

Gabe Flanagin

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Education

Western Washington University, Bellingham, WA 2025–2027
M.S. in Mathematics

Western Washington University, Bellingham, WA 2021–2025
B.S. in Mathematics; Minor in Chemistry

Research Interests

Numerical partial differential equations; optimization and optimal control; inverse problems; scientific computing; mathematical modeling

Research Experience

Task-Specific Models for Cryo-Electron Tomography Jun.–Aug. 2026
G-RIPS, Zuse Institute Berlin (ZIB) — Mentors: Noushin Hajarol and Frosina Stojanovska

- Fine-tuned CryoSiam for segmenting biological structures in three-dimensional cryo-electron tomograms.
- Developed and evaluated PyTorch training pipelines for low-signal imaging data affected by noise and missing-wedge artifacts.
- Conducted GPU-based training experiments on computing clusters using Linux, Slurm, and CUDA-enabled workflows.

Terrain-Aware Reaction–Diffusion Models and Optimal Control 2026–Present
In collaboration with Alex Escoto

- Develop reaction–diffusion models for wildlife disease spread on landscapes with heterogeneous terrain and land cover.
- Construct anisotropic diffusion tensors from topographic information to represent direction-dependent animal movement.
- Formulate and numerically investigate optimal-control strategies involving vaccination, culling, and predator introduction using adjoint-based methods.

Boundary Integral Methods for Elliptic Interface Problems 2026–Present
Advised by Dr. Zhen Chao

- Derive boundary-integral formulations for Poisson and linearized Poisson–Boltzmann interface problems.
- Implement single- and double-layer potential methods and verify jump relations, interface conditions, and far-field behavior.
- Validate numerical formulations through benchmark solutions and convergence studies.

Hamilton–Jacobi Equations and Max-Plus Approximation 2025
Advised by Dr. Rick Barnard

- Implemented a max-plus method for approximating value functions governed by Hamilton–Jacobi–Bellman equations.
- Extended a quadratic under-approximation result from the C^2 setting to functions that are C^1 except at finitely many locally convex nonsmooth points.
- Generalized a semiconvexity-preservation theorem for the linear-quadratic regulator semigroup, proving preservation for every positive time step in a broader function class.

First-Principles Modeling of Chalcogenide Semiconductors 2024–2025
Advised by Dr. Robert Berger

- Performed density-functional-theory calculations to study cation ordering, geometric distortion, and electronic properties in ABX_2 (I–V–VI₂) chalcogenide semiconductors.
- Introduced a novel model connecting atomic sequences along B–X bond axes with local 2-center 2-electron and 3-center 4-electron bonding motifs, rationalizing structural variation and its relationship to tunable electronic properties.

- Produced a first-author peer-reviewed publication in the *Journal of Physical Chemistry C*.

Publications

Flanagin, G. and Berger, R. (2026). “Rationalizing Patterns in the Cation Ordering, Geometric Distortion, and Electronic Properties of a Class of I–V–VI₂ Chalcogenide Semiconductors.” *Journal of Physical Chemistry C*. doi:10.1021/acs.jpcc.5c05853.

Presentations and Talks

An Introduction to Spatiotemporal Rabies Models, WWU Mathematics Colloquium Series Apr. 2026
Using Max-Plus Algebra to Compute Reachability in Dynamic Systems, WWU Mathematics May 2025
 Scholars Week

Teaching Experience

Western Washington University 2025–2026
Graduate Teaching Assistant, Department of Mathematics
 • Instructor — MATH 115: Precalculus II Spring 2026
 • TA Liaison — MATH 114: Precalculus I Winter 2026
 • Instructor — MATH 112: Functions and Algebraic Methods Fall 2025

Awards and Honors

Richard Greene Scholarship, Western Washington University 2026

Programming and Computational Tools

Python (NumPy, SciPy, PyTorch), MATLAB, Bash, FEniCSx, PETSc, VASP, Linux, Slurm, HTCondor, CUDA, Git, ParaView, Amira, QGIS