

Christopher Housholder

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EDUCATION

Missouri State University - *Springfield, Missouri*

Aug. 2022–Dec. 2026 (expected)

B.S. in General Mathematics; B.S. in Data Science

Overall GPA: 4.00/4.00

RELEVANT COURSEWORK

Real Analysis, Complex Analysis, Functional Analysis, Numerical Analysis

RELEVANT PROJECTS

Harmonic Analysis, Williams College SMALL REU

2026–Present

Research Advisors: Alex Iosevich, Steven J. Miller, Eyvindur Palsson

- Developed Fourier Ratio bounds connecting spectral regularity and eigenvalue growth to approximate sparsity, stable random sampling, and sensitivity to sensor placement.
- Proved that on compact measured resistance spaces the reciprocal eigenvalue sum equals one half of the average resistance distance, yielding cutoff-independent sampling bounds and geometric restrictions on spectral dimension.
- Established regularity-based Fourier Ratio estimates using Hölder, fractional Sobolev, and energy methods, with applications to fractal spaces, electrical networks, and discretized signals.

Analytic Number Theory, Williams College SMALL REU

2026–Present

Research Advisor: Steven J. Miller

- Studied low-lying zeros in families of holomorphic cuspidal newforms and, assuming GRH, obtained quantitative lower bounds and positive-proportion results for forms possessing zeros near the central point.
- Analyzed the 1- and 2-level densities of families of cusp-form L -functions, showing that lower-order terms are non-universal and retain explicit arithmetic dependence on the prime factorization of the level.
- Investigated Fourier Ratios of arithmetic trace signals, proving maximal-order spectral delocalization for broad classes of non-isotrivial elliptic-curve families and related arithmetic families.

Combinatorics, Missouri State University

2023–Present

Research Advisor: Steven Senger

- Established sharp and near-sharp VC-dimension bounds for subsets of Hamming graphs, including tight size thresholds guaranteeing VC-dimension two or three in $H(2, q)$.
- Studied Erdős-type configuration problems for weighted dot-product trees, proving new lower bounds for the number of distinct weight patterns determined by finite planar point sets.
- Developed combinatorial and incidence-geometric arguments for repeated and distinct configurations, improving previously known bounds for several families of dot-product trees.

Numerical Analysis, Missouri State University

2024–Present

Research Advisors: Animesh Biswas, Hazhar Rahmani

- Designed a finite-recurrence reconstruction method for distributed interpolation under MapReduce, allowing both model construction and extrapolation to be performed without centralized polynomial preprocessing.
- Proved exact recurrence reconstruction for sampled polynomials, exponentials, trigonometric sums, and damped trigonometric sums, together with $O(h^k)$ local residual bounds for general smooth sampled functions.
- Developed a spatial-temporal nonlocal traffic-flow model with adaptive kernels, established its analytical properties, and validated the model on high-resolution NGSIM trajectory data.

Artificial Intelligence, Missouri State University

2025–2026

Research Advisor: Yifan Zhang

- Conducted a systematic ablation study of five Transformer-based multivariate time-series forecasting models, comparing full encoder–decoder, encoder-only, and decoder-only architectures across multiple benchmarks and forecasting horizons.
- Demonstrated that decoder-only architectures frequently match or outperform full encoder–decoder models while substantially reducing model complexity, challenging the assumption that NLP-style architectural symmetry is necessary for time-series forecasting.

RELEVANT EXPERIENCE**Chief Information Officer**, Omni Manufacturing Inc. – Houston, TX

Jan. 2024 – Present

- Built and maintained internal software systems and data workflows supporting company operations.
- Developed and managed the company’s web presence, analytics infrastructure, and related digital systems.
- Supported customer-facing technical communication by translating operational and technical requirements into usable software and systems solutions.

Manuscript Referee, *Journal of Number Theory* and *The Fibonacci Quarterly*

2026

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- Reviewed submitted manuscripts for mathematical correctness for publication.

SKILLS**Computer:** Python, C++, Java, SQL, Linux, PyTorch, PySpark**Language:** fluent in English, conversational in Korean**Laboratory:** $\text{\LaTeX}$ **ADDITIONAL EXPERIENCE**Association for Computing Machinery, Missouri State University **President**

Aug 2025 – Present

- Lead the university’s ACM student chapter, coordinating meetings, technical programming, and professional-development activities for computing students.
- Organize events and initiatives connecting students with opportunities in software development, research, and the broader computing community.
- Manage officer coordination, chapter planning, and communication with members and university faculty.

Webster County 100 Club **Secretary**

Jan. 2023 – Present

- Lead organizational planning, member coordination, and community engagement for the Webster County 100 Club.
- Oversee meetings, initiatives, and communication among members while helping set organizational priorities.
- Represent the organization in community partnerships and support efforts to expand participation and local impact.

RESEARCH INTERESTS

- Harmonic Analysis
- Spectral Theory
- Numerical Analysis
- Analytic Number Theory

PUBLICATIONS, PREPRINTS, & PRESENTATIONS

Housholder, Christopher L., Layna Mangiapanello, and Steven Senger. “VC-Dimension of Subsets of Hamming Graphs.” *Graphs and Combinatorics*. Accepted for publication.

Autry, Aaron, Slade Gunter, Christopher Housholder, and Steven Senger. “Bounds on Distinct and Repeated Dot Product Trees.” *CANT 2024*. Published.

Housholder, Christopher, Xuantonng Ning, Zelun He, and Yifan Zhang. “Rethinking the Encoder-Decoder Structure for Transformer-Based Time Series Forecasting.” *Information Technology: New Generations (ITNG)*, Springer, 2026.

Agarwal, Shaurya, Animesh Biswas, Christopher Housholder, and Archie Huang. “Spatial-Temporal Nonlocal Traffic Dynamics: Analytical Properties, Adaptive Kernel Formulation, and Empirical Validation.” Submitted to *IEEE Transactions on Intelligent Transportation Systems*.

Chen, Lucas, Christopher Housholder, Joshua Khan, Steven J. Miller, and Devayani Pradhan. “Bounding the Number of Zeros Near the Central Point in Families of Cuspidal Newforms.” Preprint, arXiv:2608.15063.

Housholder, Christopher, Alex Iosevich, Steven J. Miller, and Eyvindur Pálsson. “The Fourier Ratio on Resistance Spaces and Applications to Electrical Networks.” Preprint.

Amit, Yuval, Lucas Chen, Christopher Housholder, Joshua Im, Alex Iosevich, Steven J. Miller, Eyvindur Pálsson, and Devayani Pradhan. “The Fourier Ratio of Elliptic, Hyperelliptic, and L -Function Families.” Preprint.

Alberti, Nico, Christopher Housholder, Alex Iosevich, Steven J. Miller, and Eyvindur Pálsson. “The Fourier Ratio and Sensitivity to Sensor Placement.” Preprint.

Amit, Yuval, Lucas Chen, Lawrence Dillon, Christopher Housholder, Xiaoyao Huang, Joshua Khan, Say-Yeon Kwon, Meiling Laurence, Steven J. Miller, Vishal Muthuvel, Devayani Pradhan, Luke Rowen, Pramana Saldin, Connor Yau, and Steven Zanetti. “Breaking Universality in the Lower Order Terms in the 1-level and 2-level Density of Holomorphic Cusp Newforms.” Preprint.

Housholder, Christopher, and Hazhar Rahmani. “Scalable Interpolation under MapReduce and Finite-Recurrence Reconstruction.” Preprint.

Amit, Yuval, Lucas Chen, Christopher Housholder, Joshua Im, Joshua Khan, Steven J. Miller, Mateo Palomares, and Devayani Pradhan. “Product and Quotient Set Dominance in Finite Groups.” Preprint.

Amit, Yuval, Azmera Gebre, Christopher Housholder, Joshua Khan, Steven J. Miller, Emily Upton, and Connor Yau. “Random Fibonacci Tilings.” Preprint.

Housholder, Christopher L. “VC-Dimension of Subsets of Hamming Graphs.” *MAKO Undergraduate Mathematics Research Conference*.

Housholder, Christopher L. “Rethinking the Encoder-Decoder Structure for Transformer-Based Time Series Forecasting.” *The 23rd International Conference on Information Technology: New Generations*.

Housholder, Christopher L. “Random Fibonacci Tilings.” *The 22nd International Conference on Fibonacci Numbers and Their Applications*.

Housholder, Christopher L. “The Fourier Ratio and Sensitivity to Sensor Placement.” *SUMRY Mini-conference*.

Housholder, Christopher L. “The Fourier Ratio and Sensitivity to Sensor Placement.” *Young Mathematicians Conference*.

AWARDS & HONORS

- **Dean’s List** — August 2022 - May 2026
- **Chief of Staff, Williams College SMALL REU.**
- **Ed Huffman Mathematics Scholarship** — 2024
- **1st Place** — CNAS Undergraduate Research Symposium, four times.