

3.13 Unit Step Response

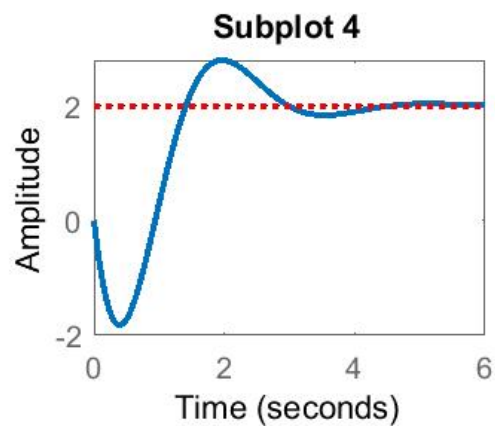
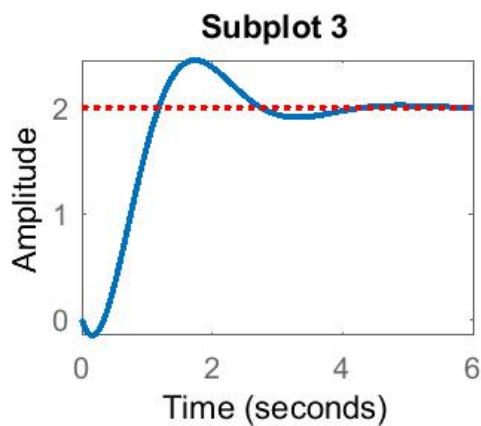
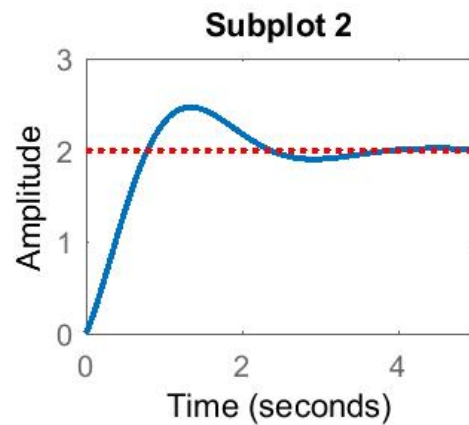
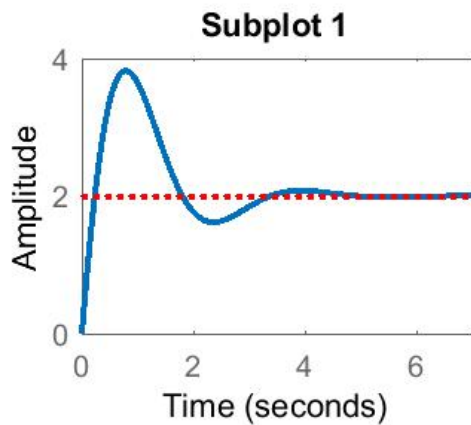
Four systems and four unit step responses are given below. Match each system to its unit step response.

(a) $G_A(s) = \frac{-2s+10}{s^2+2s+5}$

(b) $G_B(s) = \frac{-10s+10}{s^2+2s+5}$

(c) $G_C(s) = \frac{2s+10}{s^2+2s+5}$

(d) $G_D(s) = \frac{10s+10}{s^2+2s+5}$



Solution :

Subplot1: $G_D(s)$

Subplot2: $G_C(s)$

Subplot3: $G_A(s)$

Subplot4: $G_B(s)$

GPT Answer:

To match each system with its unit step response, we consider the signs and coefficients in the transfer functions and compare them with the characteristics of the step responses.

- $G_C(s)$ corresponds to Subplot 1 due to the positive initial slope and positive steady-state.
- $G_B(s)$ or $G_A(s)$ could correspond to Subplot 2 since it seems to approach zero, but this is ambiguous.
- $G_A(s)$ corresponds to Subplot 3 due to the negative initial slope and positive steady-state.
- $G_B(s)$ corresponds to Subplot 4 due to the negative initial slope and negative steady-state.

Confidence Level: 75%

Reasoning Error**Calude Answer:**

Matching each subplot to one of the given transfer functions:

- Subplot 1: $G_C(s) = \frac{2s+10}{s^2+2s+5}$
- Subplot 2: $G_D(s) = \frac{10s+10}{s^2+2s+5}$
- Subplot 3: $G_A(s) = \frac{-2s+10}{s^2+2s+5}$
- Subplot 4: $G_B(s) = \frac{-10s+10}{s^2+2s+5}$

The reasoning is as follows:

- Subplots 1 and 2 have positive steady-state values, corresponding to the positive numerator coefficients in $G_C(s)$ and $G_D(s)$.
- Subplot 2 has a higher steady-state value than Subplot 1, matching the larger numerator coefficient sum of 20 in $G_D(s)$ compared to 12 in $G_C(s)$.
- Subplots 3 and 4 have negative dips, corresponding to the negative numerator coefficients in $G_A(s)$ and $G_B(s)$.
- Subplot 4 has a larger negative dip than Subplot 3, matching the larger negative coefficient of -10 in $G_B(s)$ compared to -2 in $G_A(s)$.

Confidence level: 98%

Reasoning Error