Mechanical Resonance

Purpose: Demonstrates resonance in a mechanical system driven at low frequencies.

This is a fairly dramatic example of resonance. The low-frequency driver assembly hooks onto one end of the long Pasco collision track. It transforms uniform circular motion into a constant-amplitude, sinusoidal, linear driving force. A collision cart, suspended between two springs, oscillates back and forth under this force

Note: Special hooks on the small end of the springs allow for attachment to the cart (see detail below).

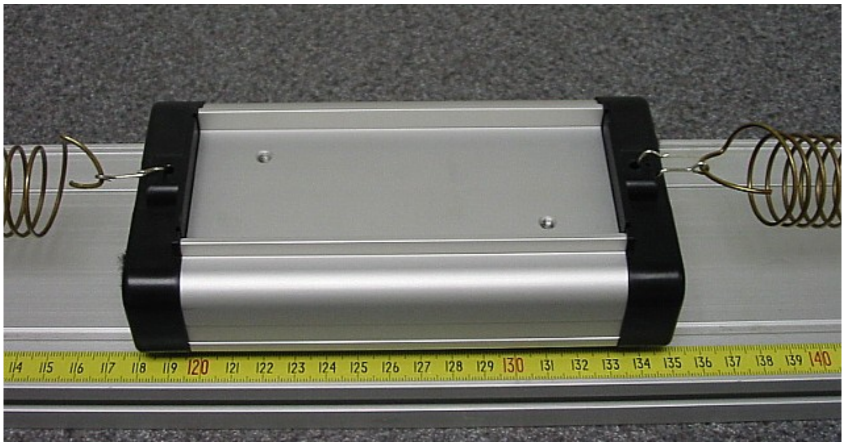
The driver unit's frequency is proportional to the driver voltage, and varies roughly from 0-3 Hz for input from 0-12V. Using a stopwatch and counting oscillations, the frequency has been calibrated for this particular setup (see graph below). The frequency depends on the load, and so probably will always depend on the setup.

Step 1. It is probably best to show first that the system has a natural frequency of oscillation. With the driver turned off, displace the cart and let it go. Using a stopwatch, I measured a natural frequency of 0.83 Hz.

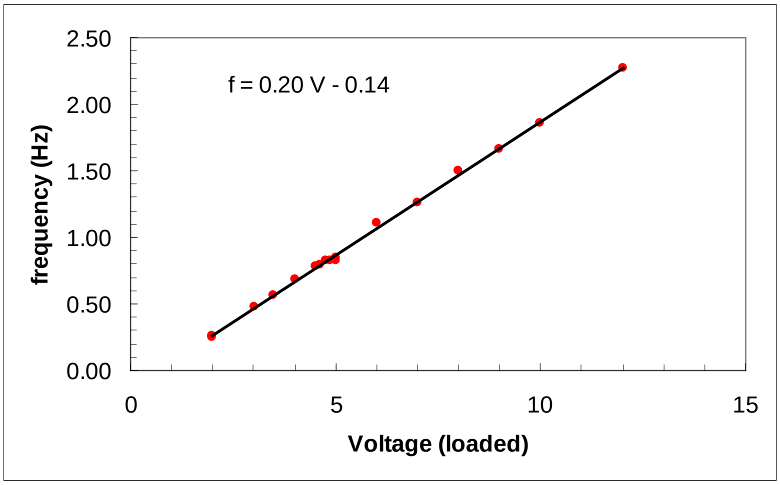
Step 2. Start the driver and watch. I think it is most dramatic to start at a high frequency, say with the power supply set at 10 V. Since we are dealing with low frequencies, it is important not to change the frequency too fast; It takes a few moments to attain steady state motion. Off resonance, the cart oscillates back and forth only a few centimeters. However, near resonance the cart will move with a surprisingly large amplitude. In my case it used up almost the whole length of track. The resonance is very sharp, as the graph below shows. Here, the 'amplitude' is really 2A, the total distance traveled by the cart.

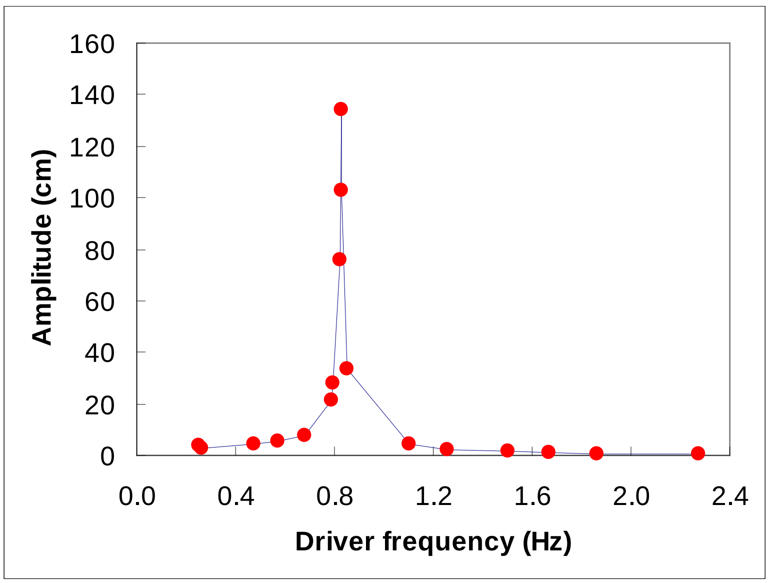
Resonance Extras

The Setup



Detail of Spring Attachment





Extra Equipment: Pasco collision track and cart (see collision carts), and a 12V power supply. Maybe a stopwatch if you want to determine frequency.

Location: Shelf A3.

See Driver Manual