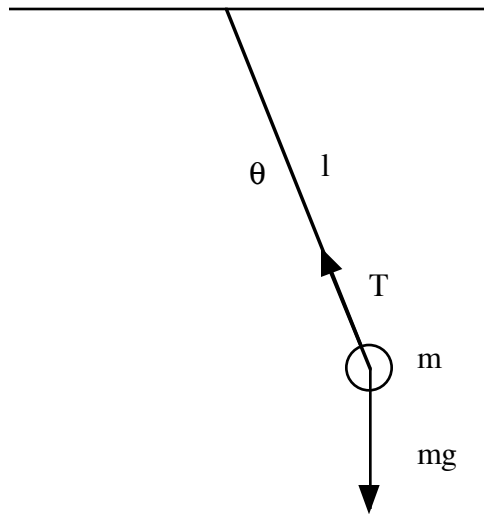


Assignment 4: Pendulum Motion

Assignment: Adapt your RK4 to study the motion of a pendulum and find the period vs. amplitude dependence. Find and plot the period of a pendulum with length 1 m for amplitudes from 0 to approximately π radians.

Background: The differential equation for the motion of the pendulum can be found starting with the torque.



$$\begin{aligned}\vec{\tau} &= \vec{r} \times \vec{F} \\ I\alpha &= -l m g \sin \theta \\ m l^2 \frac{d^2 \theta}{dt^2} &= -l m g \sin \theta \\ \frac{d^2 \theta}{dt^2} &= -\frac{g}{l} \sin \theta\end{aligned}$$

We can easily identify the “f” function to be put into the RK4 algorithm.

How to do it.

Adapt your existing RK4 to solve for the motion. You will need to find the period by measuring the time from one point to a like point on the motion. You should have received a code “snippet” in your email that gives an example of how to do this. It finds the average time from zero crossing with positive slope to the next identical point. The code find a all of these in the run that you have made and finds the average period.

Run and plot:

Plot period vs amplitude and submit your plot with your code. Be sure that the step size is small enough that the result is stable.