Andrew Higgins

Albuquerque, NM
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Education

Aug. 2018 - May 2024 **Ph.D., Mathematics**, *Temple University*, Philadelphia, PA
Dissertation: Analysis and Implementation Considerations of Krylov Subspace Methods on Modern Heterogeneous Computing Architectures
Advisor: Daniel B. Szyld
GPA: 3.98

Aug. 2018 - May 2022 **Master of Science, Mathematics**, *Temple University*, Philadelphia, PA
GPA: 3.98

Aug. 2013 - May 2017 **Bachelor of Science, Applied Mathematics**, *Temple University*, Philadelphia, PA
GPA: 3.95, Summa Cum Laude

Personal Information & Skills

Programming: C++, OpenMP, CUDA, Kokkos, Java, C, MATLAB, Python, LaTeX

Research Interests: Numerical Linear Algebra, High-Performance Scientific Computing, GPU Computing, Krylov Subspace Methods, Scalable Linear Solvers, Randomized Linear Algebra

Publications, Technical Reports, and Preprints

[1] Ichitaro Yamazaki, Andrew J. Higgins, Erik G. Boman, and Daniel B. Szyld. Two-stage block orthogonalization to improve performance of s-step GMRES. In *2024 IEEE International Parallel and Distributed Processing Symposium (IPDPS)*, pages 26–37, 2024.

[2] Andrew J. Higgins, Daniel B. Szyld, Erik G. Boman, and Ichitaro Yamazaki. Analysis of randomized Householder-Cholesky QR factorization with multisketching, 2024. arXiv:2309.05868, Submitted.

[3] Andrew J. Higgins, Erik G. Boman, Daniel B. Szyld, and Ichitaro Yamazaki. Randomized Householder-Cholesky QR factorization with multisketching. Technical Report SAND2023-13916R, Computer Science Research Institute, Sandia National Laboratories, 2023.

[4] Erik G. Boman, Andrew J. Higgins, and Daniel B. Szyld. Optimal size of the block in block GMRES on GPUs: Computational model and experiments. *Numerical Algorithms*, 93:119–147, 2023.

[5] Andrew J. Higgins, Erik G. Boman, Jennifer A. Loe, and Ichitaro Yamazaki. Numerical evaluation of random sketch GMRES. Technical Report SAND2022-10280R, Computer Science Research Institute, Sandia National Laboratories, 2022.

Professional Experience

Aug. 2024 - Present **Postdoctoral Appointee, Scalable Algorithms**, *Sandia National Laboratories*, Albuquerque, NM
- Researched novel randomized algorithms to implement within linear solvers
- Analyzed performance of sparse direct methods on large-scale problems on distributed machines

May 2022 - Aug. 2024 **Graduate Intern, Scalable Algorithms**, *Sandia National Laboratories*, Albuquerque, NM
- Developed new communication-avoiding linear algebra algorithms and mathematically proved their stability and accuracy
- Implemented the algorithms on state-of-the-art GPUs, demonstrating their efficiency on modern supercomputers

Aug. 2018 - May 2024 **Teaching Assistant**, *Temple University*, Philadelphia, PA
- Served as a grader, recitation/lab instructor, or instructor of record for each of my 11 semesters as a graduate student
- Served as instructor of record for 5 courses

Aug. 2017 - Aug. 2018 **Actuarial Assistant, Life Insurance Pricing**, *New York Life Insurance Co.*, New York, NY
- Coded a new life insurance product design in life insurance modeling software
- Structured costs for new product balancing profitability, sales, and consumer benefit

May 2016 - Aug. 2016 **Actuarial Intern, Strategy Research & Analytics**, *New York Life Insurance Co.*, New York, NY
- Created tools used to set weekly income annuity payout rates based on strategic profitability and sales considerations via stochastic scenario generation
- Applied confidence intervals and statistical hypothesis testing to interest rate trends to influence the company's annuity pricing schedule

May 2015 - Aug. 2015 **Actuarial Intern, Healthcare Forecasting**, *United Healthcare*, Shelton, CT
- Created automated tools in Visual Basic to ensure the accuracy of medical claims forecasting models

Teaching Experience

Fall 2023 **Lab for College Algebra**, *Instructor of Record*

Spring 2023 **Numerical Analysis & Linear Algebra**, *Teaching Assistant*

Fall 2022 **Numerical Analysis**, *Lab Instructor*

Spring 2022 **Precalculus**, *Instructor of Record*

Fall 2021 **Intermediate Algebra**, *Instructor of Record*

Summer 2021 **Numerical Analysis Ph.D. Comprehensive Exam Preparation Course**, *Instructor of Record*

Spring 2021 **Differential Equations**, *Recitation Instructor*

Fall 2020 **Numerical Analysis**, *Lab Instructor*

Spring 2020 **Probability & Statistics for Life Sciences**, *Recitation Instructor*

Fall 2019 **Linear Algebra**, *Teaching Assistant*

Spring 2018 **Linear Algebra**, *Teaching Assistant*

Fall 2018 **Mathematical Patterns**, *Teaching Assistant*

Talks & Presentations

Conference Talks

Mar. 2024 **Analysis of randomized Householder-Cholesky QR factorization with multisketching**, *SIAM Conference on Parallel Processing for Scientific Computing (PP24)*, Baltimore, MD

Nov. 2023 **Analysis of randomized Householder-Cholesky QR factorization with multisketching**, *Mid-Atlantic Numerical Analysis Day*, Philadelphia, PA

Oct. 2023 **Analysis of randomized Householder-Cholesky QR factorization with multisketching**, *SIAM New York-New Jersey-Pennsylvania Section Annual Meeting*, Newark, NJ

Feb. 2023 **Optimal Size of the Block in Block GMRES on GPUs: Computational Model and Experiments**, *SIAM Conference on Computational Science and Engineering (CSE23)*, Amsterdam, The Netherlands

Apr. 2022 **Optimal Size of the Block in Block GMRES on GPUs: Computational Model and Experiments**, *Seventeenth Copper Mountain Conference on Iterative Methods*, Virtual

Mar. 2022 **Optimal Size of the Block in Block GMRES on GPUs: Computational Model and Experiments**, *Latest trends and insights into matrix theory, iterative methods, and preconditioning: A conference honoring the 65th birthday of Prof. Daniel B. Szyld*, Temple University, Philadelphia, PA

May 2021 **Experiences with Block GMRES on GPUs**, *SIAM Conference on Applied Linear Algebra (LA21)*, Virtual

Seminar Talks

Feb. 2022 **Optimal Size of the Block in Block GMRES on GPUs: Computational Model and Experiments**, *Temple University Applied Math Seminar*, Temple University, Philadelphia, PA

Poster Presentations

Jul. 2023 **Analysis of a Randomized QR Factorization**, *CSRI Student Lightning Talks*, Sandia National Laboratories, Albuquerque, NM

Oct. 2022 **Optimal Size of the Block in Block GMRES on GPUs: Computational Model and Experiments**, *Mid-Atlantic Numerical Analysis Day*, Temple University, Philadelphia, PA

Jul. 2022 **Random Sketch GMRES**, *CSRI Student Intern Poster Blitz*, Sandia National Laboratories, Albuquerque, NM

Workshop Participation

June 2021 **CRM Summer School**, *Virtual*, Centre de Recherches Mathématiques, Université de Montréal
Solving large systems efficiently in multiphysics numerical simulations

Honors & Awards

Jan. 2024 **Dissertation Completion Grant**, *Temple University*

June 2021 **Jay Novik Endowed Graduate Student Fellowship**, *Temple University*

May 2021 **SIAM Student Travel Award**, *Society for Industrial & Applied Mathematics*

May 2017 **Phyllis Zayon Steinberg Memorial Award in Mathematics**, *Temple University*

2013 - 2017 **College of Science and Technology Dean's List**, *Temple University*

2013 - 2017 **President's Full Tuition Scholarship**, *Temple University*

Service to Profession

2022-Present **Temple University SIAM Student Chapter**, *President*

2019-2021 **Temple University SIAM Student Chapter**, *Vice President*