finite-dimensional embeddings*, Expositiones Mathematicae 38(3) (2020), 319–336
43. with H. Tyagi, *Learning non-smooth sparse additive models from point queries in high dimensions*, Constr. Appr. 50(3) (2019), 403–455
42. with M. Ullrich, *An upper bound on the minimal dispersion*, J. Compl. 45 (2018), 120–126
41. with L. M. Ghiringhelli, E. Ahmetchik, R. Ouyang, S. V. Levchenko, C. Draxl, and M. Scheffler,*Learning physical descriptors for materials science by compressed sensing*, New Journal of Physics, 19 (2017), 023017

40. with A. Hinrichs and J. Prochno, *Entropy numbers of embeddings of Schatten classes*, J. Funct. Anal. 273 (10) (2017), 3241–3261

39. with H. F. Goncalves and H. Kempka, *Franke-Jawerth embeddings for Besov and Triebel-Lizorkin spaces with variable exponents*, Ann. Acad. Sci. Fenn. Math. 43(1) (2018), 187–209

38. with T. Conrad, M. Genzel, N. Cvetkovic, N. Wulkow, A. Leichtle, G. Kutyniok, and Ch. Schuette, *Sparse Proteomics Analysis - A compressed sensing-based approach for feature selection and classification of high-dimensional proteomics mass spectrometry data*, BMC Bioinformatics 18:160 (2017)

37. with A. Hinrichs and A. Kolleck, *Carl's inequality for quasi-Banach spaces*, J. Funct. Anal. 271 (8) (2016), 2293–2307

36. with A. Kolleck, *Non-asymptotic Analysis of l_1-norm Support Vector Machines*, IEEE Trans. Inf. Theory 63, no. 9 (2017), 5461–5476

35. with H. Kempka, *Volumes of unit balls of mixed sequence spaces*, Math. Nachr. 290, no. 8-9 (2017), 1317-1327

34. with A. Kolleck, *On some aspects of approximation of ridge functions*, J. Appr. Theory 194 (2015), 35–61

33. with L. M. Ghiringhelli, S. V. Levchenko, C. Draxl, and M. Scheffler, *Big data of materials science - Critical role of the descriptor*, Phys. Rev. Lett. 114, 105503 (2015)

32. with S. Mayer and T. Ullrich, *Entropy and sampling numbers of classes of ridge functions*, Constr. Appr. 42 (2) (2015), 231-264

31. *Weak and quasi-polynomial tractability of approximation of infinitely differentiable functions*, J. Compl. 30 (2) (2014), 48–55

30. with W. Sickel and L. Skrzypczak, *Complex interpolation of weighted Besov- and Lizorkin-Triebel spaces*, Acta Math. Sin. (Engl. Ser.) 30 (8) (2014), 1297–1323

29. with W. Sickel and L. Skrzypczak, *The characterization of radial subspaces of Besov- and Lizorkin-Triebel spaces by differences*, Banach Center Publ. 102 (2014), 197–214

28. with H. Kempka, *Lorentz spaces with variable exponents*, Math. Nachr. 287, no. 8-9 (2014), 938–954

27. with C. Schneider, *Non-smooth atomic decompositions, traces on Lipschitz domains, and pointwise multipliers in function spaces*, J. Funct. Anal. 264 (5) (2013),1197–1237.

26. with C. Schneider, *Homogeneity property of Besov and Triebel-Lizorkin spaces*, J. Funct. Spaces Appl. (2012), 281085 (17 pages).

25. with M. Fornasier and J. Haškovec, *Particle systems and kinetic equations modeling interacting agents in high dimension*, SIAM: Multiscale Modeling and Simulation, 9(4)(2011), 1727–1764.

24. with H. Kempka, *Spaces of variable smoothness and integrability: Characterizations by local means and ball means of differences*, J. Fourier Anal. Appl. 18 (4) (2012), 852–891.

23. with H. Kempka, *A note on the spaces of variable integrability and summability of Almeida and Hästö*, Proc. Amer. Math. Soc. 141 (9) (2013), 3207–3212.

22. *Average best m-term approximation*, Constr. Approx. 36 (1) (2012), 83–115.

21. with M. Fornasier and K. Schnass, *Learning functions of few arbitrary linear parameters in high dimensions*, Found. Comput. Math. 12 (2) (2012), 229–262.

20. with W. Sickel and L. Skrzypczak, *On the interplay of regularity and decay in case of radial functions I. Inhomogeneous spaces*, Commun. Contemp. Math. 14 (1) (2012), 1250005 (60 pages).

19. *A variant of the Johnson-Lindenstrauss lemma for circulant matrices*, J. Funct. Anal. 260(4) (2011), 1096–1105.

18. with A. Hinrichs, *Johnson-Lindenstrauss lemma for circulant matrices*, Random Struct. Algor. 39(3) (2011), 391–398.

17. with A. Hinrichs, *On positive positive-definite functions and Bochner's Theorem*, J. Compl. 27 (2011), 264–272.

16. with S. Hencl, J. Malý and L. Pick, *Weak estimates cannot be obtained by extrapolation*, Expo. Math., 28 (2010), 375–377.

15. with C. Schneider, *On dilation operators in Triebel-Lizorkin spaces*, Funct. Approx., 41(2) (2009), 139–162.

14. *Sobolev and Jawerth embeddings for spaces with variable smoothness and integrability*, Ann. Acad. Sci. Fenn. Math. 34:2 (2009), 529–544.

13. *On sharp embeddings of Besov and Triebel-Lizorkin spaces in the subcritical case*, Proc. Amer. Math. Soc. 138 (2010), 141–146.

12. with M. Hansen, *The Jawerth-Franke embedding of spaces with dominating mixed smoothness*, Georg. Math. J. 16 (2009), No. 4, 667–682.

11. with L. Skrzypczak, *Corrigenda to the paper: "On approximation numbers of Sobolev embeddings of weighted function spaces"*, J. Approx. Theory 156 (2009), 116–119.

10. with A. Hinrichs and E. Novak, *Linear information versus function evaluations for L_2-approximation*, J. Approx. Theory 153 (2008), 97–107.

9. *Widths of embeddings in function spaces*, J. Compl. 24 (2008), 545–570.

8. *A new proof of Jawerth-Franke embedding*, Rev. Mat. Complut. 21 (2008), 75–82.

7. *Dilation operators and sampling numbers*, J. of Function Spaces and Appl. 6 (2008), 17–46.

6. *Sampling numbers and function spaces*, J. Compl. 23 (2007), 773–792.

5. with W. Sickel, *Traces of function spaces with dominating mixed derivative in* $\mathbb{R}^3$, Czechoslovak Math. J. Vol. 57, no. 4 (2007) 1239–1273.

4. *Optimal Sobolev embeddings on* $\mathbb{R}^n$, Publ. Mat. 51 (2007), 17–44.

3. *A diagonal embedding theorem for function spaces with dominating mixed smoothness*, Funct. et Appr. 33 (2005), 101–120.

2. *A remark on better-λ inequality*, Math. Ineq. and Appl. 10 (2007), 335–341.

1. *Function spaces with dominating mixed smoothness*, Diss. Math. 436 (2006), 1–73.

Papers in refereed proceedings, preprints and others:

4. with M. Fornasier and K. Schnass, *Learning functions of few arbitrary linear parameters in high dimensions*, Proceedings of SampTA 2011.

3. *Generating random signals and sparse and compressible vectors*, Proceedings of SampTA 2011.

2. with K. Schnass, *Compressed Learning of High-Dimensional Sparse Functions*, Proceedings of ICASSP 2011.

1. *Characterisations of function spaces with dominating mixed smoothness properties*, Jenaer Schriften zur Mathematik und Informatik, Math/Inf/15/03, 2003.

Languages:

Czech - native speaker
German - fluent
English - fluent

Service to the community:

Since 2024: Member of the editorial board of Mathematische Nachrichten
Since 2024: Member of the editorial board of Constructive Approximation
Since 2014: (Senior) member of the editorial board of Journal of Complexity

Member of the organization committee of Algorithms and Complexity for Continuous Problems, Dagstuhl, Germany, August 27 – September 1, 2023
Member of the organization committee of Qualitative Improvement and New Dimensions Erlebachova bouda, Czech Republic, September 13–17, 2020
Member of the organization committee of 11th International Conference Nonlinear Analysis, Function Spaces and Applications, Prague, Czech Republic, July 9–14, 2018
Member of the organization committee (together with prof. H. Boche (TU Munich), prof. R. Calderbank (Duke) and prof. G. Kutyniok (TU Berlin)) of MATHEON Workshop: "Compressed Sensing and its Applications", Berlin, December 2013.

Participation at conferences and schools:

Plenary talks:

• Foundations of Computational Mathematics
June 12 – June 21, 2023, Paris, France
Semi-plenary talk: *Lower bounds for numerical integration and approximation*

• Nonlinear Analysis, Function Spaces and Applications (NAFSA)
May 30 – June 3, 2022, Praha, Czech Republic
talk: *Regularity of paths of the Wiener process and of the Brownian sheet*

• Lubos Pick turns 60
September 15 – 19, 2021, Zelezna Ruda, Czech Republic
talk: *Sure you know Schur*

• Summer School, Joint PhD Programm of universities in Aveiro, Coimbra, Minho and Porto, September 9-13, 2019, Braga, Portugal
talk: *Morrey-Besov spaces, heat equations and Navier-Stokes equation*

• Analysis Seminar 2018, June 8 – 10, 2018, Traunkirchen, Austria
talk: *Approximation of structured functions and simple neural networks*

• Approximating high dimensional functions, December 18 – 19, 2017, Turing Institute, London, UK
talk: *Ridge functions, their sums, and sparse additive functions*

• NOMAD Summer, September 25 – 29, 2017, Berlin, Germany
talk: *Compressed Sensing and Neural Networks*

• New perspectives in the theory of function spaces and their applications, September 18 – 22, 2017, Bedlewo, Poland
talk: *From approximation theory to machine learning*

• WDI^2 - Approximation Theory and Applications, March 10, 2017, Innsbruck, Austria
talk: *Optimality and lower bounds in approximation theory*

• Perspectives in High-dimensional Probability and Convexity, February 6-10, 2017, Oberwolfach, Germany
talk: *IBC: Approximation problems and lower bounds*

• Facets of Complexity, September 29 - September 30, 2016, FU Berlin, Germany
talk: *Information Based Complexity*

• Function Spaces, Differential Operators and Nonlinear Analysis (FSDONA) 2016, July 4 - 9, Prague, Czech Republic
talk: *What is Information Based Complexity?*

Last change: September 6, 2024