4.3.2: Examples of Waves

Sound waves are an example of a longitudinal wave, the air molecules vibrate back and forth as the sound wave passes through them. We will look at the details of sound waves in the next few chapters. We are mainly interested in sound waves in this book but many other types of waves exist and have the same properties and behavior as sound waves. It is also the case that the same equations apply to many types of waves, although we won't go into great detail about this. If you are interested in the deeper mathematical properties of waves, have a look at Forinash's Wave Tutorial.

Although waves on the surface of a pond or ocean look like examples of transverse waves, they are actually a bit more complicated. A cork on the surface also has a little bit of back and forth motion as it bobs up and down. For a particle suspended in the water at a certain depth the back and forth motion increases with depth and the up and down motion decreases.

An earthquake occurs when there is a sudden movement of two parts of the earth's crust relative to each other. If the movement is inside the earth, two different types of waves, S-waves and P-waves are formed. S- or Shear waves are transverse waves; the earth moves up and down (or back and forth) as the wave moves through. P- or Primary waves are longitudinal (compressional) waves; the earth moves back and forth relative to the direction the wave is traveling as the wave passes. P-waves travel faster than S-waves. If these disturbances cause a wave to travel along the surface of the earth they are called surface or L-waves which generally move more slowly than S- or P- waves. The main types of surface waves are Rayleigh waves, Love waves and Stonely waves. Rayleigh waves are rolling waves, similar to transverse waves but with more bending motion. Love waves are a type of transverse wave where the motion is side to side instead of up and down. Love waves generally cause more damage than Rayleigh waves since buildings can often withstand an up and down jolt but are not typically built to withstand side to side motion. Stonely waves are transverse waves at an intersection or boundary inside the earth. All of these types of waves (and several others) travel at different speeds and the difference in speed can be used to locate the origin of the earthquake.

Video/audio examples:

- Wave pulse in slow motion.
- Sound waves can be visualized using a technique called Schlieren Flow Visualization (Wikipedia). Several examples are given in this video.
- Wikipedia has simulations of both S-waves and P-waves as well as other seismic waves.
- Video examples of earthquakes: mostly P-wave, mostly S-wave.