Ritoban Roy-Chowdhury

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Education

Sept 2022 – Jun 2026
B.S. in Computer Science, *University of California, San Diego*, (Total) GPA: 3.94
Significant courses: Advanced Data Structures, Analysis of Algorithms, Theory of Computation, Programming Languages, Cryptography, Digital Logic) Discrete Differential Geometry, Parallel Computation, Physics Simulation

Sept 2022 – Jun 2026
B.S. in Mathematics, *University of California, San Diego*, GPA: 3.94
Significant courses: Honors Linear Algebra & Multivariable Calculus, Enumerative Combinatorics, Real Analysis, Partial Differential Equations, Probability, Mathematical Statistics, Numerical PDEs, Differential Geometry, Functional Analysis.

Publications

Ritoban Roy-Chowdhury. Hamiltonian fluids from sub-riemannian geometry. *UCSD CSE Honors Program. In Preparation for Siggraph 2026.*

Nathan Urban Anthony Gruber Ritoban Roy-Chowdhury, Irina Tezaur. Onsager's variational principle for solving inverse problems. *CSRI Summer Proceedings*, 2025.

Mohammad Sina Nabizadeh, Ritoban Roy-Chowdhury, Hang Yin, Ravi Ramamoorthi, and Albert Chern. Fluid implicit particles on coadjoint orbits. *SIGGRAPH Asia*, 2024. **Best Paper Honorable Mention**.

Ritoban Roy-Chowdhury, Tamar Shinar, and Craig Schroeder. Higher order divergence-free and curl-free interpolation on mac grids. *Journal of Computational Physics*, page 112831, 2024.

Craig Schroeder, Ritoban Roy Chowdhury, and Tamar Shinar. Local divergence-free polynomial interpolation on mac grids. *Journal of Computational Physics*, 468:111500, 2022.

Research Experience

June 2025–Present
Sandia National Labs, Advisors: Anthony Gruber, Irina Tezaur, Nathan Urban

- Explored Onsager's Variational Principle (OVP), which describes irreversible thermodynamical systems, and its connections to gradient flows and optimal transport.
- Developed a machine learning-based framework for solving inverse problems, for systems described by OVP.
- Wrote a paper for the Sandia CSRI Summer Proceedings based on my work; planned journal submission by end-of-year.

Sept 2023–Present
University of California, San Diego, Advisor: Albert Chern

- Learned about differential geometry, applied to Hamiltonian fluid mechanics: Lie groups of diffeomoprphisms, symplectic/Poisson manifolds, coadjoint orbits.
- Helped develop a structure preserving, high order accurate fluid simulation algorithm based on FLIP, leading to a SIGGRAPH Asia publication that won a Best Paper Honourable Mention.

April 2021–Aug 2023 — **University of California, Riverside**, Advisors: Prof. Tamar Shinar & Prof. Craig Schroeder at UCR

○ Used the National Research Platform Kubernetes cluster to Design and Run Numerical Experiments. I've continued to do research in structure preserving numerical methods for fluids, inspired by differential geometric ideas.

○ Implemented Physics-Based Animation algorithms in Rust and C++: Smoothed Particle Hydrodynamics for Fluids, Material Point Method for Elastic Solids, Snow.

○ Two Journal of Computational Physics papers developed interpolation algorithms for divergence and curl-free vector fields.

○ Collaborated on a Geometric Deep Learning project on surface reconstruction from Particle Data, experimenting with PointNet++, KPConv, etc.

Teaching and Leadership

September 2024 – Present — **Tutor for Digital Logic, Programming Languages, Computer Graphics**, *University of California, San Diego*

Tutored for CSE 140 (Digital Logic), CSE 130 (Programming Languages), CSE 167 (Computer Graphics). Responsibilities included office hours, answering question on Piazza, grading homework and exams, proctoring exams, and helping write challenging exam questions.

Jan 2023 – Jan 2025 — **IEEE Supercomputing Chair**, *San Diego Supercomputing Center*

Worked on a mesh networking project, introduced students to distributed computing using a Raspberry Pi Cluster, organized the Single-Board Cluster Competition with over 5 teams from around the world, mentored the UCSD Student Cluster Competition team on computational physics and numerical analysis applications.

Programmming Projects

○ **TritonTrails** A React/TypeScript web application that that displays walking trails in the San Diego Area. Users can create accounts, post images, and reviews, filter trails by length, difficulty, weather, and more! Part of a CSE 110, Software Engineering project. [code]

○ **Physics Simulator** A real-time physics simulator written in Rust, with implementations of Smoothed Particle Hydrodynamics for fluid simulation and the Material Point Method for elastic solids and snow. [code]

○ **Firework** A path tracing 3d renderer written in Rust, featuring multithreading, BVH acceleration structures, diffuse, specular, glass, and emissive materials, several different kinds of analytic objects and meshes that can be rendered, particle systems, simple volumetics, and scene serialization using YAML. [code]

○ **Chess Engine** A Chess GUI and engine I wrote as my first major project in the Rust programming language. The interface was written using the Piston OpenGL library, with custom UI code, and the chess AI used a parallelized minimax algorithm for finding moves, alpha-beta pruning, a hand-written transposition table data structure avoid redundant computations. [code]

Skills

Programming Languages
Rust, Python, C++, JavaScript, C#, Java, Haskell

Tools
Blender, Unity, Numpy, Scipy, PyTorch, Open3D, Houdini, SageMath, LaTeX, Bash, (n)Vim, Git, OpenMPI, Kubernetes, SLURM