Alice Ku and Daniel Sun

Prof. Tom Abel

Physics 113: Computational Physics

12 May 2023

# Final Project Proposal

As both students of physics and musicians in the orchestra, we wanted to do a final project which combines physics and music. We seek to numerically characterize the unique timbre (sound quality) of various musical instruments. In doing this, we plan to study standing wave solutions to the wave equation, with boundary conditions corresponding to the instrument we are trying to model. We will add effects like damping and anharmonicity to modify the wave equation. By computing the Green's function (impulse response) for each "instrument" that we model, we can simulate the resulting oscillations for an arbitrary driving signal. Finally, we will compile our results in audio form and compare the computed results to what the instruments actually sound like in reality.

## References

[1603.05516] The wave equation for stiff strings and piano tuning