

4.4.1: Introduction

A tensioned string is a classic example of controlled vibration which may create waveforms with many overtones or harmonics. This may result in a waveform considerably more complex in appearance than a simple sine wave although it will have a discernable period. Pythagoras studied the variables in the system circa 500 BCE and made important contributions to the science behind Western musical scales. The frequency of oscillation of a tensioned string is

$$f = \frac{1}{2l} \sqrt{\frac{T}{u}}$$

where f is the frequency in hertz, T is the tension in kilogram meters per second squared (newtons), u is the mass per unit length of the string in kilograms per meter, and l is the vibrating length of the string in meters. In this experiment, the tension, T , is simply the product of a suspended mass (kilograms) times the acceleration due to gravity (9.8 meters per second squared). That is, tension is a force and force is equal to mass times acceleration. Note that longer strings and more massive strings produce a lower frequency of oscillation and that increased tension increases frequency.

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