Zev A.C. Woodstock

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Work Authorization: USA (Citizen) & EU (Blue Card)

Background

2022 – **Postdoctoral Staff Scientist (Wissenschaftlicher Mitarbeiter)**, *Interactive Optimization and Learning (IOL) Lab, Technische Universität Berlin (TU Berlin) & Zuse Institute Berlin (ZIB)*, Berlin, DE.
- Advisor: Sebastian Pokutta

2021 **Ph.D., Mathematics**, *North Carolina State University*, Raleigh, NC, USA.
- Thesis: **Construction of Functions from Nonlinear Transformations**
- Advisor: Patrick L. Combettes

2018 **M.Sc., Applied Mathematics**, *North Carolina State University*, Raleigh, NC, USA.
- 4.0/4.0 GPA

2016 **B.Sc., Mathematics**, *James Madison University*, Harrisonburg, VA, USA.
- 3.93/4.0 GPA (Summa Cum Laude)

Awards, Honors, & Recognitions

2023 – 2025 **Principal Investigator**, *Berlin Mathematics Research Center MATH+ Grant.*
EF1-23: *On a Frank-Wolfe Approach for Abs-smooth Optimization*,
Funding a 3-year PhD position at Humboldt-Universität zu Berlin; PIs with S. Pokutta and A. Walther.

2022 **MATH+ Travel Grant**, *Berlin Mathematics Research Center.*

2022 & 2023 **REU Advisor**, *Zuse Institute Berlin.*
Advising on research, acquiring visas and funding, general organization

2022 – **MATH+ Postdoctoral Member**, *Berlin Mathematics Research Center.*

2018 – 2021 **National Science Foundation Graduate Research Fellowship (NSF-GRFP)**, *NC State University.*
Three-Year full time research grant ($138,000)

2016 **University Graduate Fellowship**, *NC State University*, ($4,000).

2016 **Ikenberry Prize**, *James Madison University*, Department of Mathematics & Statistics.
Presented to the outstanding member of the senior class

2015 **Joan and Ernest Droms Memorial Scholarship in Mathematics**, *James Madison University*, ($4,000).

2014 & 2016 **COMAP International Mathematical Contest in Modeling (MCM)**.
2016: *Meritorious* (top 8%); 2014: *Honorable Mention*

2014 **Jeffrey E. Tickle Scholarship in Mathematics**, *James Madison University*, ($4,000).

2013 & 2014 **Lisa Persson-Helms Scholarship in Mathematics**, *James Madison University*, ($1,000 both years).

2014 **Putnam Exam**, *James Madison University*, Score: 9.

Research

Projects

2022 – **Interactive Optimization and Learning (IOL) Lab**, *TU Berlin (Math Dept.) & Zuse Institute Berlin (AI in Society, Science, and Technology Dept.)*, Advisor: Sebastian Pokutta.
Research on continuous optimization with applications in machine learning and data science.
Projects include: (1) REU developing an asynchronous optimization software package, (2) Developing Frank-Wolfe algorithms for abs-smooth optimization in ML (`FrankWolfe.jl`, [Kreimeier et al.]), (3) Conditional gradient algorithms for split-feasibility problems, and (4) Using nonlinear analysis to motivate new relaxations of optimization problems.

2017 – 2021 **Construction of Functions from Nonlinear Transformations**, *NCSU*, Advisor: Patrick L. Combettes.
PhD Thesis: modeling, analysis, and algorithm development for solving nonlinear problems in signal/image/audio processing, data science, and large-scale optimization.

2014 – 2016 **Independent Study: Aeroacoustics of Turbulent Coanda Wall Jets**, *JMU*, Advisor: Caroline Lubert.

2015 **NSF-REU** (Algebraic methods in computational biology), *Texas A&M University*, Advisor: Anne Shiu.

2014 **NSF-REU** (Inverse scattering problems), *James Madison University*, Advisor: Hala A. H. Shehadeh.

Refereeing

2023 **Journal of Machine Learning Research (JMLR)**.

2023 **International Conference on Learning Representations (ICLR)**.

2023 **Conference on Neural Information Processing Systems (NeurIPS)**.

2023 **International Conference on Machine Learning (ICML)**.

2023 **Advances in Computational Mathematics (ACOM)**.

2022 **Conference on Neural Information Processing Systems (NeurIPS)**.

2020 & 2021 **Journal of Mathematical Analysis and Applications (JMAA)**.

2020 **Journal of Approximation Theory (JAT)**.

Technical

High-level languages,

- *`MATLAB/Octave` (10 years)* .
- `Python 3` (2 years) packages: numpy, scipy, tensorflow, keras, matplotlib, and jupyter notebook
- `Julia` (2 years) and `FORTRAN` ($\leq$ 1 year)

Markup languages, *LaTeX, Beamer, Microsoft Office, and HTML.*

Tools, *Linux/Mac/Windows, bash, vim, meld, git, docker, slurm, Maple, Mathematica, and Moodle.*

Programming Experience.
Coded projects for classification, image recognition, encoder/decoder models, asynchronous parallel optimization algorithms, computational geometry, finite element methods, numerical integration/differentiation, control theory, sparse interpolation, fixed point equations, optimization (convex, nonconvex, asynchronous, parallelized, block-iterative, nonsmooth, ...), and signal/image/audio processing. Numerical work in publications 3 – 10; new algorithms in publications 5, 6, 9, 10, and 11.

Peer-Reviewed Articles

11. *Splitting the conditional gradient algorithm*, Z. W. and Sebastian Pokutta, submitted (2023).

10. *On a Frank-Wolfe approach for abs-smooth functions*, T. Kreimeier, S. Pokutta, A. Walther, and Z. W., Revision submitted to **Optimization Methods and Software**, (2023).

9. *Signal recovery from inconsistent nonlinear observations*, P. L. Combettes, and Z. W., **Proceedings of the IEEE International Conference on Acoustics, Speech, and Signal Processing (ICASSP)**, pp. 5872–5876. Singapore, May 22–27, (2022).

8. *Block-activated algorithms for multicomponent fully nonsmooth minimization*, M. N. Bùi, P. L. Combettes, and Z. W., **Proceedings of the 2022 IEEE ICASSP**, pp. 5428–5432. Singapore, May 22–27, (2022).

7. *A variational inequality model for the construction of signals from inconsistent nonlinear equations*, P. L. Combettes and Z. W., **SIAM Journal on Imaging Sciences**, vol. 15, pp. 84–109 (2022).

6. *Reconstruction of functions from prescribed proximal points*, P. L. Combettes and Z. W., **Journal of Approximation Theory**, vol. 268, art. 105606, (2021).

5. *A fixed point framework for recovering signals from nonlinear transformations*, P. L. Combettes and Z. W., **Proceedings of the European Signal Processing Conference**, pp. 2120–2124. Amsterdam, NL, January 18–22, (2021).

4. *Obstructions to convexity in neural codes*, C. Lienkaemper, A. Shiu, and Z. W., **Advances in Applied Mathematics**, vol. 85, pp. 31–59 (2017).

3. *Rocket launch noise and the Coanda effect*, C. P. Lubert, J. N. Romero, J. S. Sochacki, and Z. W. **AIAA Space**, art. 2016-5625, (2016).

2. *Analyzing multistationarity in chemical reaction networks using the determinant optimization method*, B. Félix, A. Shiu and Z. W., **Applied Mathematics and Computation**, vol. 287–288, pp. 60–73 (2016).

1. *Architectural acoustical oddities.* Z. W. and C. P. Lubert, **Proceedings of Meetings on Acoustics**, vol. 22, art. 025002, (2015).

Teaching

2018 – **Mentor**, *IOL Lab (2022 –) and NC State U∪G (2018 – 2021).*
Advising on PhD/MS/BS research projects; applying for grants; organizing seminars; reviewing applications; coaching students on curriculum, jobs, and conference presentations.

Student Statistics:

Gender	M/F/Nonbinary	4/3/1
Degree	PhD/MS/BS	2/1/5
Nationality	FR/DE/USA/India	1/1/2/4

2022 – **ZIB Tutorial Lecture Series Organizer**, *Zuse Institute Berlin*, Berlin, DE.
Organizing and presenting expository lectures on useful topics which are not found in "standard" coursework.

2016 – 2018 **Recitation Leader and Teaching Assistant**, *NC State University.*
Calculus I for business and life science, Calculus I for math majors and engineers, and Calculus III

Question (1-5 scale)	Class Mean	Dept. Mean
The instructor explained material well	4.7	4.2
The instructor was prepared for class	4.7	4.5
The instructor was enthusiastic about teaching the course	4.8	4.4
The instructor consistently treated students with respect	4.8	4.5
Overall, the instructor was an effective teacher	4.7	4.3

2016 – 2018 **Math Tutor**, *NCSU Multimedia Center (2017–2018); JMU Science & Math Learning Center (2016).*

2015 – 2016 **Math 167**, *James Madison University.*
Proposed, developed, and co-taught a seminar on higher-level topics in math, accessible to first-year undergraduates.

Highlighted Coursework

Proximal Optimization in Data Science	Nonlinear programming
Representations of High-Dimensional Data (MSRI Summer School)	Convex Analysis
Semidefinite and Second-Order Conic Programming	Advanced Functional Analysis
Real Algebraic Geometry and Convex Optimization	Dynamical Systems and Control Theory*
Nonlinear Equations and Optimization	Analysis*
Vector Space Methods in System Optimization	Numerical Analysis*

* indicates a year-long sequence for which a Ph.D. Qualifying Examination was passed.

Extracurriculars

Leadership

2022 – **Organizer**, *AI in Society, Science, and Technology (AIS^{2}T) Seminar*, Zuse Institute Berlin, Berlin, DE.

2022 **Session Chair**, *Nonsmooth Optimization and Machine Learning*, INFORMS Annual Meeting, Indianapolis, IN, USA.

2018 – 2020 **Vice President**, *American Mathematical Society Graduate Student Chapter at NC State University.*
- Organized the Triangle Area Graduate Mathematics Conference for Spring 2019.
- Organized recruitment and social events for the NC State mathematical community.

2018 – 2020 **President**, *Undergrads Union Grads (U∪G)*, NC State University.
- Coordinated the mentoring program for undergraduate math majors.

2018 – 2020 **Organizer**, *Nonlinear Analysis Graduate Student Workshop*, NC State University.

Selected Presentations

INFORMS Annual Meeting. Phoenix, AZ, USA. October 18, 2023
- Invited Lecture: *Splitting the Conditional Gradient Algorithm*

Imaging Inverse Problems - Regularization, low dimensional models and applications (Mathématiques de l'Imagerie et de ses Applications CNRS workshop). Bordeaux, FR. March 23, 2023
- *Signal recovery from inconsistent nonlinear observations*

MATH+ Spotlight Series. Berlin, DE. November 2, 2022
- *A Frank-Wolfe approach for abs-smooth optimization*

INFORMS Annual Meeting. Indianapolis, IN, USA. October 16, 2022
- Invited lecture: *A Frank-Wolfe approach for abs-smooth optimization*

ZIB Tutorial Lecture Series. Berlin, DE. March 16, 2022
- *Proximity operators and nonsmooth optimization* (online)

European Signal Processing Conference (EUSIPCO) 2020. Amsterdam, NL. January 21, 2021
- *A fixed point framework for recovering signals from nonlinear transformations* (online)

Nonlinear Analysis Graduate Student Workshop. NC State, Raleigh, NC, USA. Fall 2020
- *Signal recovery from nonlinear transformations*

Triangle Area Graduate Math Conference. UNC, Chapel Hill, NC, USA. Fall 2019
- *The Gospel of Proximal Calculus: Optimization for non-differentiable problems*

SIAM Graduate Student Tutorial. NC State, Raleigh, NC, USA. March 21, 2019
- *Proximal methods for optimization*

Operator Splitting Workshop. SAMSI, Research Triangle Park, NC, USA. March 21–23, 2018
- Invited lecture: *Composite Infimal Convolutions*

Applied Math Graduate Student Seminar NCSU, Raleigh, NC, USA. Fall 2016
- *Analyzing Multistationarity in Chemical Reaction Networks*

Graduate Student Algebra Seminar NCSU, Raleigh, NC, USA. Fall 2016
- *Obstructions to Convexity and Neural Codes*

Joint Mathematics Meetings Seattle, WA, USA. January 6, 2016
- *Analyzing Multistationarity in Chemical Reaction Networks*

Texas A&M University Research Symposium College Station, TX. July 23^{rd}, 2015
-*An Infinite Family of Networks with Non-Degenerate Equilibria* : Undergraduate lecture.

M.A.A. MD-DC-VA Section Meeting Salem, VA, USA. April 24–25, 2015

- *Architectural Acoustic Oddities & The Asymptotic Behavior of Repetition Pitch*

Acoustical Society of America Conference Indianapolis, IN. Oct. 28, 2014

- *Architectural Acoustic Oddities* (poster)

Shenandoah Undergraduate Mathematics Conference (SUMS), JMU, Harrisonburg, VA, USA.

- 2016 and 2018: Graduate Student Panelist
- 2015: *Obstructions to Convexity in neural Codes*: Undergraduate lecture
- 2014: *Architectural Acoustic Oddities* (poster): First place prize winner