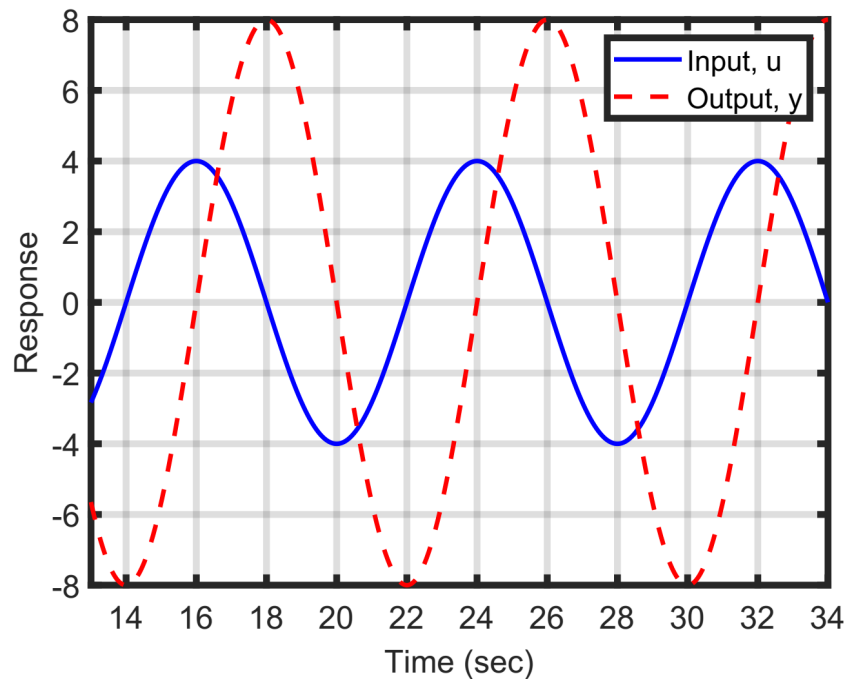


3.15 Steady State Response

The figure shows the output $y(t)$ generated by a linear system $G(s)$ with input $u(t) = A_0 \cos(\omega_0 t)$.

- What are the values of A_0 and ω_0 for the input signal $u(t)$?
- What is the magnitude $|G(j\omega_0)|$?
- What is the phase $\angle G(j\omega_0)$ in degrees?



Solution :

- $A_0 = 4$ and $\omega_0 = \frac{\pi}{4}$ rad/sec
- $|G(j\omega_0)| = 2$
- $\angle G(j\omega_0) = -\frac{\pi}{2}$

GPT Answer :

The estimated values based on the provided plot are:

- $A_0 \approx 6$ units and $\omega_0 = \frac{2\pi}{T}$, where $T \approx 8$ seconds.
- $|G(j\omega_0)| \approx \frac{8}{6}$.

- (c) $\angle G(j\omega_0)$ is approximately 90° (assuming a quarter-period phase shift).

Confidence level in these estimates: 70%

Misreading The Plot

Claude Answer :

I apologize for the confusion. Let me take another thorough look at the plot and provide a corrected response.

- (a) The input signal is $u(t) = A_0 \cos(\omega_0 t)$. From the legend, the amplitude A_0 is exactly 1. The period looks to be 8 seconds, as there are two full cycles over the 16 second interval shown. Therefore, the frequency is $\omega_0 = \frac{2\pi}{8} = \frac{\pi}{4}$ rad/s.

Confidence: 98/100

- (b) The magnitude $|G(j\omega_0)|$ is the ratio of the output amplitude to the input amplitude at frequency ω_0 . The output amplitude is approximately 3. So $|G(j\omega_0)| \approx \frac{3}{1} = 3$.

Confidence: 95/100

- (c) The phase $\angle G(j\omega_0)$ in degrees is the phase shift between the input and output sinusoids. The output appears to lag the input by $1/4$ of a period, which corresponds to a phase shift of $\frac{1}{4} \cdot 360^\circ = 90^\circ$. So $\angle G(j\omega_0) \approx 90^\circ$.

Confidence Level: 95/100

Misreading The Plot