# Skin Depth and Polarisation

It is a measure of the depth to which an electromagnetic wave penetrates into the conductor.

It is also the distance that it takes to reduce the amplitude by a factor of $\frac{1}{e}$(about a third) is called the skin depth.

## Anomalous dispersion

Most of the time the index of refraction rises gradually with increasing frequency, consistent with our experience from optics.

However, in the immediate neighbourhood of a resonance, the index of refraction drops sharply.

Because this behaviour is atypical, it is called anomalous dispersion.

Notice that the region of anomalous dispersion coincides with the region of maximum absorption.

In fact the material may be practically opaque in this frequency range.

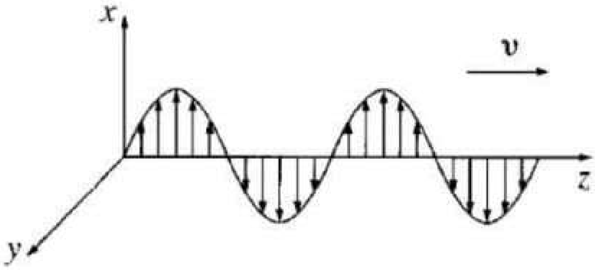
The reason is that we are now driving the electrons at their favourite frequency.

The amplitude of their oscillation is relatively large and a corresponding large amount of energy is dissipated by the damping mechanism.

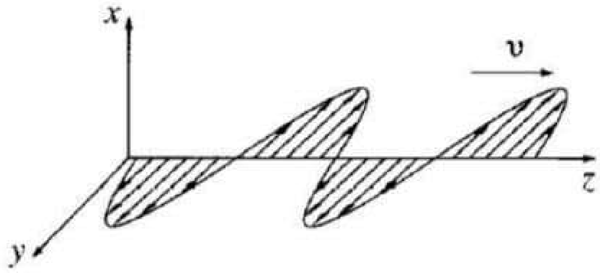
## Polarization

The waves that travel down a string when we shake it are called transverse, because the displacement is perpendicular to (transverse) the direction of propagation. Compression waves are hard to see on a string, but if we try it with a slinky they are quite noticeable. These waves are called longitudinal because the displacement from equilibrium is along the direction of propagation. Sound waves are longitudinal.

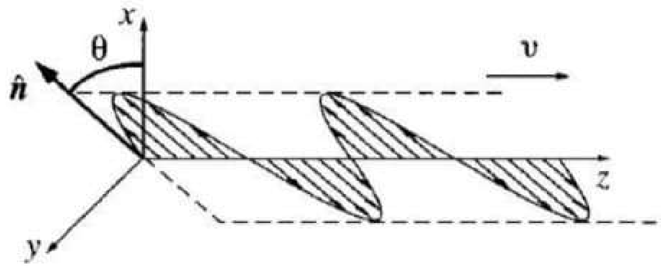
Now there are, of course, two dimensions perpendicular to any given line of propagation. Accordingly, transverse waves occur in two perpendicular states of polarization. We can shake the string up-and-down (vertical polarization).




(a) Vertical polarization




(b) Horizontal polarization




(c) Polarization vector

Or left-and-right (horizontal polarization)

The polarization vectors defines the plane of vibration.

References:-

Introduction to electrodynamics by David J. Griffith