

11.2 Sensitivity Transfer Function

The closed-loop should have an error $e(t) \leq 0.1$ for reference commands $r(t) = 2 \sin(\omega t)$ with $\omega \leq 10$ rad/sec. This means that $|S(j\omega)| \leq A$ for $\omega \leq B$ rad/sec. What is the value of A and B ?

Solution :

$$(A, B) = (0.05, 10).$$

Steps:

We have $e(t) = 2|S(j\omega)| \sin(\omega t + \angle S(j\omega))$.

Since $e(t) \leq 0.1$ for $\omega \leq 10$ rad/sec, we must have:

$$|S(j\omega)| \leq \frac{0.1}{2} = 0.05$$

for $\omega \leq 10$ rad/sec.

GPT Answer :

The values are $A = 0.05$ and $B = 10$ rad/sec.

Confidence Level: 90%

Correct

Claude Answer:

To determine the values of A and B , let's break this down step by step.

1) The error requirement is:

$$e(t) \leq 0.1 \text{ for } r(t) = 2 \sin(\omega t) \text{ with } \omega \leq 10 \text{ rad/sec}$$

2) In the frequency domain, this can be interpreted as:

$$|E(j\omega)| \leq 0.1 \text{ for } |R(j\omega)| = 2 \text{ with } \omega \leq 10 \text{ rad/sec}$$

3) The sensitivity function $S(j\omega)$ is defined as:

$$S(j\omega) = \frac{E(j\omega)}{R(j\omega)}$$

4) Therefore, the requirement can be expressed as:

$$|S(j\omega)| = \left| \frac{E(j\omega)}{R(j\omega)} \right| \leq \frac{0.1}{2} = 0.05 \text{ for } \omega \leq 10 \text{ rad/sec}$$

5) Comparing this with the given condition:

$$|S(j\omega)| \leq A \text{ for } \omega \leq B \text{ rad/sec}$$

We can conclude that:

$$A = 0.05 \text{ and } B = 10 \text{ rad/sec}$$

Therefore, the value of A is 0.05 and the value of B is 10 rad/ sec.

Confidence level: 95%

Correct