

Education

MS Computing, Graphics & Visualization

University of Utah

Aug 2022 - July 2024

3.9 GPA

BS Computer Science

New Mexico Institute of Mining and Technology (NMT)

Aug 2016 - May 2020

3.79 GPA

Professional Experience

Graduate Research Assistant @ University of Utah

Fall 2023 - Now

Research with Dr. Cem Yuksel (cem@cemyuksel.com) on a novel, intuitive 3D modeling methodology combining workflows from polygonal modeling, CAD, and sculpting.

- Co-wrote a fully functional 3D modeling application in C++ and OpenGL as a preliminary for a future user study and publication
- Implemented a bespoke half-edge mesh representation scheme, reducing 36 to 16 bytes per triangle, minimizing GPU memory transfer overhead during modeling tasks such as extrusion and slicing, which were implemented using compute shaders
- Implemented mesh editing tools such as extrusion, scale, translate, rotate, manipulation of geometry using harmonic weight calculation to preserve mesh details

Post-Baccalaureate Student @ Los Alamos National Laboratory

June 2020 - July 2022

- Researched parallel interpolation algorithms for large scientific data sets under the mentorship of Dr. Daniel Sheppard (danielsheppard@lanl.gov), publishing "[SIMD-Optimized Search Over Sorted Data](#)" in ASME Computing and Engineering. The result was a SIMD-optimized binning and search algorithm that improved over binary search by 110% in vectorized contexts.

Undergraduate Research Assistant @ New Mexico Institute of Mining and Technology

Jan 2019 - June 2020

- Worked with Dr. Denis Cohen (denis.cohen@gmail.com), and a fellow student to rewrite a complex 3D landslide simulation from scratch, while redesigning it to operate in parallel on unstructured meshes rather than a regular grid. We reduced the runtime for large datasets by 80% while eliminating nearly 50% of the code.

Parallel Computing Research Internship @ Los Alamos National Laboratory

June 2019 - Aug 2019

- Worked as a student in the Parallel Computing Summer Research Internship at LANL researching performance analysis techniques on parallel algorithms, under mentorship of Dr. Rao Garimella (rao@lanl.gov)

Projects

Elastic Hair Simulation and Rendering

2023

- Implemented an interactive hair simulation using discrete elastic rods and rigid-body collisions using position-based dynamics. Wrote an OpenGL compute shader able to generate 64 rendered hairs per simulated hair in < 10ms every frame.
- Implemented deep opacity shadow maps, alongside a physically-based hair shading model for a realistic-appearing result.

GPU-Accelerated Surface Meshing

2023-2024

Implemented a dual-mesh isosurface extraction algorithm as well as a surface geometry smoothing scheme using a trilinear interpolation as a multi-stage OpenGL compute shader pipeline. The pipeline is able to generate 0.7 million vertices and triangles in less than 10 milliseconds on modern hardware.

WebGL Compact Cellular Automata

2020

- Developed a method for storage of arbitrary, multi-state cellular automata rules which exponentially improves on naive implementations that rely on enumerating permutations of neighbor sequences.
- The method is able to store and retrieve rules from 4k textures, with a maximum of 14 states fitting into less than 2^{25} bits. A naive implementation would require nearly 2^{44} bits. Outside the constraints of a 4k texture, the method generalizes to any number of states, and any size or dimension of neighborhood, not just the standard 8-cell 2D moore neighborhood.

Fast Particle Simulation

2021

Co-developed a highly optimized parallel particle simulator in Rust, able to simulate and render over 1,000,000 colliding particles at interactive frame rates.

CUDA Raytracer

2020

Created a parallel raytracing program using NVIDIA CUDA C++ and OpenGL. Supports BSDF materials.

Technical Skills

Confident with C++, OpenGL, and CMake. Somewhat experienced with CUDA, DirectX 12, OpenMP, Rust, WebGPU, WebGL, and Vulkan. Working knowledge of linear algebra, numerical methods, and parallel algorithm design.