Waves

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Contents

1 Wave

A wave is a propagation of a disturbance (energy) which oscillates repeatedly.

1.1 Waves in different dimensions

Waves can expand in different dimensions. Here are examples of each dimension

1. 1 dimension: an oscillating rope
2. 2 dimensions: surface of water oscillating
3. 3 dimensions: sound propagating through the air

1.2 Direction of the wave

A wave is *transverse* when its oscillations are perpendicular to the direction of the wave propagation (e.g. slinky up and down).

A wave is *longitudinal* when its oscillations are parallel to the direction of the wave propagation (e.g. slinky left and right).

1.3 Types of waves

There are different types of waves, namely, *mechanical* waves, *electromagnetic* wave and *gravitational* waves.

Electromagnetic and gravitational waves are always longitudinal.

2 Mechanical waves

2.1 Wave length

The *wavelength* λ of a wave describes how long the wave is.

2.2 Period

The *period* T of a wave is the time it takes to complete a full oscillation.

2.3 Frequency

The *frequency* f of a wave represents how many oscillation completed in one unit of time (seconds).

$$f = \frac{1}{T}$$

2.4 Phase velocity

The *phase velocity* v is the rate at which the wave propagates.

$$\begin{aligned} v &= \frac{\lambda}{T} \\ &= f\lambda \end{aligned}$$

2.5 Amplitude

The *amplitude* A of a mechanical wave is the measure of the maximum distance a point can reach from its equilibrium position.

3 Harmonic waves

An armonic wave is a periodic wave where the points of the medium where it moves oscillate.

$$s(t;x) = A\sin\left(\omega t - \frac{2\pi}{\lambda}x\right) \text{ where } \omega = \frac{2\pi}{T}$$