

Frank Fan

Toronto, ON, Canada | 647-885-9079 | yuheng.fan@uwaterloo.ca
frank-fan.com | linkedin.com/in/frankfan8

SUMMARY

PhD student in computer graphics at the University of Waterloo working on physically based rendering, spectral light transport, and biophysically based material appearance modelling, with a paper at the Eurographics Symposium on Rendering (EGSR) 2026. Four software internships in 3D simulation, visualization, and game development, including a RocFall3 feature, built as the sole developer, that still ships today.

EDUCATION

PhD, Computer Science | University of Waterloo, Waterloo, ON Sep 2026 – Aug 2030 (expected)
Advisor: Prof. Gladimir Baranoski, Natural Phenomena Simulation Group. Funded by an NSERC research grant.
Research area: physically based rendering, spectral light transport, predictive appearance modelling.

Master of Mathematics (MMath), Computer Science | University of Waterloo, Waterloo, ON Sep 2024 – Apr 2026
Advisor: Prof. Gladimir Baranoski, Natural Phenomena Simulation Group. GPA 4.0/4.0.
Thesis: [A Biophysically-Based Framework for the Simulation and Visualization of Chlorophyll Fluorescence Under Different Illumination Conditions](#).

Bachelor of Computer Science (BCS) | University of Waterloo, Waterloo, ON Sep 2019 – Apr 2024
GPA 3.8/4.0. University of Waterloo Entrance Scholarship (2019).
Relevant coursework: CS488 Computer Graphics, CS489 Advanced Topics in Computer Graphics, CS370 Numerical Computation, CS341 Algorithms.

PUBLICATIONS

- Y. Sun, G. V. G. Baranoski, **F. Fan**, S. Steinfield. [A Phasor-based Camera-Space Construction for Making Radiometric Accumulation Assumptions Explicit](#). *Eurographics Symposium on Rendering (EGSR)*, 2026.
- **F. Fan**, G. V. G. Baranoski. [A Study on Rendering Techniques to Visually Represent Sparkles](#). *Technical Report CS-2024-02*, University of Waterloo, 2024.

RESEARCH EXPERIENCE

Graduate Researcher | Natural Phenomena Simulation Group, University of Waterloo Sep 2024 – Present

- Built a biophysically based, multispectral framework that simulates and renders chlorophyll fluorescence under ultraviolet and visible excitation, grounded in fluorescence spectroscopy and extensible to other fluorescent materials (MMath thesis).
- Implemented it in C++ as a new participating-medium class in pbrt-v4, modelling absorption from measured absorbance spectra, Rayleigh scattering, and fluorescent re-emission, weighted within pbrt-v4's spectral multiple importance sampling.
- Produced, to our knowledge, the first renderings of fluorescence under combined ultraviolet and visible light, showing the hue shifts and colour mixing this combination produces; validated predictions against qualitative trends in measured data.
- Co-authored an EGSR 2026 paper that makes the radiometric accumulation assumptions of rendering explicit through a phasor-based camera-space construction; shaped its introduction and how it motivates the method.

Undergraduate Research Assistant | University of Waterloo, Waterloo, ON Jan 2024 – Apr 2024

- Studied the Uniform Theory of Diffraction (UTD) with GGX microfacet models to capture wave-optics effects in physically based BRDFs, supervised by Prof. Shlomi Steinberg.
- Compared wave-optical and geometric-optics reflectance models for real-time and offline rendering.

Undergraduate Research Assistant | University of Waterloo, Waterloo, ON Sep 2023 – Dec 2023

- Compared stochastic, spectral, and rasterization-based techniques for rendering sparkle phenomena on visual fidelity and computational cost, supervised by Prof. Gladimir Baranoski.
- Wrote the findings up as Technical Report CS-2024-02, published by the University of Waterloo.

TEACHING EXPERIENCE

Teaching Assistant | University of Waterloo, Waterloo, ON Sep 2024 – Present

- TA for six course offerings: CS488 Computer Graphics (3 terms, including 1 as Lead TA), CS398 Introduction to Graphics Programming, CS370 Numerical Computation, and CS245 Logic and Computation.
- As Lead TA for CS488, coordinated a team of 2 TAs supporting about 60 students and 250 assignments and final rendering projects.

- Held office hours, marked assignments and projects, and answered student questions on Piazza about ray tracing, rasterization, transformation hierarchies, and shader debugging.

WORK EXPERIENCE

Software Developer Intern | Rocscience Inc., Toronto, ON

Jan 2023 – Apr 2023

- As the sole developer, built the 3D Barrier Design and Analysis feature of [RocFall3](#), a commercial rockfall simulator still shipping today, which engineers use to size and place rockfall barriers from simulated 3D impacts.
- Developed C# algorithms computing trajectory height, impact angle, velocity, and kinetic energy for thousands of simulated rock paths, from collisions between falling rocks and mesh surfaces.
- Built interactive 3D visualizations of rock-barrier impacts, including trajectory height and energy heatmaps, using OpenGL through the devDept EYESHOT framework.

Software Developer Intern | Tactic Studios, Toronto, ON

May 2022 – Aug 2022

- Built a Java CI pipeline on the Perforce API for the studio's in-house game engine, automating the branch syncing, merging, remote builds, and asset baking that developers had done by hand.

Software Developer Intern | Rocscience Inc., Toronto, ON

Sep 2021 – Dec 2021

- Rearchitected C++ spatial partitioning for polygon meshes of about one million triangles, replacing a 3D uniform grid with an octree to accelerate point-mass-to-mesh collision detection in rockfall simulation.

Software Developer Intern | PSI Technologies Inc., Saskatoon, SK

Jan 2021 – Apr 2021

- Built a tool in C# (.NET WinForms, devDept EYESHOT) that slices a 3D model along any plane to expose its interior cross section, in geotechnical software used to visualize, simulate, and construct roads.
- Implemented the real-time mesh clipping algorithm that regenerates the cross-section geometry live as the user moves the plane, on models of millions of triangles.

PROJECTS

Recursive Ray Tracer | C++, OpenGL

2022

- Built a recursive ray tracer supporting reflection, refraction, glossy reflection and refraction, texture mapping, bump mapping, and stochastic anti-aliasing.

Stochastic Colloidal Particle Collision Simulator | MATLAB, Monte Carlo methods

2023

- Implemented a physically based model of Brownian motion in colloidal particle systems, using stochastic techniques and Monte Carlo integration to detect and resolve inter-particle collisions.

TECHNICAL SKILLS

Languages: C++, C, C#, Python, GLSL, MATLAB, Java, JavaScript, SQL, Bash, Scala, PHP

Rendering: Physically based rendering, spectral rendering, light transport, radiometry, fluorescence simulation, predictive appearance modelling, BRDF and microfacet models (GGX), ray tracing, path tracing, Monte Carlo integration, rasterization, OpenGL, GLSL shaders, pbrt-v4, texture and bump mapping, mesh processing

Algorithms: Octrees, bounding volume hierarchies (BVH), spatial data structures, collision detection, computational geometry, numerical methods, stochastic simulation, performance optimization

Tools: Git, Perforce, Subversion, Linux, .NET, WinForms, ImGui, devDept EYESHOT, PostgreSQL, CI/CD, LaTeX