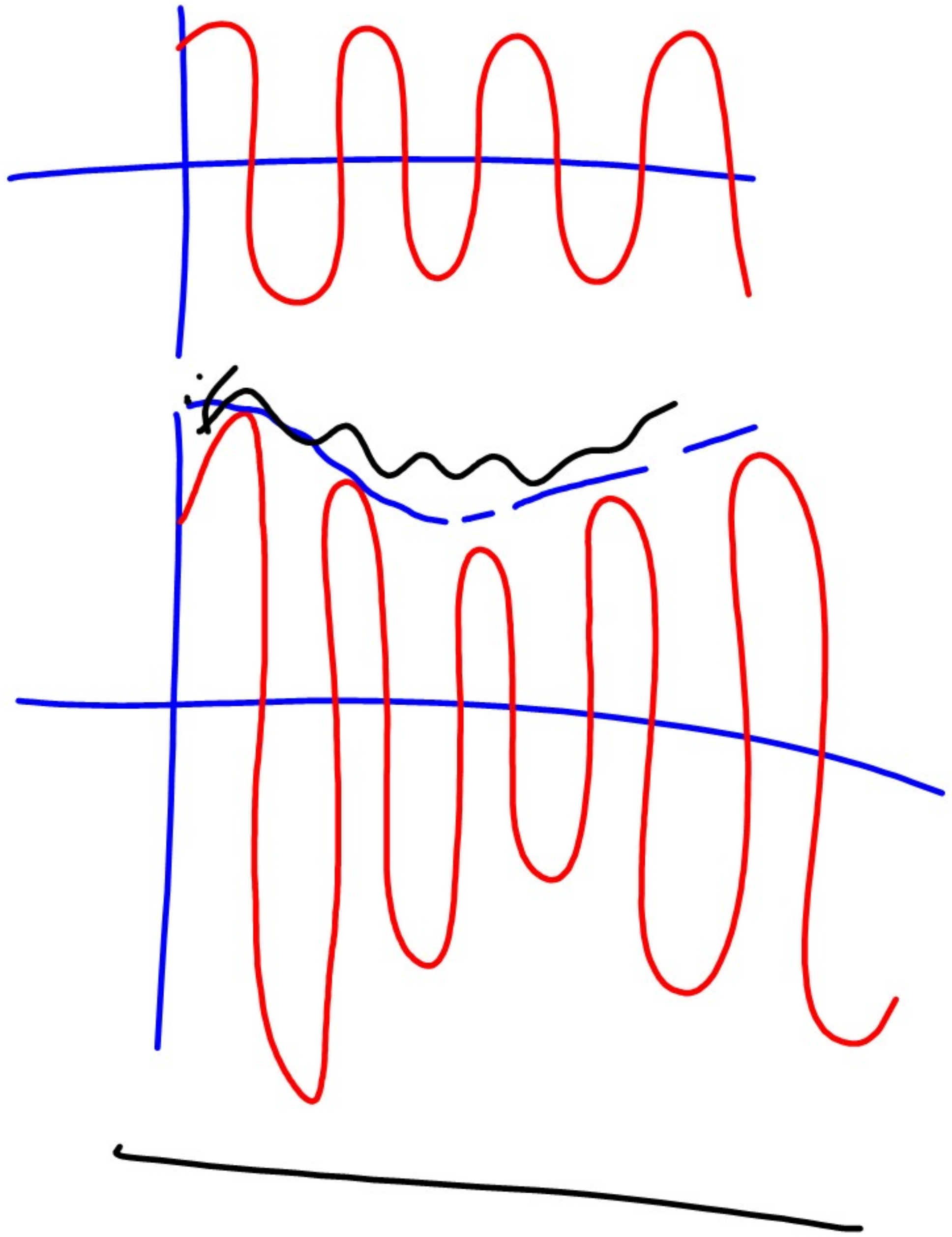
$$c(t) = \underline{A_c}\cos(\underbrace{2\pi \underline{f_c}\, t + \underline{\phi}}_{\text{Angle}})$$

A_c: fixed

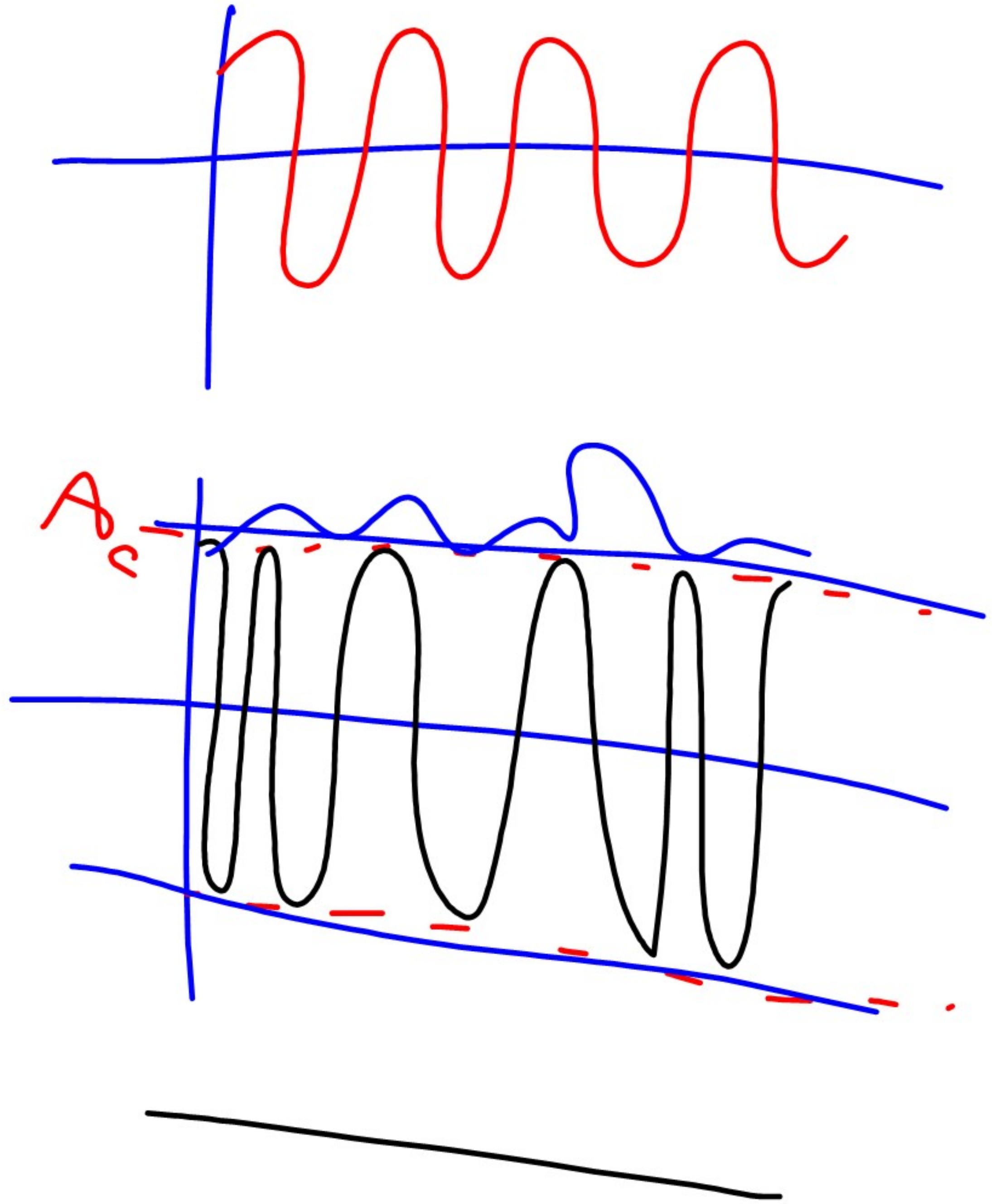
θ

f_c | ϕ
FM | PM

AM LC

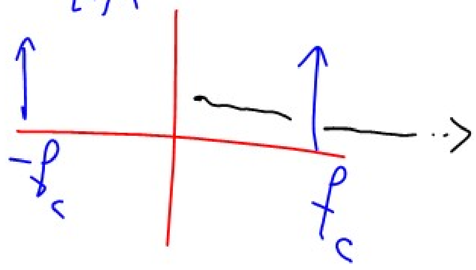


FM



$$c(t) = A_c \cos(2\pi f_c t) = A_c \cos(\omega_c t)$$

$$\underset{FM}{s(t)} = A_c \cos(2\pi(f_c + \Delta f \overset{m(t)}{m(t)})t)$$



$$\underset{FM}{s(t)} = A_c \cos(2\pi f_i t) = A_c \cos(\omega_i t)$$

θ_i $$= A_c \cos(\theta_i)$$

$$\theta_i = 2\pi f_i t$$

$$\frac{1}{2\pi}\theta_i = f_i t \longrightarrow \boxed{f_i = \frac{1}{2\pi}\frac{d\theta_i}{dt}}$$

$$f_i = f_c + k_f A_m \cos(2\pi f_m t)$$

Δf = freq deviation (peak freq dev)

$$\Delta f = k_f A_m$$

$$f_i = \frac{1}{2\pi}\frac{d\theta_i}{dt} = f_c + \Delta f \cos(2\pi f_m t)$$

$$\theta_i = 2\pi f_c t + \frac{\cancel{2\pi} \Delta f}{\cancel{2\pi} f_m} \sin(2\pi f_m t)$$

$$\beta = \frac{\Delta f}{f_m}$$ modulation index

Angle deviation

$$\theta_i = 2\pi f_c t + \beta \sin(2\pi f_m t)$$

$$\underset{FM}{s(t)} = A_c \cos(2\pi f_c t + \beta \sin(2\pi f_m t))$$

If $m(t)$ is general

$$\underset{FM}{s(t)} = A_c \cos(\underline{2\pi f_c t} + \overbrace{2\pi k_f \int m(\tau)\, d\tau})$$

$$\underset{PM}{s(t)} = A_c \cos(\overbrace{2\pi f_c t} + \overbrace{k_p m(t)})$$