Amplitude Modulation -1

Modulation is the technique used to transmit low frequency baseband signal from sender to receiver in a communication system

The amplitude of carrier signal is modulated by the modulating or message signal

Message Signal

$x_m(t) = A_m \cos \omega_m t$

Amplitude of message signal

Angular Frequency

Carrier Signal

$x_c(t) = A_c \cos \omega_c t$

$$x_{AM}(t) = x_c(t) + x_m(t) \cos \omega_c t \quad \text{——(i)}$$

$$= A_c \cos \omega_c t + x_m(t) \cos \omega_c t$$

$$= A_c \cos \omega_c t \left(1 + \frac{x_m(t)}{A_c}\right) \quad \text{——(ii)}$$

$$x_{Am}(t) = A_c \cos \omega_c t \left(1 + \frac{A_m}{A_c} \cos \omega_m t\right) \quad \text{——(iii)}$$

$\frac{A_m}{A_c}$ → modulation Index (m)

$$x_{Am}(t) = A_c \cos \omega_c t \left(1 + m \cos \omega_m t\right)$$ → Expression for AM Signal

No message Signal / No modulation ← $0 < m \leq 1$ → 100% modulation (Ideal case)

$$x_{AM}(t) = x_c(t) + x_m(t) \cos \omega_c t$$

$$x_{Am}(t) = A_c \cos \omega_c t + A_m \cos \omega_m t \cos \omega_c t$$

$$= A_c \cos \omega_c t + \frac{A_m}{2}\left(2 \cos \omega_c t \cos \omega_m t\right)$$

$$= A_c \cos \omega_c t + \frac{A_m}{2}\left(\cos(\omega_c + \omega_m)t + \cos(\omega_c - \omega_m)t\right)$$

ω_c $\omega_c + \omega_m$ $\omega_c - \omega_m$

$x_m(t) = A_m \cos \omega_m t$ $\quad \because \omega = 2\pi f$

$x_c(t) = A_c \cos \omega_c t$