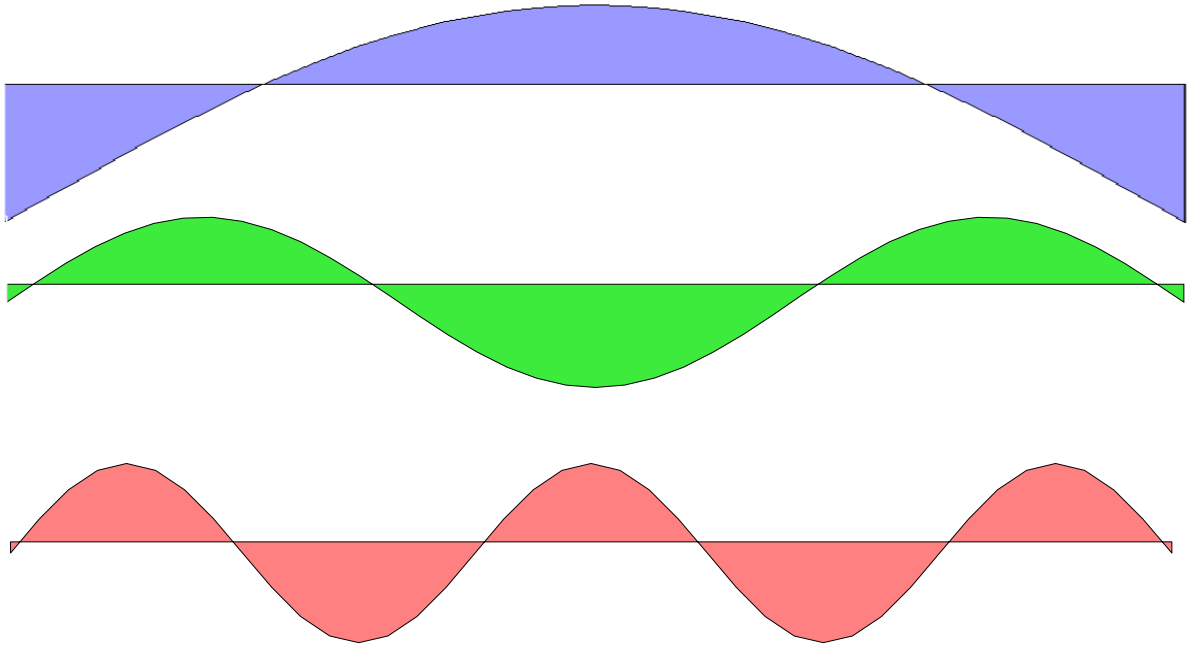
Vibrating Rod

IEEE Consultants Network

The physics and math behind a vibrating rod shows up in many places: musical instruments, including wind chimes and marimbas; electronic, including transmission lines and antennas; civil engineering, including bridges and buildings.

The experiment we have is simply a vibration metal rod (a section of steel electrical conduit and a section of aluminum tubing). If gravity were not involved, the rod when it is vibrates can take on shapes like these.



Each of these shapes is called a mode. We will demonstrate the top mode. While our rod is vibrates in other modes they are hard to see with the eye although they can be felt and heard.

You will notice that there are places in the rod where it is not moving from side to side, but is rotating (twisting) about. These places are called nodes. The places where the peak excursions are are called anti-nodes. In our world gravity is involved and without support the rod would fall to the ground. To support the rod it must be held somewhere. **How? Where?**

Notice that when the rod vibrates, most obviously in the top mode, but it is true in all of them, that portions of the rod move in opposite directions. **Why?**

How does this influence how you would design a bridge, marimba or wind chimes?