

Fall 2023: ME759 Final Project Proposal

Quick intro:

- Name: **Kincannon Wilson**
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- Home department: **Computer Sciences**
- Status: Undergraduate student/**MS Student**/PhD Student
- Name of your teammate (if applicable):

Project Title: N-Body Simulation and Virtual-Reality Viewing

Link to git repo for project: <https://git.doit.wisc.edu/KGWILSON2/759-final>

Problem statement: I will evaluate different approaches to the N-Body problem of simulating the movement of bodies in a vacuum due to gravity. I will report on various strategies one can use to speed up the calculations for this problem, and demonstrate the performance increases. Finally, I will create a Virtual Reality application deployed on a Meta Quest headset that lets a user see the result of the calculation.

Motivation/Rationale: My research is under the Virtual Environments group at the Wisconsin Institute for Discovery. I am interested in virtual reality, simulations, and visualizations, so viewing the result in VR fits with my research interests. The evaluations of different algorithmic approaches to the problem addresses the topics taught in 759.

Explain how you contemplate going about it: I will evaluate the differences between sequential CPU, GPU, and OpenMP for use in the N-Body problem. The main speedup approach I'm considering is tiling, where particles are grouped together and the forces between particles in different groups is calculated in a more global fashion.

ME759 aspects the proposed work draws on: Timing, calculating speedups, tiling, and various tricks like loop unrolling.

Deliverables: By the final delivery date on 12/13/2023, I will provide my code in my GitLab repo and a report detailing the approaches taken, results generated, and lessons learned.

How you will demonstrate what you accomplished: In addition to the code and report, I will also create a video of a recording generated from within the headset.

Other remarks: None