

# David Krieg

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Born in 1991 on the 8th of July in Würzburg, Germany.

## Education

- 2016–2019 Ph.D. in Mathematics (Dr. rer. nat.)  
Friedrich Schiller University Jena, Germany  
Thesis: Algorithms and complexity for some multivariate problems  
Summa cum laude  
Supervisor: Erich Novak
- 2014–2016 M.Sc. in Mathematics  
Friedrich Schiller University Jena, Germany  
Thesis: On the randomization of Frolov’s algorithm for multivariate integration  
Grade: 1.0
- 2015 Exchange Semester  
Eötvös Loránd University Budapest, Hungary
- 2011–2014 B.Sc. in Mathematics  
Friedrich Schiller University Jena, Germany  
Grade: 1.0
- 2013 Exchange Semester  
Lund University, Sweden
- 2002–2011 Abitur (German higher education entrance qualification)  
Friedrich-Koenig-Gymnasium Würzburg, Germany  
Grade: 1.0
- 2008–2010 Early study program in Mathematics  
Julius Maximilian University Würzburg, Germany

## Appointments

- 04/19– Scientific employee (Postdoc), Johannes Kepler University Linz, Austria.  
Funded by the Austrian Science Fund (FWF) Project F5513–N26 as a part of the Special Research Program “Quasi-Monte Carlo Methods: Theory and Applications”.
- 04/16–03/19 Scientific employee and Ph.D. student, Friedrich Schiller University Jena, Germany.
- 04/15–08/15 Teaching assistant, Friedrich Schiller University Jena, Germany.
- 10/12–02/13 Undergraduate teaching assistant, Friedrich Schiller University Jena, Germany.

## Teaching

- WS20/21 Mathematics for Artificial Intelligence III, exercise class, JKU Linz, in English.
- SS20 Analysis 2 (for mathematicians), exercise class, JKU Linz, in German.
- WS19/20 Analysis 1 (for mathematicians), exercise class, JKU Linz, in German.
- WS18/19 Mathematics for bio- and earth scientists, exercise classes, FSU Jena, in German.
- SS18 Analysis for computer scientists, exercise classes, FSU Jena, in German.
- WS17/18 Complexity of Continuous Problems, one to one teaching, FSU Jena, in English.
- SS17 Ordinary differential equations (for mathematicians and teachers), exercise classes, FSU Jena, in German.
- WS16/17 An introduction to numerical mathematics (for mathematicians), exercise classes, FSU Jena, in German.
- SS16 Analysis 1 (for teachers), exercise class and tutorial, FSU Jena, in German.
- SS15 Analysis for computer scientists, tutorial, FSU Jena, in German.
- WS12/13 Probability theory for computer scientists, exercise class, FSU Jena, in German.

## Honors and Awards

- 2020 *Joseph F. Traub Information-Based Complexity Young Researcher Award*
- 2020 *Promotionspreis* of the Friedrich Schiller University for the thesis “Algorithms and complexity for some multivariate problems”.
- 2017 *Examenspreis* of the president of the Friedrich Schiller University for the thesis “On the randomization of Frolov’s algorithm for multivariate integration”.
- 2015 *Examenspreis* of the dean of the department of mathematics and computer science at the Friedrich Schiller University for the thesis “Optimal quadrature formulae for tensor product Sobolev spaces”.
- 2014–16 Scholarship at the *Studienstiftung des deutschen Volkes*.
- 2013–14 Scholarship *Deutschlandstipendium der Carl-Zeiss-Stiftung*.
- 2011 *Abitur-Preis der Siemens AG* for best graduation in the natural sciences.
- 2011 *Facharbeitspreis* for the outstanding term paper “Das Rechnen mit Resten” by the *Verein der Freunde des Friedrich-Koenig-Gymnasiums*.

## Publications

### Submitted Manuscripts

- [3] Function values are enough for  $L_2$ -approximation: Part II (with M. Ullrich). arXiv: [2011.01779](https://arxiv.org/abs/2011.01779).
- [2] Random points are optimal for the approximation of Sobolev functions (with M. Sonnleitner). arXiv: [2009.11275](https://arxiv.org/abs/2009.11275).
- [1] Random sections of ellipsoids and the power of random information (with A. Hinrichs, E. Novak, J. Prochno, and M. Ullrich). arXiv: [1901.06639](https://arxiv.org/abs/1901.06639).

### Refereed Journal Papers

- [9] Lower bounds for the error of quadrature formulas for Hilbert spaces (with A. Hinrichs, E. Novak, and J. Vybiral). To appear in *Journal of Complexity*. DOI: [10.1016/j.jco.2020.101544](https://doi.org/10.1016/j.jco.2020.101544), arXiv: [2004.00274](https://arxiv.org/abs/2004.00274).
- [8] Function values are enough for  $L_2$ -approximation (with M. Ullrich). To appear in *Foundations of Computational Mathematics*. DOI: [10.1007/s10208-020-09481-w](https://doi.org/10.1007/s10208-020-09481-w), arXiv: [1905.02516](https://arxiv.org/abs/1905.02516).
- [7] Expected dispersion of uniformly distributed points (with A. Hinrichs, R.J. Kunsch, and D. Rudolf). *Journal of Complexity*, 61:101483, 2020. DOI: [10.1016/j.jco.2020.101483](https://doi.org/10.1016/j.jco.2020.101483), arXiv: [1911.12074](https://arxiv.org/abs/1911.12074).
- [6] Uniform recovery of high-dimensional  $C^r$ -functions. *Journal of Complexity*, 50:116–126, 2019. DOI: [10.1016/j.jco.2018.10.002](https://doi.org/10.1016/j.jco.2018.10.002), arXiv: [1805.06220](https://arxiv.org/abs/1805.06220).

- [5] Recovery algorithms for high-dimensional rank one tensors (with D. Rudolf).  
*Journal of Approximation Theory*, 237:17–29, 2019.  
DOI: [10.1016/j.jat.2018.08.002](https://doi.org/10.1016/j.jat.2018.08.002), arXiv: [1711.03986](https://arxiv.org/abs/1711.03986).
- [4] Optimal Monte Carlo methods for  $L^2$ -approximation.  
*Constructive Approximation*, 49:385–403, 2019.  
DOI: [10.1007/s00365-018-9428-4](https://doi.org/10.1007/s00365-018-9428-4), arXiv: [1705.04567](https://arxiv.org/abs/1705.04567).
- [3] On the dispersion of sparse grids.  
*Journal of Complexity*, 45:115–119, 2018.  
DOI: [10.1016/j.jco.2017.11.005](https://doi.org/10.1016/j.jco.2017.11.005), arXiv: [1709.02983](https://arxiv.org/abs/1709.02983).
- [2] Tensor power sequences and the approximation of tensor product operators.  
*Journal of Complexity*, 44:30–51, 2018.  
DOI: [10.1016/j.jco.2017.09.002](https://doi.org/10.1016/j.jco.2017.09.002), arXiv: [1612.07680](https://arxiv.org/abs/1612.07680).
- [1] A universal algorithm for multivariate integration (with E. Novak).  
*Foundations of Computational Mathematics*, 17(4):895–916, 2017.  
DOI: [10.1007/s10208-016-9307-y](https://doi.org/10.1007/s10208-016-9307-y), arXiv: [1507.06853](https://arxiv.org/abs/1507.06853).

### Book chapters

- [1] On the power of random information (with A. Hinrichs, E. Novak, J. Prochno, and M. Ullrich).  
In F.J. Hickernell, P. Kritzer (eds.): *Multivariate Algorithms and Information-Based Complexity*, pp. 43–64, Berlin/Boston: DeGruyter, 2020.  
DOI: [10.1515/9783110635461](https://doi.org/10.1515/9783110635461), arXiv: [1903.00681](https://arxiv.org/abs/1903.00681).

### Theses

- [2] Algorithms and Complexity for some Multivariate Problems.  
Dissertation, Friedrich Schiller University Jena, Germany, 2019.  
arXiv: [1905.01166](https://arxiv.org/abs/1905.01166).
- [1] On the randomization of Frolov’s algorithm for multivariate integration.  
Master thesis, Friedrich Schiller University Jena, Germany, 2016.  
arXiv: [1603.04637](https://arxiv.org/abs/1603.04637).

### Invited Talks

- [20] Webinar *Point Distributions*, organized by Damir Ferizović (TU Graz), Ryan Matzke (University of Minnesota), and Oleksandr Vlasiuk (Florida State University), online, August 2020.  
Talk: Order-optimal point configurations for function approximation.
- [19] Semi-plenary lecture at *Foundations of Computational Mathematics* (FoCM 2020), Simon Fraser University of Vancouver, Canada, June 2020 [canceled].  
Talk: Function recovery in Hilbert spaces.
- [18] Conference *New Perspectives and Computational Challenges in High Dimensions*, Mathematical Research Institute of Oberwolfach, Germany, February 2020.  
Talk: Random information and high dimensional geometry.

- [17] Fall School *Algorithms and Complexity in High Dimensions*, Graz, Austria, October 2019.  
Talk 1: How good is random information? – Part I.  
Talk 2: How good is random information? – Part II.
- [16] Summer School *Analysis and Theoretical Numerics*, Siegmundsburg, Germany, August 2019.  
Talk 1:  $L_2$ -Approximation in Hilbert spaces – Part I.  
Talk 2:  $L_2$ -Approximation in Hilbert spaces – Part II.
- [15] Dagstuhl Seminar *Algorithms and Complexity for Continuous Problems*, Schloss Dagstuhl, Germany, August 2019.  
Talk: How good are random sampling points?
- [14] *9th International Congress on Industrial and Applied Mathematics (ICIAM 2019)*, Valencia, Spain, July 2019.  
Talk: How good are random sampling points?
- [13] *12th International Conference on Monte Carlo Methods and Applications (MCM 2019)*, Sydney, Australia, July 2019.  
Talk: The power of random information.
- [12] Workshop *Stochastic Computation and Complexity* at the Henri Poincaré Institute (IHP), Paris, France, April 2019.  
Talk: How good are random sampling points?
- [11] *9th International Conference on Numerical Methods and Applications (NM&A'18)*, Borovets, Bulgaria, August 2018.  
Talk 1: Uniform approximation of high-dimensional rank one tensors.  
Talk 2: How good is random information for  $L^2$ -approximation?
- [10] *13th International Conference on Monte Carlo and Quasi-Monte Carlo Methods in Scientific Computing (MCQMC 2018)*, Rennes, France, July 2018.  
Talk: On the dispersion of sparse grids.
- [9] Research Seminar of the Johann Radon Institute for Computational and Applied Mathematics (RICAM), Linz, Austria, February 2018.  
Talk: Randomized algorithms for  $L^2$ -approximation.
- [8] Annual celebrations of the Faculty of Mathematics and Computer Science at the Friedrich Schiller University, Jena, Germany, November 2017.  
Talk: A randomized algorithm for numerical integration (in German).
- [7] 2nd workshop of the program *Tractability of high dimensional problems and discrepancy* at the Erwin Schrödinger International Institute for Mathematics and Physics (ESI), Vienna, Austria, October 2017.  
Talk: Randomized algorithms for  $L^2$ -approximation.
- [6] *11th International Conference on Monte Carlo Methods and Applications (MCM 2017)*, Montreal, Canada, July 2017.  
Talk: On the approximation of tensor product operators.
- [5] Seminar *Mathematics of Computation*, University Bonn, Germany, February 2017.  
Talk: On the approximation of tensor product operators.

- [4] *IBC on the 70th anniversary of Henryk Woźniakowski*, Będlewo, Poland, August 2016.  
Talk: A universal algorithm for multivariate integration.
- [3] *12th International Conference on Monte Carlo and Quasi-Monte Carlo Methods in Scientific Computing* (MCQMC 2016), Stanford, USA, August 2016.  
Talk: A universal algorithm for multivariate integration.
- [2] Research Seminar *Functional Analysis*, Johannes Kepler University, Linz, Austria, June 2016.  
Talk: A universal algorithm for multivariate integration.
- [1] *Workshop in Discrepancy Theory*, Varenna, Italy, June 2016.  
Talk: A universal algorithm for multivariate integration.

### **Administration and Community Service**

- Mid-level staff representative at the examination committee of the department of mathematics and computer science at the Friedrich Schiller University from October 2016 to March 2019.
- Official examiner for the first state examination for teachers of mathematics (gymnasium and regular school) in Thuringia in 2017 and 2018.
- Assistance for the admissions committee for international master students at the Friedrich Schiller University from July 2017 to March 2019.
- Referee for several bachelor and master theses.
- Reviewer for *Foundations of Computational Mathematics*, the *Journal of Complexity*, *Mathematics of Computation*, and the *SIAM Journal on Numerical Analysis*.

References are available on request.