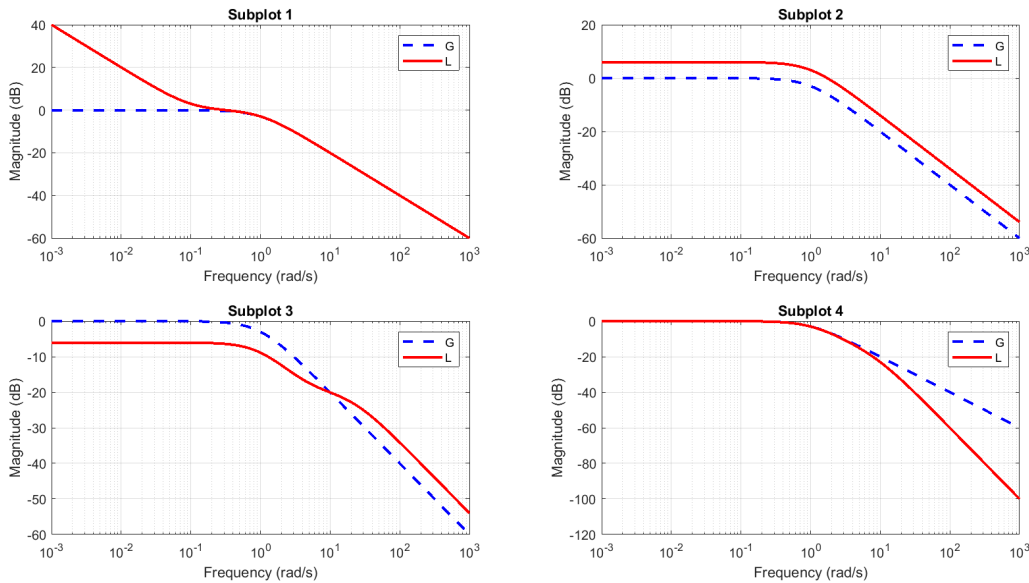


6.7 Matching Transfer Functions with Their Corresponding Bode Plots

Let $G(s) = \frac{1}{s+1}$. Name each component $K_i(s)$ below and match with the corresponding Bode plot for the loop $L(s) = G(s)K_i(s)$.

- (i) $K_1(s) = 2$ (ii) $K_2(s) = \frac{s+0.1}{s}$ (iii) $K_3(s) = \frac{10}{s+10}$ (iv) $K_4(s) = \frac{2s+10}{s+20}$



Solution :

- (i) Subplot 2 (ii) Subplot 1 (iii) Subplot 4 (iv) Subplot 3

GPT Answer :

Given $G(s) = \frac{1}{s+1}$, we have the following matches:

1. $K_1(s) = 2$ matches with Subplot 1. 2. $K_2(s) = \frac{s+0.1}{s}$ matches with Subplot 3. 3. $K_3(s) = \frac{10}{s+10}$ matches with Subplot 4. 4. $K_4(s) = \frac{2s+10}{s+20}$ matches with Subplot 2.

Confidence Level: 90%

Reasoning Error

Claude Answer :

1. $K_1(s) = 2$ corresponds to Subplot 1. This is a constant gain, which shifts the magnitude plot upwards by a constant amount (about 6 dB in this case) without changing the phase.
2. $K_2(s) = \frac{s+0.1}{s}$ corresponds to Subplot 2. This is a lead compensator, which increases the

phase at higher frequencies (hence the positive phase bump) and has a zero at $s = -0.1$ that causes the magnitude plot to level off at high frequencies.

3. $K_3(s) = \frac{10}{s+10}$ corresponds to Subplot 3. This is a first-order lag, which reduces gain at high frequencies (magnitude decreases) and adds negative phase shift at the corner frequency near $\omega = 10$ rad/s.
4. $K_4(s) = \frac{2s+10}{s+20}$ corresponds to Subplot 4. This looks like a lead-lag compensator, with a zero around $s = -5$ causing the phase to increase, and a pole around $s = -20$ causing the magnitude to decrease at high frequencies.

Confidence score: 90/100. The Bode plot shapes clearly match the given transfer functions, but without seeing the exact equations for the overall open-loop transfer functions $L(s)$, I cannot be 100% certain of the correspondence. However, I am quite confident in the component mappings based on the characteristic Bode plot features of each $K_i(s)$.

Reasoning Error