Arpan Rau

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Project Script – Double Pendulum

Intro:

Jeremy: Hi, I’m Jeremy.

Arpan: Hi, I’m Arpan. Our project was to model a double pendulum. We essentially had the goal in mind of making a model that reflects reality.

Simple Model:

Energy Conservation:

Arpan: In order to validate our model, we had to confirm that it conserves energy; as we are abstracting away friction and air resistance, energy should be conserved. To do this, we took the sum of the kinetic and potential energy of each object, setting the initial potential energy to be zero. On this plot you can see the energy vs time of our model.

Energy stays constant over small windows of time. Over large periods of time, integration error in our code tends to make the amount of energy in our system slowly increase. This becomes noticeable after around 150 seconds. This is fine because our abstraction probably does not represent a real system after that timespan anyways because friction and air resistance would start to be significant (depending on the size/mass of the pendulum).

This validates that our model follows the real-world behavior of the system (neglecting friction). We also drove our first mass to near zero, turning the model into a pendulum (which worked), and drove our second mass to near zero, making the model again a pendulum with extremely chaotic motion of the 2nd pendulum.

Visualization:

Jeremy: Since our primary goal was to construct our model, once we had it constructed we were mostly done. We did, however, produce some interesting results for visualizing the behavior of the pendulum, including a real time animation of the pendulum and a position trace of the pendulum over several seconds.

Future work and Conclusions:

Arpan: There are quite a few things we could do with this model. We considered using it to evaluate the length of trapeze it would take to make a trapeze artist lose their limbs due to the g-forces, but decided that that was too macabre. Also, there is no data on how easy it is to tear apart someone’s limbs.

I’d like personally to have incorporated friction or some sort of damping into our model.

Jeremy: I thought using this to analyze the motion of swinging a golf club or tennis racket would be really interesting.