Digital Pendulum
Physics 413
Old Dominion University

Goal: To measure the damping and large angle oscillatory behavior of a real pendulum.

Physics: The simple pendulum is truly simple. The real pendulum is much more complicated. You will need to determine the appropriate equations to fit to the data. Things to consider include the length of a physical pendulum, non-harmonic behavior at large angles, frictional damping, and air resistance damping. (Hint: which damping term is velocity-dependent?)

Apparatus: Use the pendulum hanging on the wall next to the sink. It has a potentiometer that can be used to measure the pendulum angle. The height of the pendulum bob is adjustable. An extra flat piece of metal (or stiff cardboard) can be attached to the pendulum to vary the drag.

Procedure: Apply +10 V to the input leads of the potentiometer. Measure the output voltage as a function of pendulum angle in order to calibrate the potentiometer. Measure the pendulum angle as a function of time for

a) small initial displacements of the pendulum measured for a few periods (at two different bob heights)
b) large initial displacements of the pendulum (where the small angle approximation is no longer valid) measured for a few periods
c) medium initial displacements of the pendulum measured for many periods (to include the effects of damping)
    a. at two different pendulum bob heights
    b. with an additional flat piece of material attached to the pendulum to change the drag

Data Analysis: Fit the data. Draw the appropriate conclusions.

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