3.3.1.1: Resonance Examples

Resonance occurs in an oscillating system when the driving frequency happens to equal the natural frequency. For this special case the amplitude of the motion becomes a maximum. An example is trying to push someone on a swing so that the swing gets higher and higher. If the frequency of the push equals the natural frequency of the swing, the motion gets bigger and bigger.

For many systems we can make a graph of amplitude versus frequency and see where resonance occurs. Suppose we have a mass on a spring and attach a vibrator with a frequency we can choose. We start at low driving frequencies and measure the amplitude of the motion (how far it bounces) at each frequency. We might end up with a graph like the one below. Notice that the amplitude was a maximum at a driving frequency of 2.5 Hz. So the natural frequency of the system without the vibrator was also 2.5 Hz. In other words, we are driving the spring at resonance.

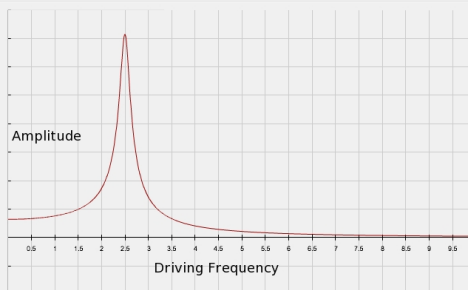

Figure $3.3.1.1.1$

Video/audio examples:

- Swing Resonance. What is the driving force in this case?
- Air track resonance cart. Why is the amplitude of the cart larger at one particular frequency?
- Resonance cart. Note there are three different natural frequencies in this example. Why is this so?
- Tidal resonance at the Bay of Fundy. The high water mark is reached every 12 hours. Why is it 12 instead of every 24 hrs?