

# Heather D. Wilber

## EDUCATION

Cornell University, Ithaca, NY      PhD, Applied Mathematics      May 2021  
Advisor: Prof. Alex Townsend

**DISSERTATION:** [Computing numerically with rational functions.](#)  
(Awarded [AWM Dissertation Prize](#) 2022, [Householder Prize](#) 2022)

Boise State Univ., Boise, ID      M.S., Mathematics      Aug 2016  
Advisor: Prof. Grady Wright

**THESIS:** [Numerical computing with functions on the sphere and disk.](#)  
(Selected as [Distinguished Thesis](#) in STEM for 2016-2017)

Boise State Univ., Boise, ID      B.S., Mathematics      Dec 2007  
Boise State Univ., Boise, ID      B.A., English-Linguistics      Dec 2007

## CURRENT POSITION

Oden Institute, University of Texas at Austin: NSF postdoctoral fellow, July 2021-present

## MANUSCRIPTS IN PROGRESS (drafts available upon request)

3. Epperly, E.N., Wilber, H. *A superfast direct inversion method for the nonuniform discrete Fourier transform*
2. Chen, K., Martinsson, G., Wilber, H. *A fast, high-accuracy method for solving the fractional Poisson equation in complex geometries.*
1. Beckermann, B., Kressner, D., Wilber, H. *Compression properties in rank-structured solvers for Toeplitz-like linear systems*

## JOURNAL PUBLICATIONS

6. Wilber, H., Damle, A., Townsend, A. [Data-driven algorithms for signal processing with trigonometric rational functions.](#) *SIAM J. Sci. Comput.*, 44-3, C185-C209 (2022).
5. Rubin, D., Townsend, A., Wilber, H. [Bounding Zolotarev numbers using Faber rational functions.](#) *Constructive Approx.*, 56, 1-26. (2022)
4. Quinn, K., Wilber, H., Townsend, A., Sethna, J.P. [Chebyshev approximation and the global geometry of model predictions.](#) *Phys. Rev. Lett.*, 122(15), 158302 (2019).
3. Townsend, A., Wilber, H. [On the singular values of matrices with high displacement rank.](#) *Linear Alg. Appl.*, V. 548, 19-41 (2018).
2. Wilber, H., Townsend, A., Wright, G. [Computing with functions in spherical and polar geometries II. The disk.](#) *SIAM J. Sci. Comput.*, 39-3, C238-C262 (2017).
1. Townsend, A., Wilber, H., Wright, G. [Computing with functions in spherical and polar geometries I. The sphere.](#) *SIAM J. Sci. Comput.*, 38-4, C403-C425 (2016).

## INVITED TALKS

10. NUMERICAL ANALYSIS IN THE 21<sup>st</sup> CENTURY (University of Oxford, Oxford, UK)  
*Plenary Talk: Title TBD (Aug. 2023)*
9. APPLIED MATHEMATICS COLLOQUIUM (Univ. Colorado at Boulder, Boulder, CO)  
*Talk: Rational functions in computational mathematics (Nov. 2022)*
8. MATHEMATICS COLLOQUIUM (Baylor University, Waco, TX)  
*Talk: Zolotarev rational functions in computational mathematics (Oct. 2022)*
7. BABUŠKA FORUM SERIES (Univ. Texas at Austin, Austin, TX)  
*Talk: Computing with rational approximations to the square root (Oct. 2022)*
6. HOUSEHOLDER XXI: HOUSEHOLDER PRIZE PLENARY LECTURE (Bari, Italy)  
*Plenary Talk: The low rank properties of structured matrices: a rational explanation (June 2022)*
5. [CAVID:COMPLEX ANALYSIS VIDEO SEMINAR SERIES](#) (virtual)  
*Talk: Low rank numerical methods via rational function approximation (June 2022)*
4. UNIV. DELAWARE NUMERICAL ANALYSIS AND PDE SEMINAR (virtual)

- Talk: Low rank methods for structured matrices. (May 2022)*
3. UNIV. TEXAS LIBRARIES NATIONAL POETRY MONTH EVENT (virtual)  
*Talk: [The poetry of math and the math of poems](#) (April 2022)*
  2. BOISE STATE UNIV. MATHEMATICS COLLOQUIUM (Boise State Univ., Boise, ID)  
*Talk: Low rank methods for structured matrices. (Feb. 2022)*
  1. CCM SEMINAR SERIES, FLATIRON INSTITUTE (virtual)  
*Talk: Designing low rank methods for matrices with displacement structure. (May 2021)*

## **SELECTED PRESENTATIONS**

17. SIAM ANNUAL MEETING 2022 (Pittsburgh, PA)  
*Poster: [Data-driven computing with trigonometric rational functions](#) (July 2022)*
16. [RISING STARS](#) 2022 (Sandia Labs, Albuquerque, NM)  
*Talk: Data-driven computing with trigonometric rational functions (April 2022)*
15. 2021 CONFERENCE ON FAST DIRECT SOLVERS (virtual)  
*Talk: Designing low rank methods for matrices with displacement structure. (Oct. 2021)*
14. GAMM 2021 (virtual)  
*Talk: Compression properties and rank-structured solvers for Toeplitz, Vandermonde and related linear systems (March 2021)*
13. SIAM ANNUAL MEETING (virtual)  
*Talk: Computing with rational approximations with applications in signal processing (July 2020)*
12. 27th BIENNIAL NUMERICAL ANALYSIS CONFERENCE (Univ. of Strathclyde, Strathclyde, UK)  
*Talk: Compression properties in rank-structured solvers for Toeplitz linear systems (June 2019)*  
**awarded SIAM UKIE prize: Best student presentation**
11. APPROXIMATION THEORY 16 (Vanderbilt University, Nashville, TN)  
*Talk: Rational approximation in superfast rank-structured solvers (May 2019)*
10. EPFL Numerical Analysis Group (EPFL, Lausanne, Switzerland)  
*Talk: Numerical computing in polar and spherical geometries (Dec. 2018)*
9. EPFL Numerical Analysis Group (EPFL, Lausanne, Switzerland)  
*Talk: On the singular values of matrices with high displacement rank (Nov. 2018)*
8. ICOSAHOM (Imperial College London, UK)  
*Talk: A low rank and spectrally accurate elliptic PDE solver (July 2018)*
7. SIAM CONF. ON COMPUTATIONAL SCIENCE AND ENGINEERING (Atlanta, GA)  
*Talk: A factored ADI method for Sylvester equations with high-rank right-hand sides (Feb. 2017)*
6. SIAM CONF. ON COMPUTATIONAL SCIENCE AND ENGINEERING (Atlanta, GA)  
*Poster: Numerical computing with functions in spherical and polar geometries (Feb. 2017)*
5. WORKSHOP ON FAST DIRECT SOLVERS (Purdue Univ., Lafayette, IN)  
*Talk: Numerical computing with functions on the sphere and disk (Nov. 2016)*
4. SCIENTIFIC COMPUTING AND NUM. ANALY. SEMINAR (Cornell University, Ithaca, NY)  
*Talk: Numerical computing with functions on the sphere and disk (Sept. 2016)*
3. SIAM ANNUAL MEETING (Boston, MA)  
*Talk: Numerical computing in polar and spherical geometries (July 2016)*
2. OXFORD NUM. ANALY. GROUP SEMINAR (University of Oxford, Oxford, UK)  
*Talk: Computing with functions on the sphere and disk (July 2016)*
1. PACIFIC NORTHWEST NUMERICAL ANALYSIS SEMINAR  
*Poster: [Computing with functions on the sphere and disk](#) (Oct. 2015)*

## **SOFTWARE DEVELOPMENT**

- [REfit](#)  
Open-source code for computing with trigonometric rational functions and exponential sums
- [freeLyap](#) Iterative solvers package  
Open-source code for solving Sylvester and Lyapunov matrix equations
- [CHEBFUN PROJECT](#)  
*Spherefun* and *Diskfun* in the open-source project *Chebfun*

## **SELECTED FELLOWSHIPS AND AWARDS**

- [Householder Prize](#) (2022)
- [AWM Dissertation Prize](#) (2022)
- National Science Foundation Mathematical Sciences Postdoctoral Research Fellowship (2021)
- SIAM UKIE prize: Best student presentation, 27th Biennial Numerical Analysis conference (2019)
- National Science Foundation Graduate Research Fellowship (NSF GRF) (2016)
- [Distinguished Thesis Award](#) (2017)
- [National Aeronautics and Space Administration \(NASA\) Fellowship Award](#) (2015-2016)

## **PROFESSIONAL ACTIVITIES**

- Referee: SIAM J. Scientific Computing, J. Comp. Physics, IMA J. of Num. Analysis, Arkiv der Mathematik, BIT numerical methods, Amer. Math. Soc., Adv. in Comp. Math.
- Lead Organizer: Banff International Research Institute 2024 proposal for workshop titled “Challenges, opportunities, and new horizons in rational approximation”
- Minisymposium organizer and co-chair: SIAM AN2022, (Pittsburgh, PA) July 2022
- Consultant: [X-prize Carbon removal competition](#) with [Ecorestoration Alliance team](#) 2022
- Minisymposium organizer and co-chair: SIAM AN2020, (Virtual) July 2020
- AWM outreach mentor 2019
- Rural schools outreach volunteer with NASA STEM Mathematics Initiative 2015-2016

## **TEACHING EXPERIENCE**

**University of Texas at Austin** **Austin, TX** **August 2022-May 2023**

*Instructor*

- Fall 2022: Advanced Calculus with Applications, II
- Spring 2023: Sequences, Series and Multivariable Calculus

**Cornell University** **Ithaca, NY** **August 2020-Dec. 2020**

*Teaching assistant*

- Spring 2021: Teaching Assistant for Prof. Steven Strogatz, Mathematical Explorations
- Fall 2020: Teaching Assistant for Prof. Alex Townsend, Linear Algebra for Engineers

**Boise State University** **Boise, Idaho** **August 2014-May 2015**

*Instructor*

- Spring 2015: Analytic Trigonometry
- Spring 2015: Trigonometry project and assessment design team member
- Fall 2014: Analytic Trigonometry, College Algebra.

**Rimrock Jr. Sr. High School** **Bruneau, Idaho** **August 2013-May 2014**

*High School Math Teacher*

- pre-algebra, algebra II, geometry, trigonometry, pre-calculus and Title-I interventionist