

Exercise 1: Signal Processing

January 16, 2024

1. **What is the relationship between the frequency and the period of a periodic signal?** The relationship is defined by:

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

where T is the period. Frequency is defined by how many periods pass in a unit of time, for example, 3 periods per second or 48 periods per second. Therefore, the relationship between them is that frequency is inversely proportional to the period.

2. **Express $\sin(\omega t)$ using cosine.**

$$\sin(\omega t) = \cos\left(\omega t - \frac{\pi}{2}\right)$$

3. **What is the magnitude of the signal $1.8 \sin(300\pi t)$?** Magnitude: 1.8
4. **What is the frequency of the signal $0.5 \cos(400\pi t)$?** Frequency: 200 Hz
5. **A system has a signal input and a signal output. How can we see if the system is linear or non-linear by putting a sine signal onto the system?** If you send a sinus signal into a system and receive an output with a different frequency, then the system is non-linear. If you send the same sine signal and receive the same frequency in the output, then the system is linear. In both cases, the amplitude and the phase can change.