- In general
- What if there are multiple frequencies?

$$f(t) = \sum_n c_n \cos(\omega_n t + \theta_n) + \sum_m F_m e^{j\omega_m t} + \sum_k b_k \sin(\omega_k t + \psi_k)$$

$$f(t) \rightarrow \boxed{H(\omega)} \rightarrow y(t) = \sum_n |H(\omega_n)| c_n \cos(\omega_n t + \theta_n + \angle H(\omega_n)) +$$

$$+ \sum_m H(\omega_m) F_m e^{j\omega_m t} + \sum_k |H(\omega_k)| b_k \sin(\omega_k t + \psi_k + \angle H(\omega_k))$$

- Decibel amplitude response

$$|H(\omega)|_{dB} = 10\log_{10}(|H(\omega)|^2) = 20\log|H(\omega)|$$

  - Small differences are emphasized

$$\text{if } |H(\omega)| = \begin{cases} \frac{1}{\sqrt{2}} & \text{then } |H(\omega)|_{dB} = -3\text{dB} \\ 1 & \text{then } |H(\omega)|_{dB} = 0\text{dB} \\ \sqrt{2} & \text{then } |H(\omega)|_{dB} = 3\text{dB} \\ 2 & \text{then } |H(\omega)|_{dB} = 6\text{dB} \end{cases}$$

Chapter objectives

- Understand the meaning and application of an LTI system's frequency response
- Be able to obtain the frequency response of an LTI system
- Know the properties of the frequency response of an LTI system
- Use the frequency response of an LTI system obtain the system's response to co-sinusoidal inputs
- Use the frequency response of an LTI system obtain the system's response to multifrequency co-sinusoidal inputs