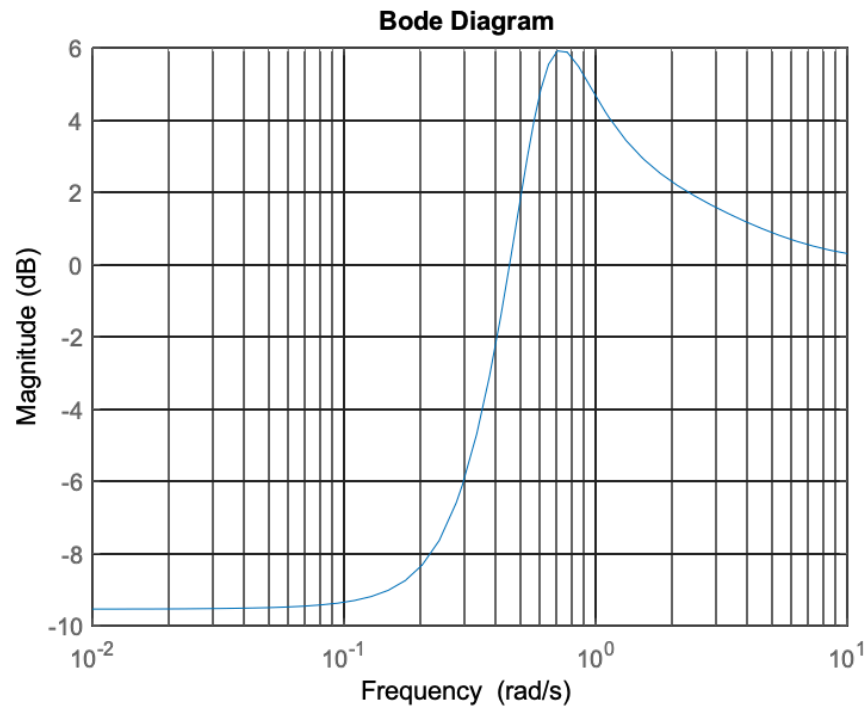


6.6 Disk Margin

Consider the following loop transfer function:

$$L(s) = \frac{4s + 1}{s^3 + 4s - 2s + 0.5} \quad (267)$$

Below is the Bode magnitude plot of the closed-loop sensitivity $S(s)$.



Compute the disk margin from the Bode magnitude plot of $S(s)$

Solution :

Since $d_{\min} = \min_{\omega} |1 + L(j\omega)|$ and $S(j\omega) = \frac{1}{1+L(j\omega)}$, the minimizing frequency will also maximize closed-loop sensitivity $\max_{\omega} |S(j\omega)| = 6\text{dB} \approx 2$ in absolute units. Therefore the disk margin is $d_{\min} \approx 1/2$.

GPT Answer :

The disk margin cannot be computed directly from the Bode magnitude plot provided. Disk margin analysis typically requires a Nyquist plot or the use of specialized software to calculate it based on the loop transfer function $L(s)$. The provided Bode plot does not offer enough information for this calculation. Confidence level in this response is high, as it aligns with standard control systems analysis practice.

Confidence Level: 100%

Incorrect Knowledge

Claude Answer :

From the Bode magnitude plot of $S(s)$, the peak value of $|S(j\omega)|$ appears to be very close to 1.0, around 0 dB.

This peak occurs at the resonance frequency.

Since the disk margin D_m is the inverse of the peak magnitude of $S(s)$, and the peak magnitude is approximately 1.0, the disk margin is:

$$D_m \approx \frac{1}{1.0} \approx 1.0$$

Confidence level: 95% (The peak value is quite clear from the given plot)

Misreading the Plot