Slinky Simulation

Goal:

To explore the properties and behaviors of waves on a Slinky.

Getting Ready:

Go to the **Slinky Lab Interactive** at The Physics Classroom.

www.physicsclassroom.com ==> Physics Interactives ==> Waves and Sound

Three properties of the Slinky are listed to the left of the slinky - **Density**, **Tension**, and **Damping**. The sliders can be used to adjust each of these properties. The manner in which a disturbance is introduced into the Slinky are listed to the right of the Slinky. Disturbances can be introduced into the Slinky Manually by wiggling the handle on the bottom left to right. Or for a more controlled disturbance, the program can create it as a **Pulse** or as a **Continuous** wave. Finally, the top end of the Slinky can be fixed or free. A **Fixed End** is an end that is clamped down and unable to move. A **Free End** is an end that is able to vibrate back and forth when a disturbance reaches it. Experiment with the various controls to see how they operate. Then, use the interactive environment to answer the following questions.

Questions:

1. Start with the **Continuous** mode. Disturbances or waves will travel through the Slinky. Describe the motion of the individual particles (or coils) as disturbances move back and forth through the Slinky.

2. The **Period** refers to the time it takes an individual particle (or coil) to complete one back and forth vibration about its fixed position. Contrast a low period set of continuous vibrations with a high period set of continuous vibrations. Which leads to a higher frequency of vibration of individual particles (i.e., coils)? Which leads to a longer wavelength? Describe fully.

3. Density or Linear Density refers to how much mass is contained within a given length of the Slinky. Slinkies with more massive, larger, or closely-packed coils have a greater density. Set the **Damping** to 0. Use the **Manual** setting. Run a few trials in which you vary the **Density** in order to determine the effect of density upon the speed at which disturbances travel through the Slinky. Tap the **Manual** button between trials to reset the Slinky.

   Describe the relationship between density and the speed at which disturbances travel.

4. The **Tension** refers to the force with which the two ends are pulled. Keep the **Damping** set to 0. Run a few trials in which you vary the **Tension** in order to determine the effect of tension upon speed. Tap the **Manual** button between trials to reset the Slinky.

   Describe the relationship between tension and the speed at which disturbances travel.

5. Now vary the **Damping** for several trials. Make observations of the effect of damping upon the ability of a disturbance to move through the Slinky. In your own words, describe what damping does.

6. Now investigate the effect of fixing or freeing the top end of the Slinky. Use either **Manual** or **Pulse** setting with little to no **Damping**. Describe the behavior of a rightward-displaced pulse when it reaches a **Free End** and when it reaches a **Fixed End**. Both reflect; but how does a **Fixed End** reflection compare to a **Free End** reflection?