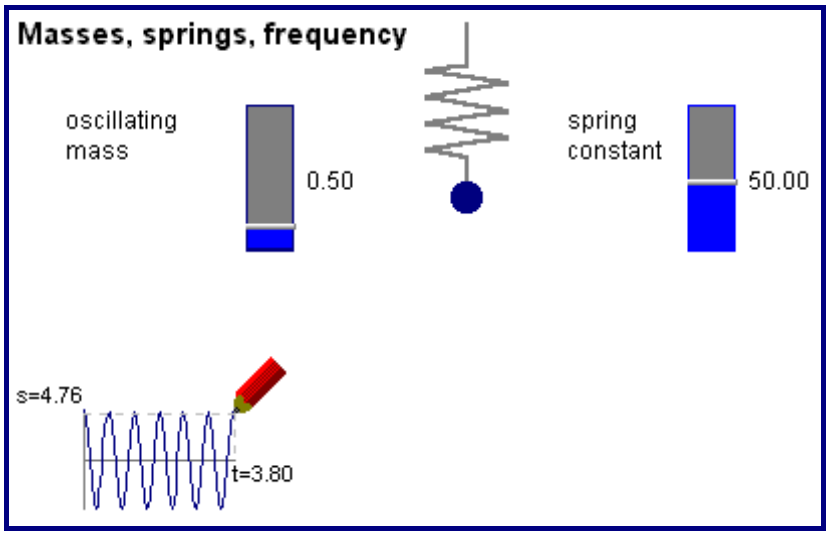
TAP 303- 3: Modelling springs and masses

This file is provided for use with:

TAP 303-2: Oscillating freely

A Modellus model to look at the relationship between f, k and m



This model allows you to alter the spring constant and mass of an oscillator, looking at changes in the motion.

The Modellus model is below

100039f1.mdl

Practical advice

This model looks at the relationship:

$$f \propto \sqrt{\frac{k}{m}}$$

This could be used after the free oscillator has been introduced. You could use it to supplement work done in the laboratory in describing the motion, both in relating all the kinematic variables, and in relating the characteristics of the oscillation to the dynamic variables. It could form the basis for a useful homework exercise. Alternatively you could demonstrate some of the features of the model using it to introduce the topic. If so, a real system should be demonstrated also. At some stage the students should analyse real data.

This model is deliberately simple, and probably should not be used to replace laboratory work on this topic. It may, however, form a useful focus for discussion, or private study. The chance to play the motion back step by step, talking through the changes to understand the dynamics, relating this to the average time for a complete oscillation, and to interact with a range of masses and spring constants should not be missed.

More confident students, or those with more time to spend here, could adapt the model to form a presentation, adding vectors to the animation, and perhaps slowing it down by making the time steps finer grained, to form a tool to help them explain the relationship between the quantities.

Alternative approaches

This model could be introduced much later when a lot of practical experience has been gained and students know about $(k/m)^{1/2}$, as you may choose to base an introduction entirely on laboratory work

.

Social and human context

This step-by-step understanding, in which every change is linked to a prior sufficient cause, is central to the theme of the clockwork Universe and Laplace's thought: 'All the effects of nature are only the mathematical consequences of a small number of immutable laws'. Mass and spring oscillators can be used to model everything from car suspensions to molecular vibrations. It is important that you get a feel for the physics involved. In this activity, a model is employed to highlight some of the important physical ideas involved in studying simple oscillating systems.

Modellus

Modellus is available as a FREE download from http://phoenix.sce.fct.unl.pt/modellus/ along with other sample files and the user manual

External reference

This activity is taken from Advancing Physics chapter 10, 130L