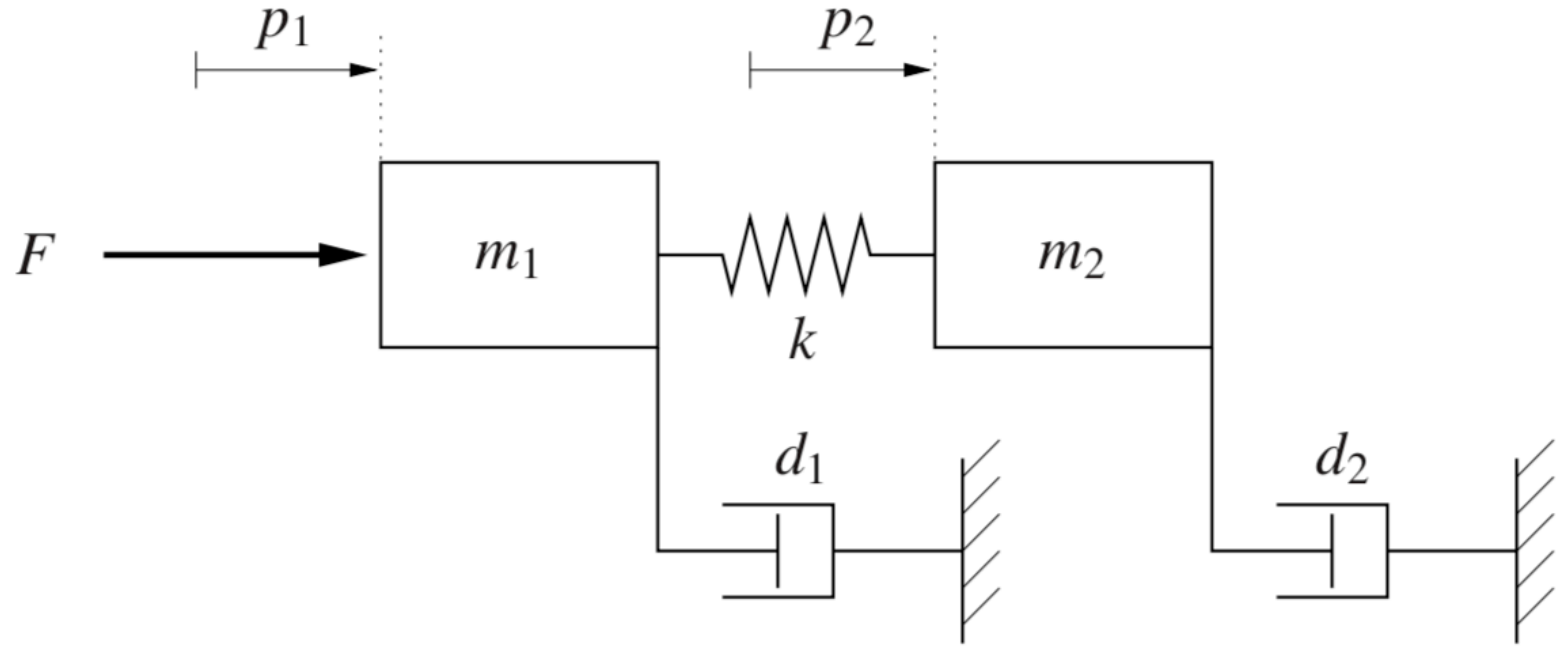
Reglerteknik AK

Laboratory Exercise 3



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How can this be seen in its Bode plot and pole-zero diagram?

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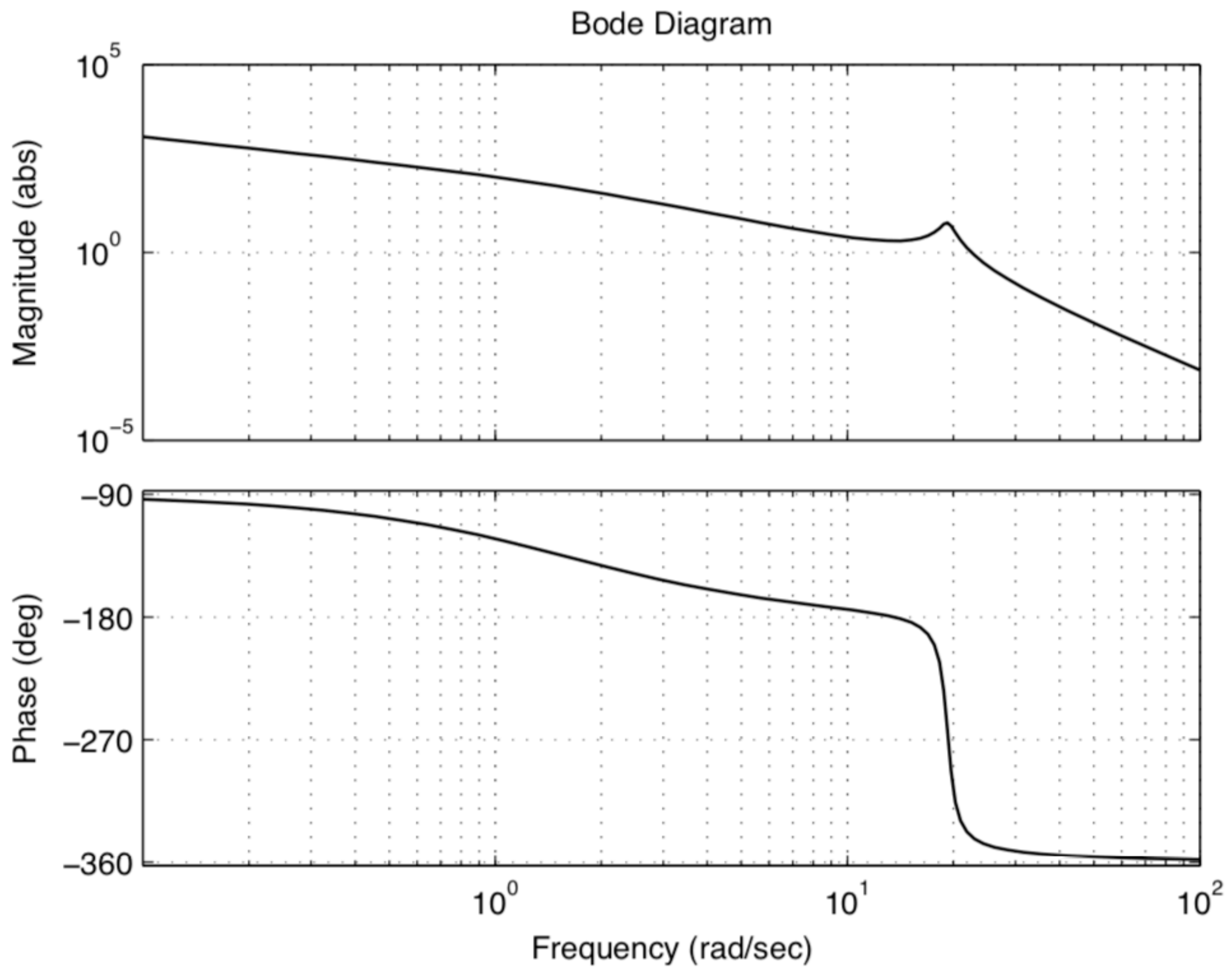

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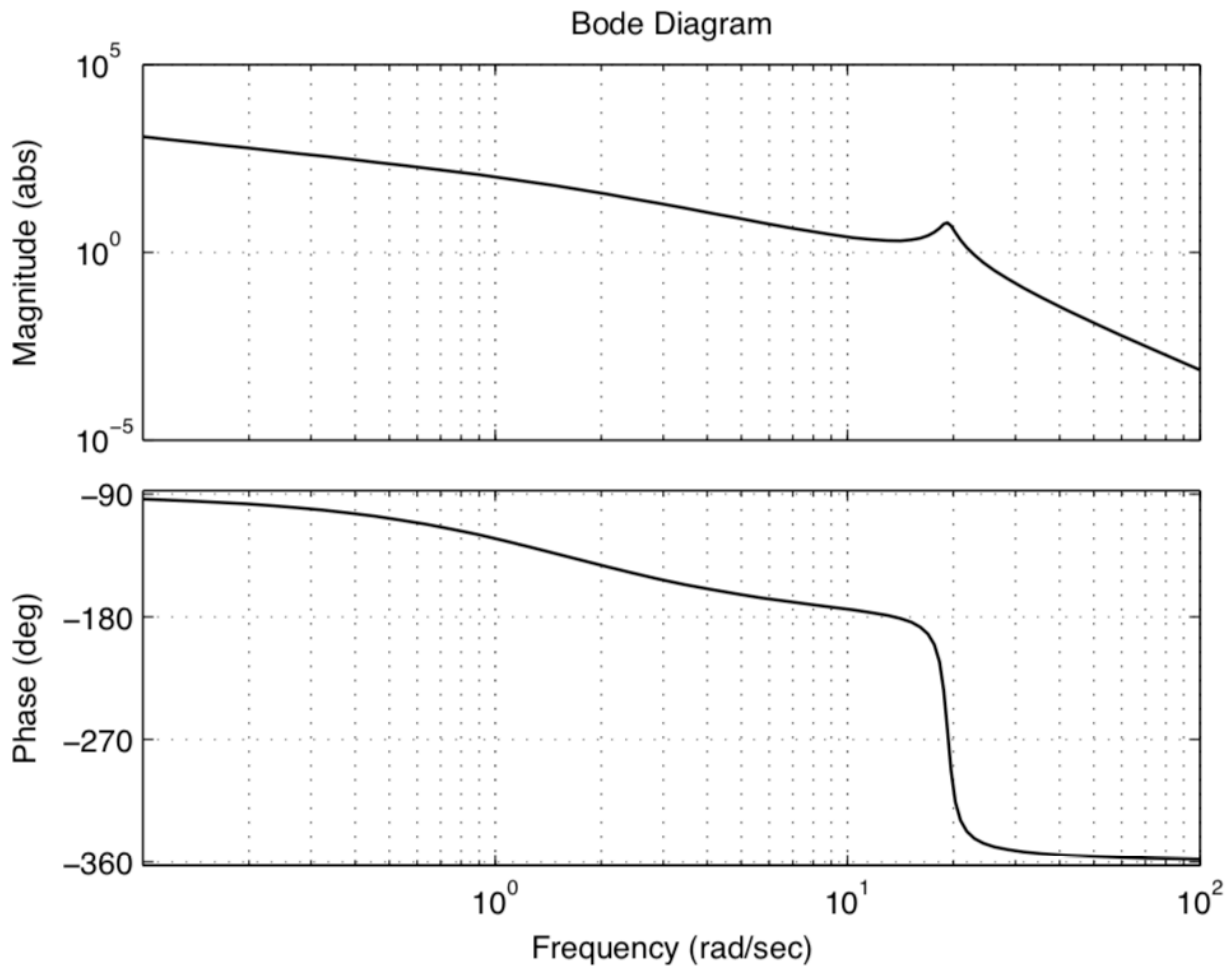

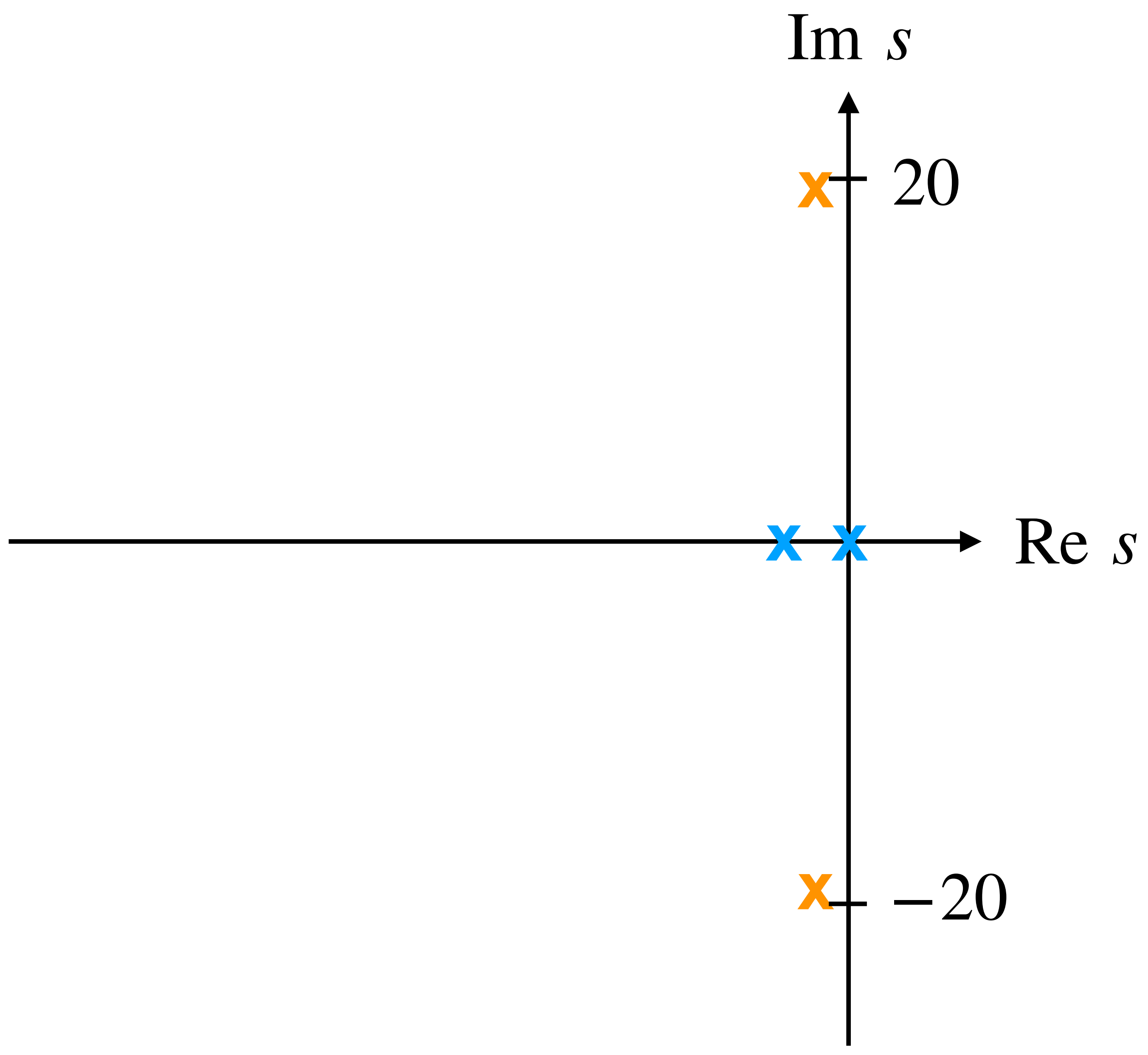

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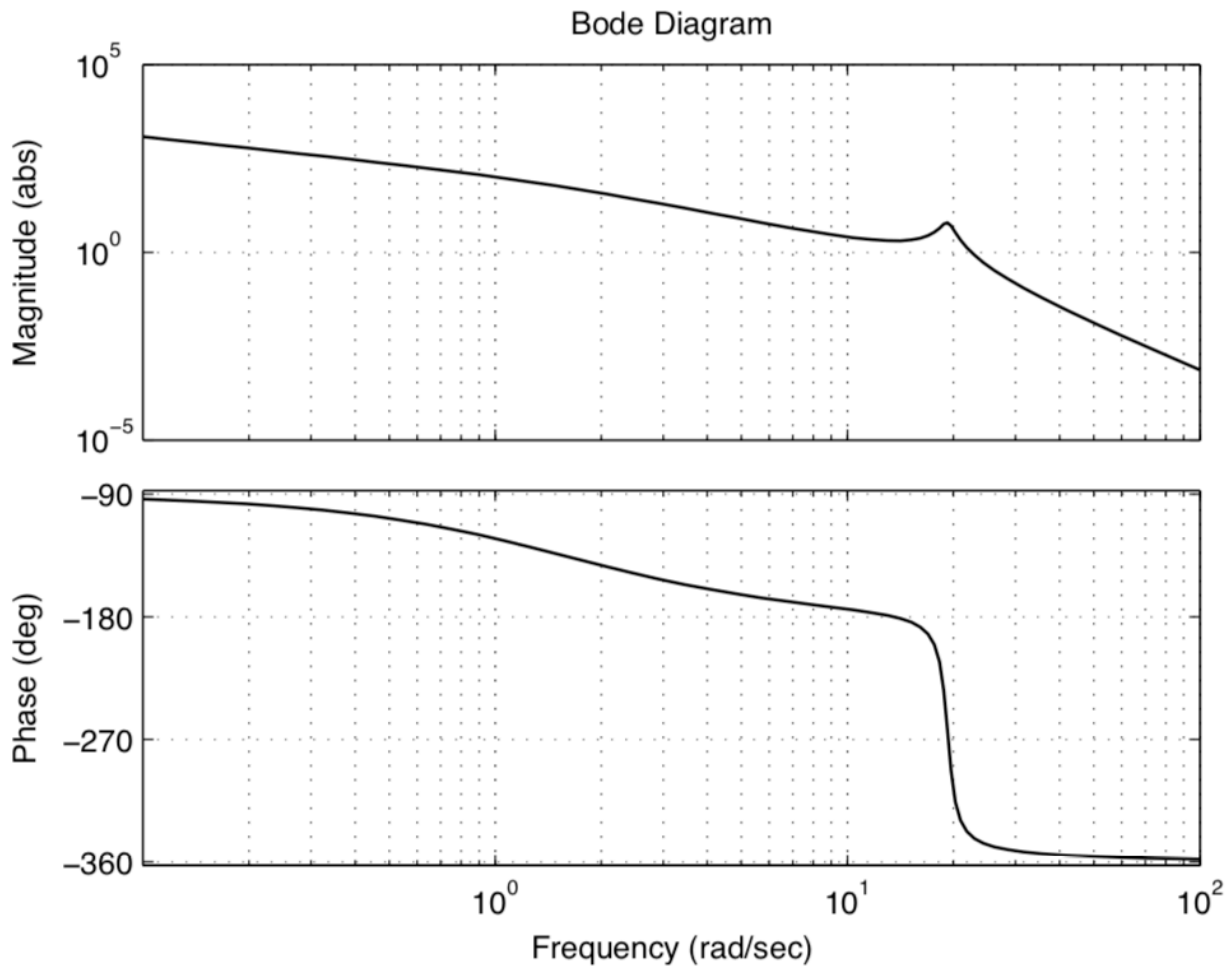
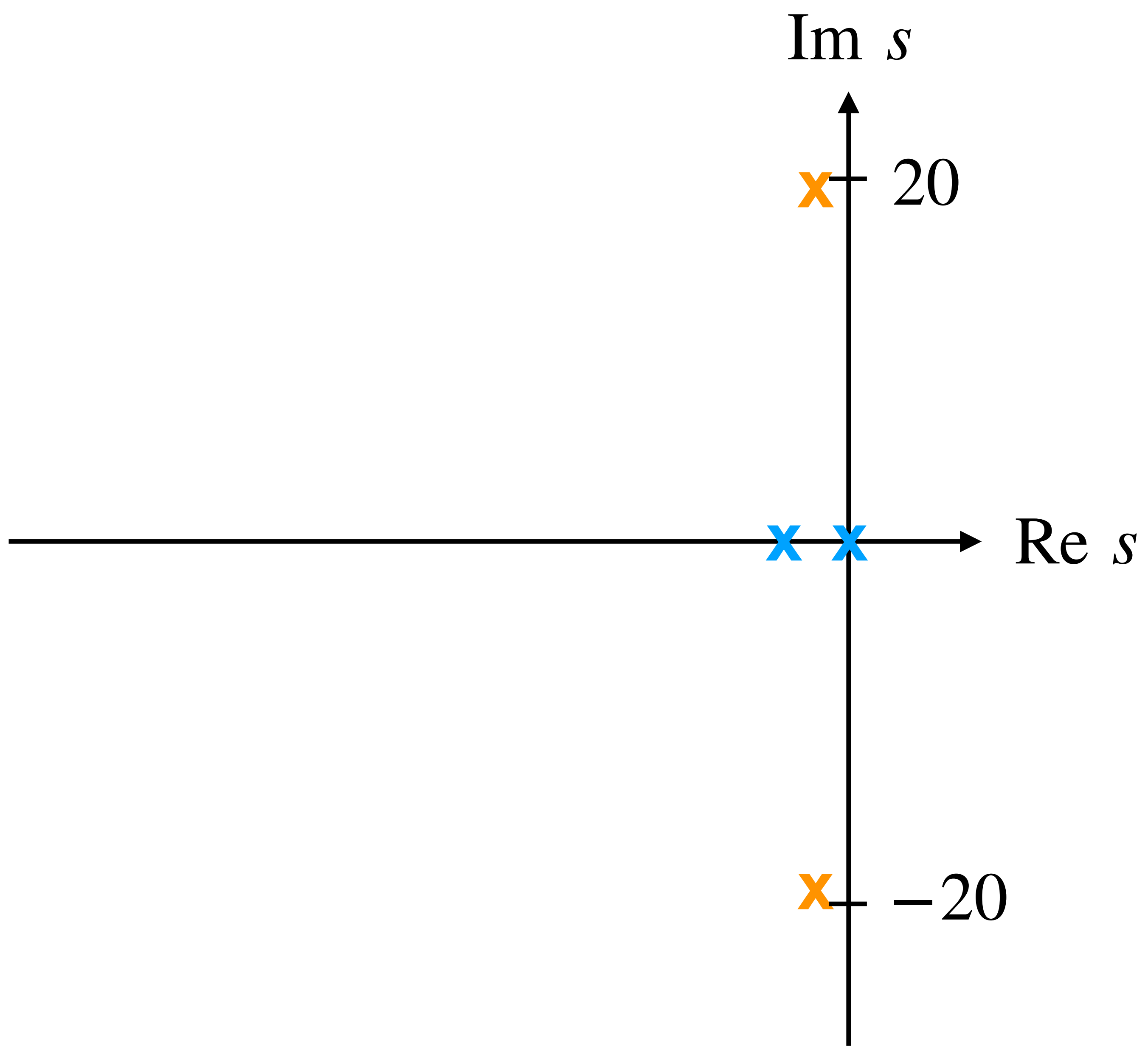
How can this be seen in its Bode plot and pole-zero diagram?

What is the resonance frequency?
How can it be estimated for the process?





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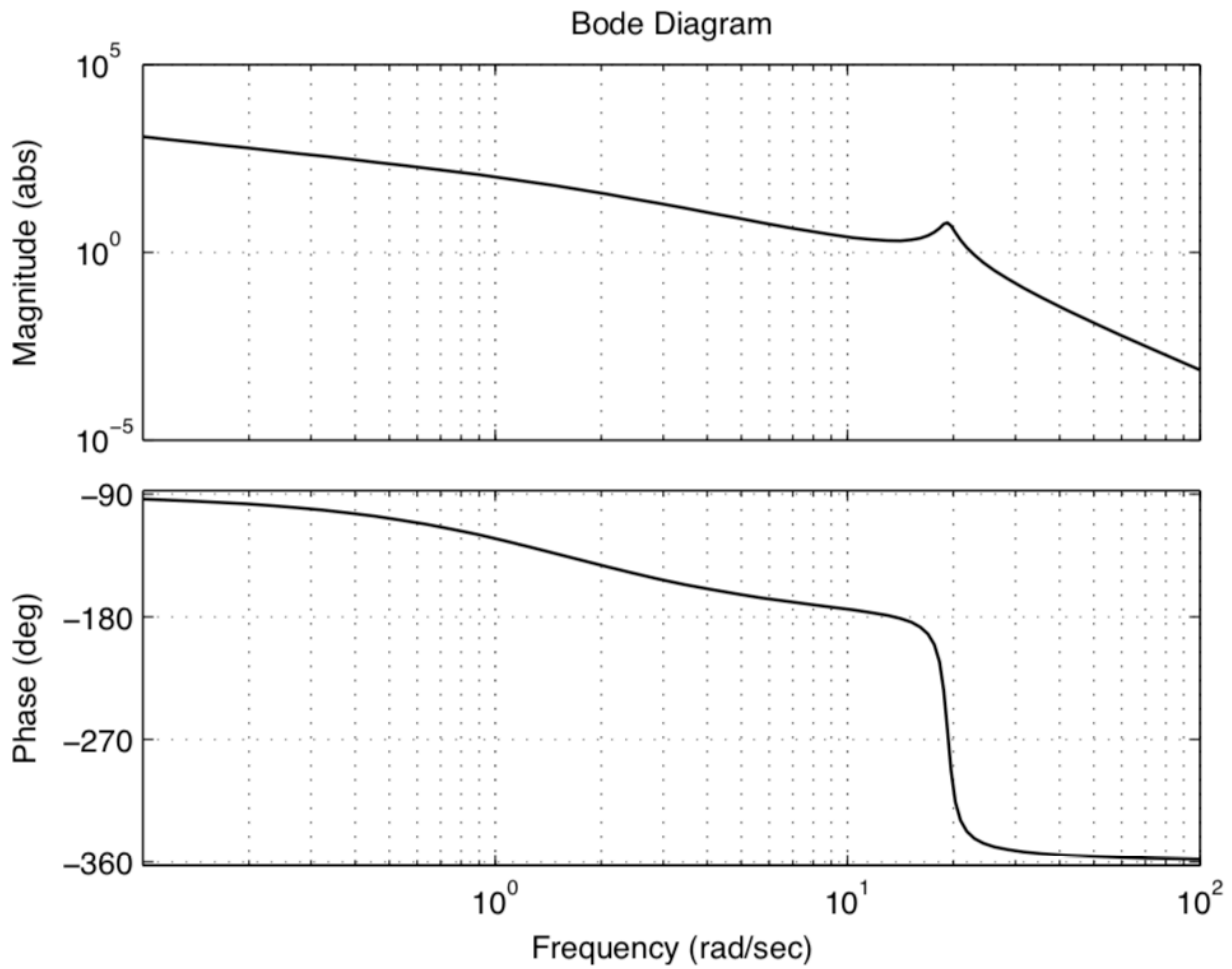

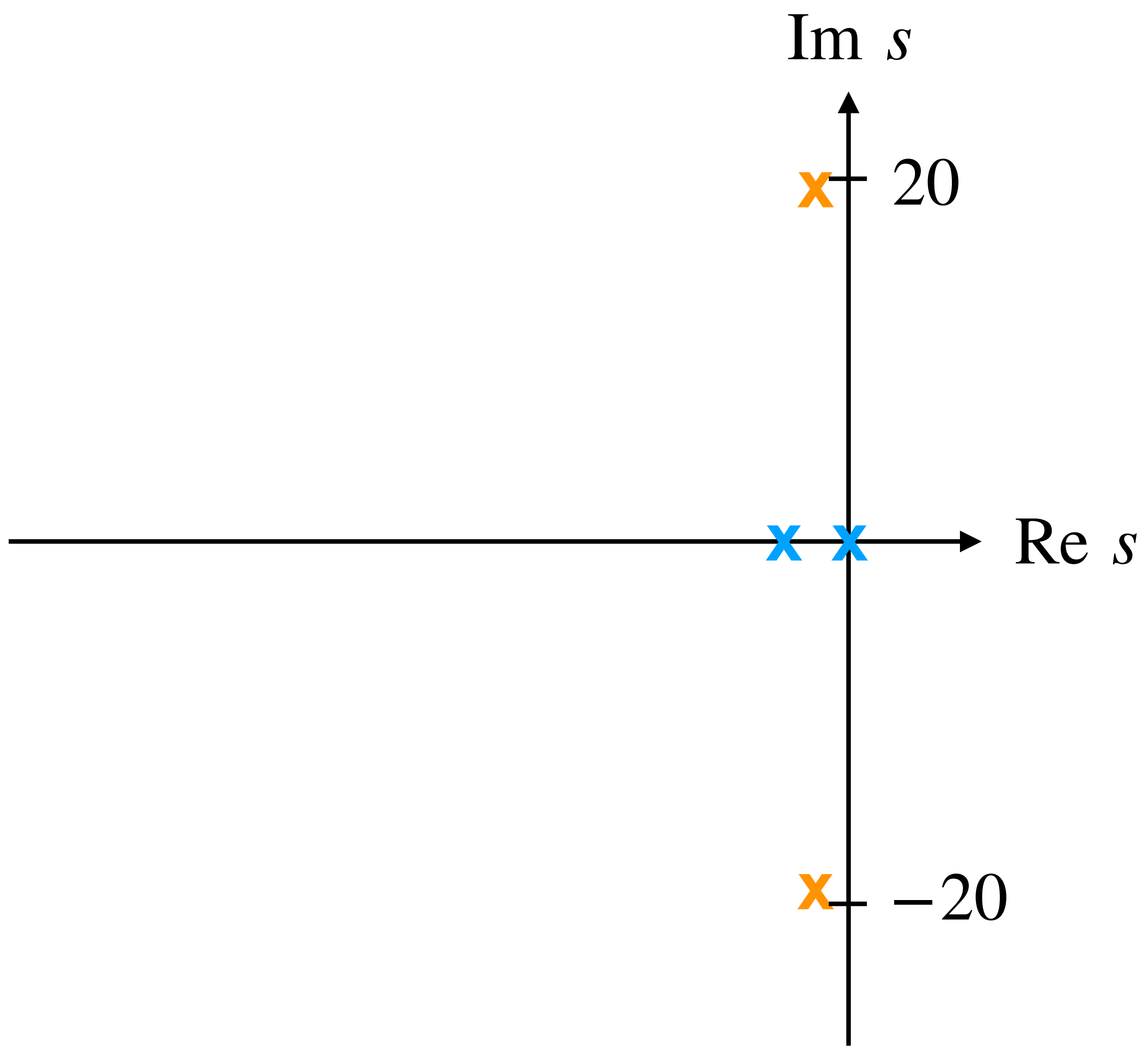

Is the system stable?

What is state feedback?
What is the difference from what we did with the PIDs in previous labs?
Which is expected to perform better?

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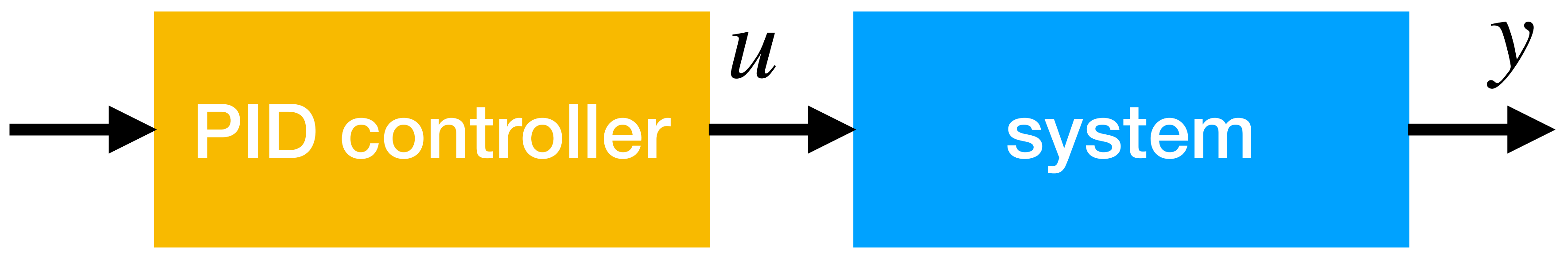

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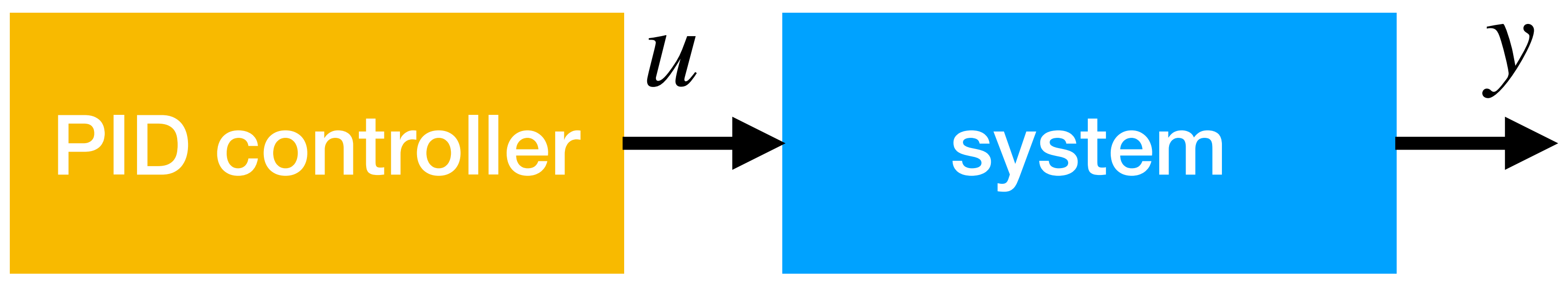

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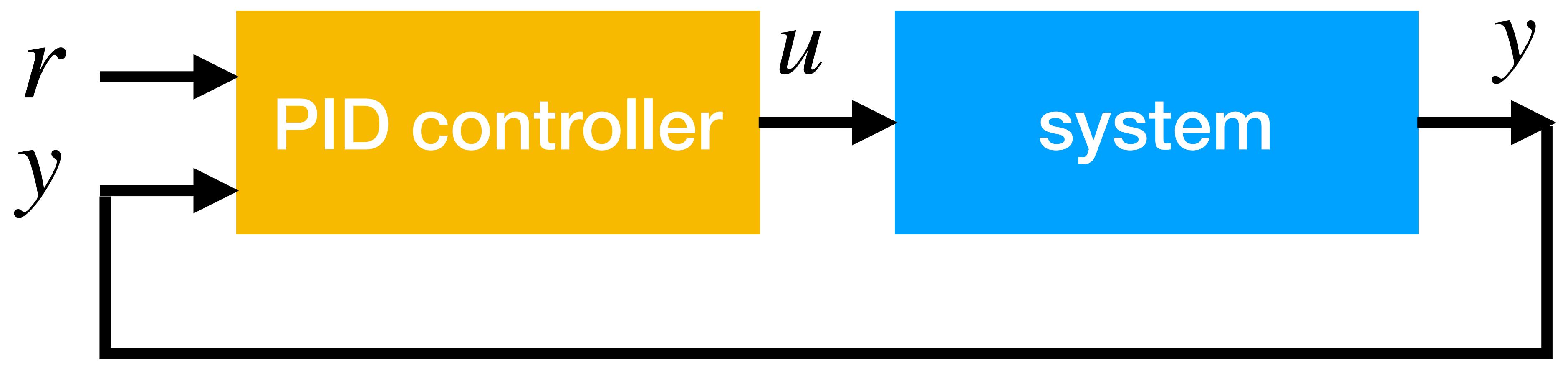

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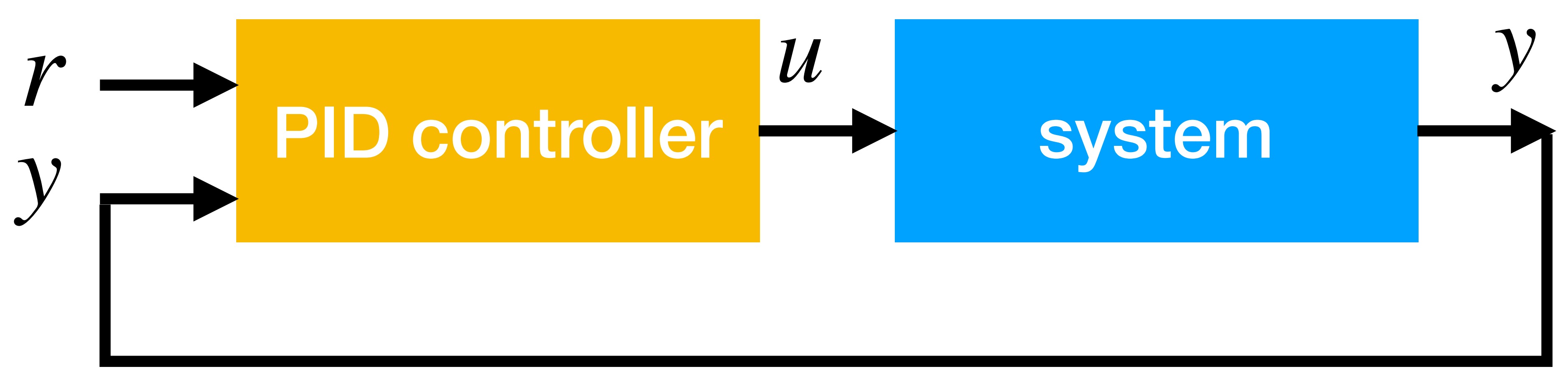

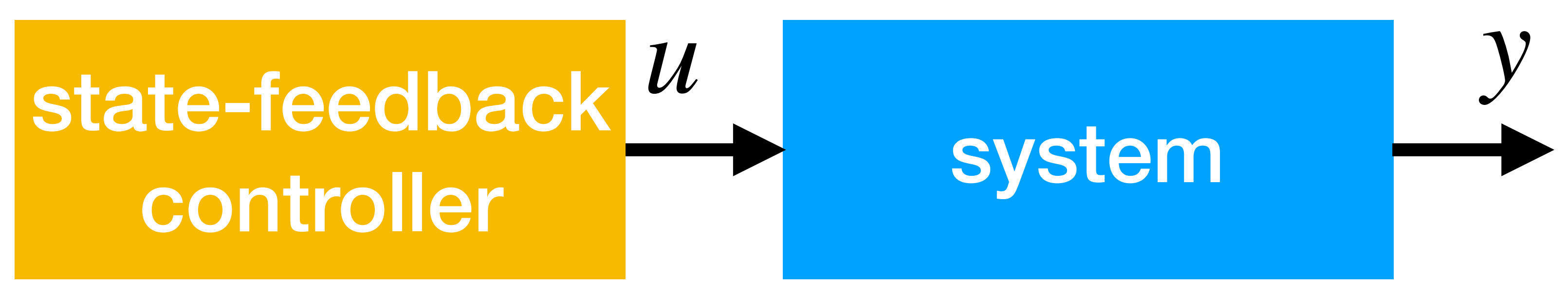

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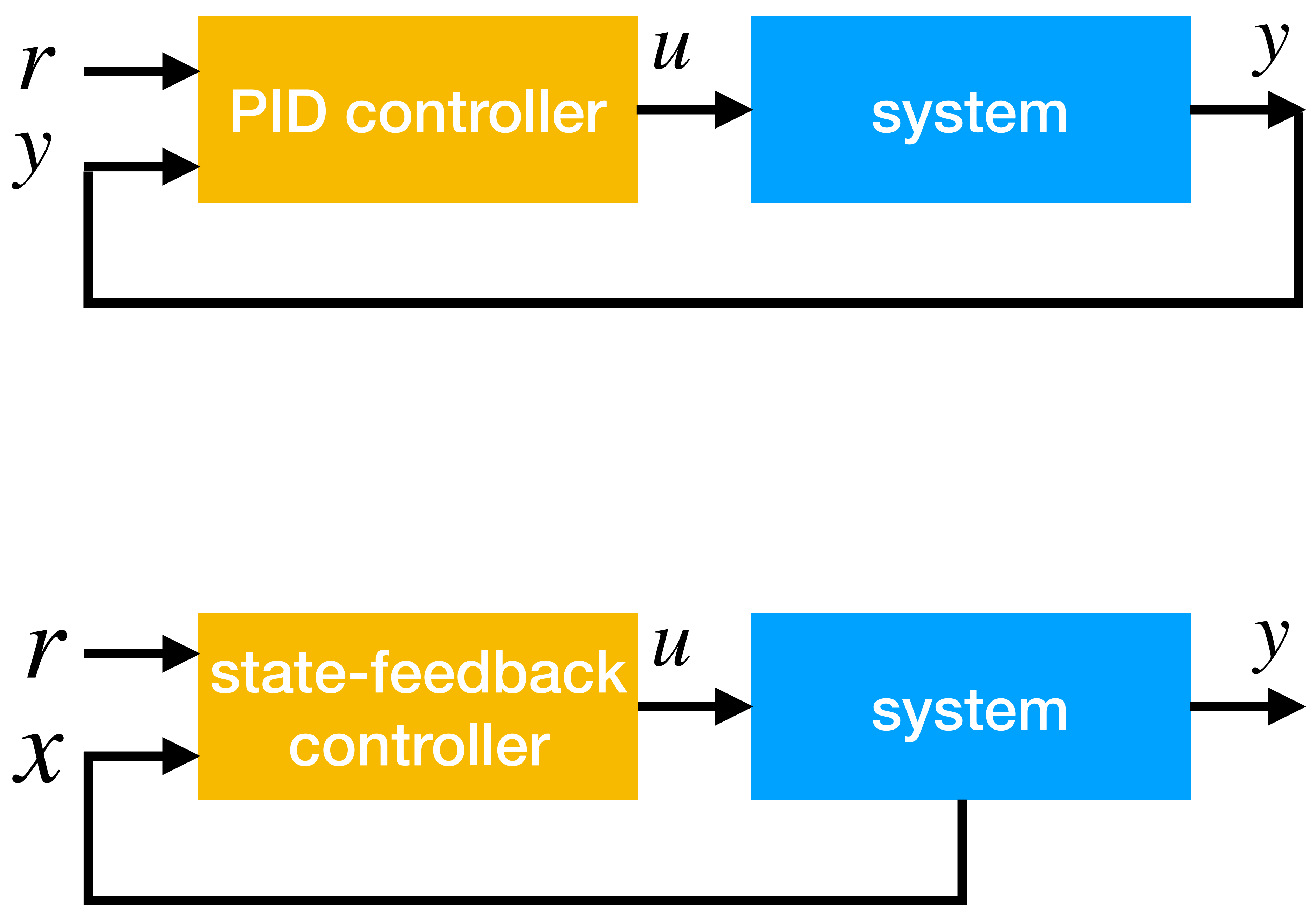

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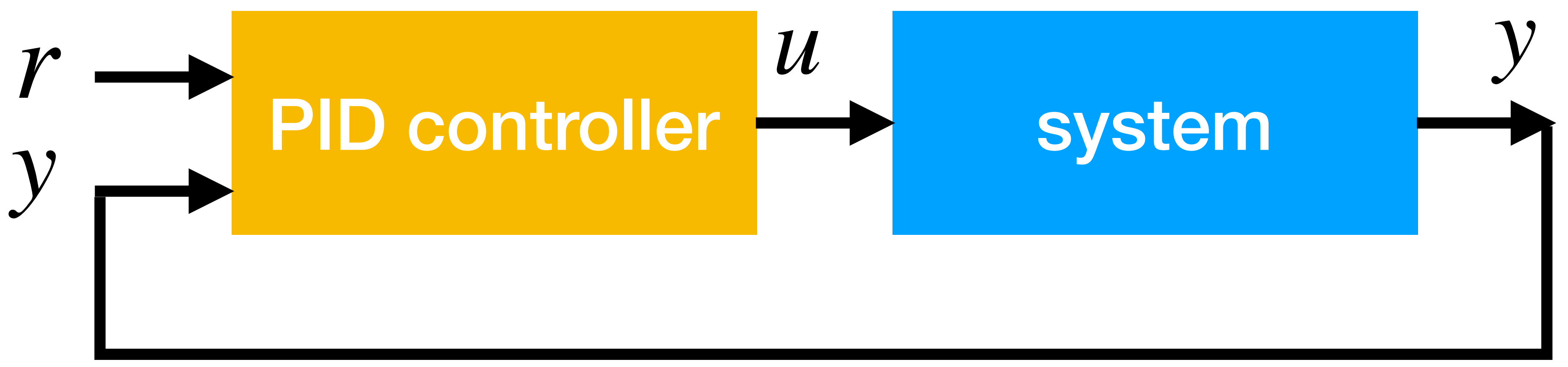
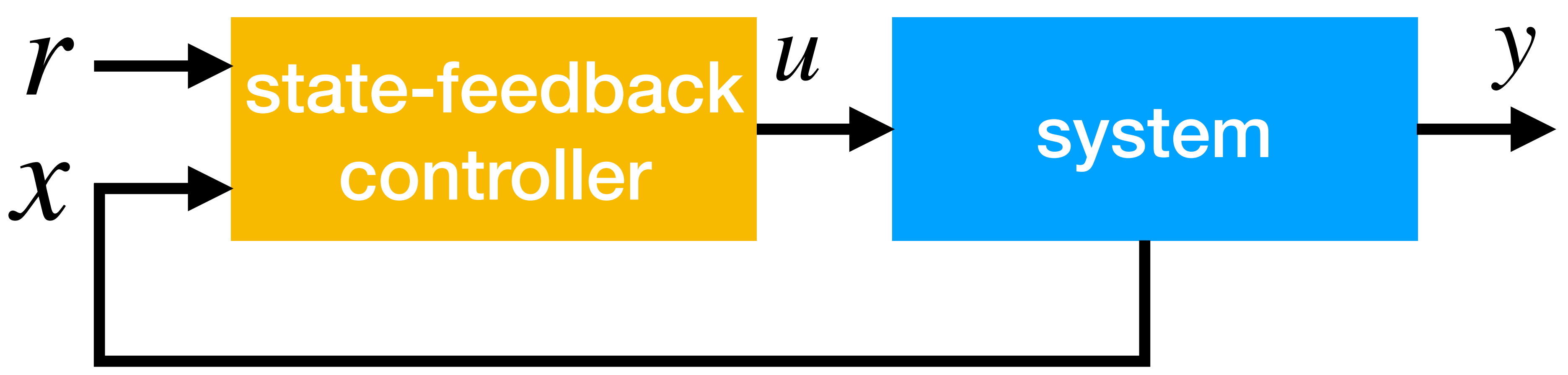


$$u = K(r - y)$$



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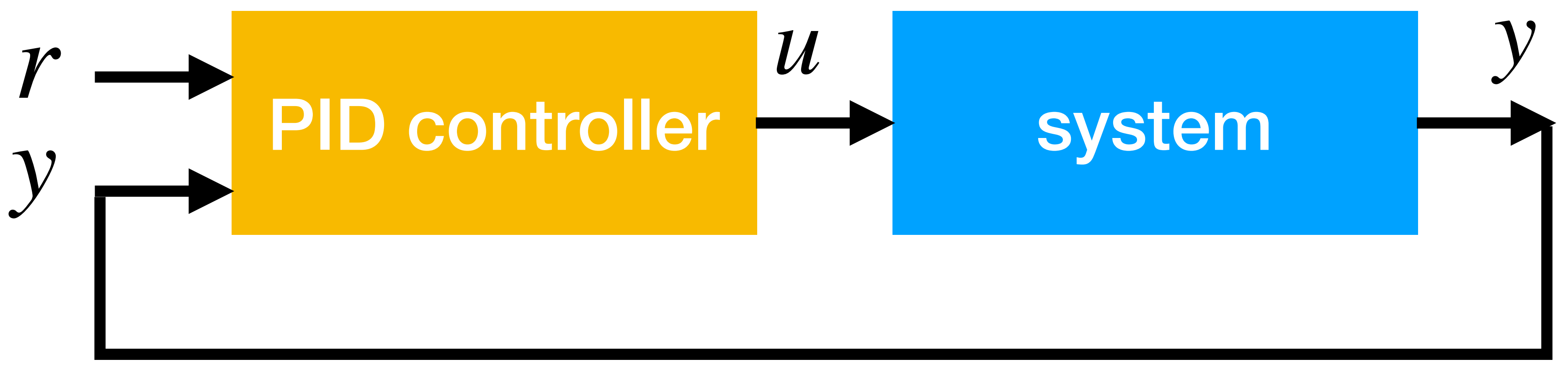

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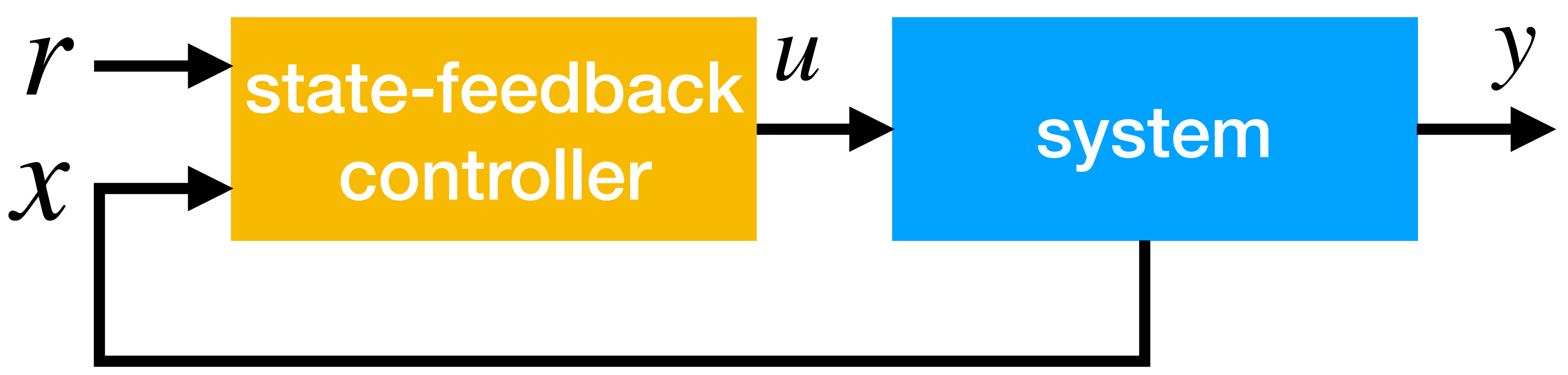

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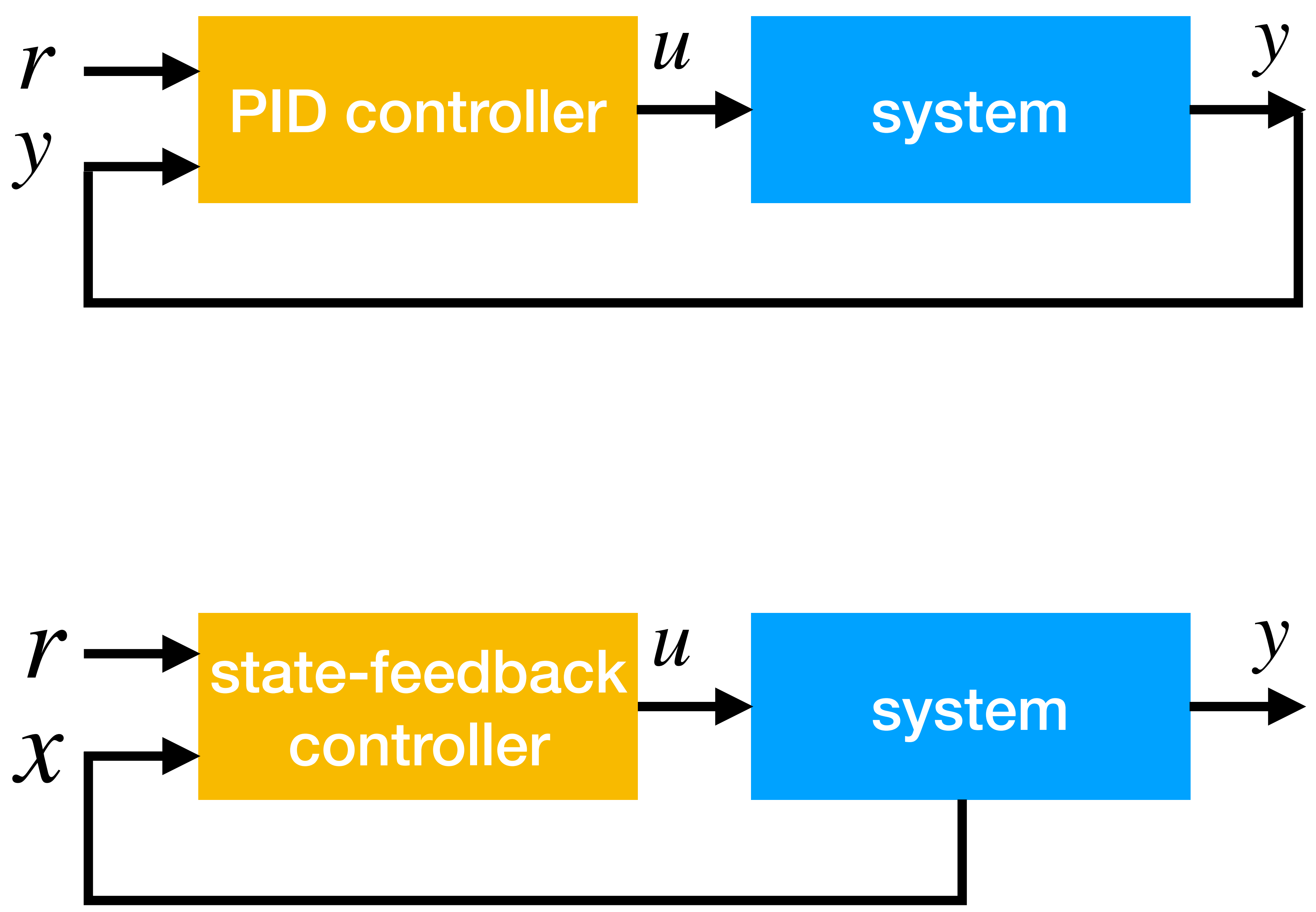

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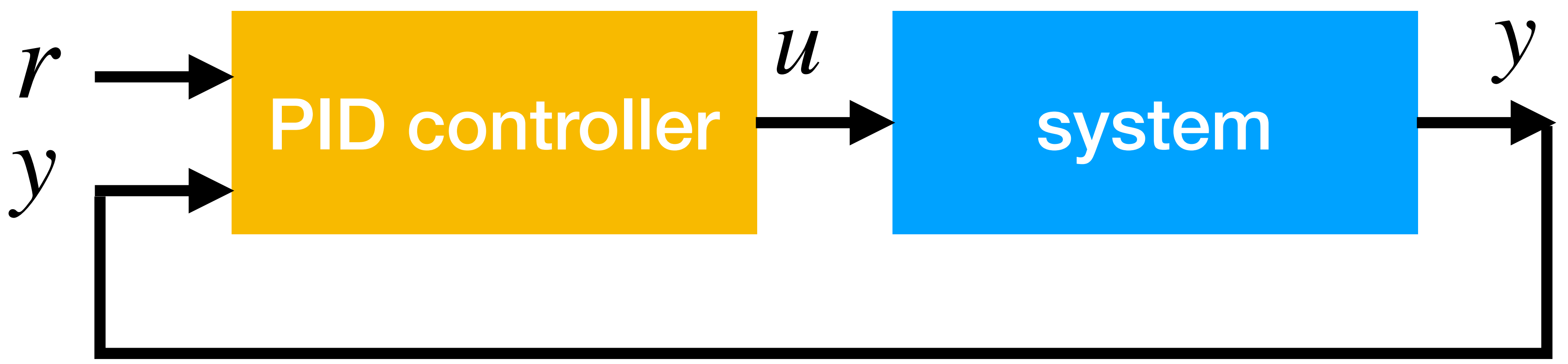

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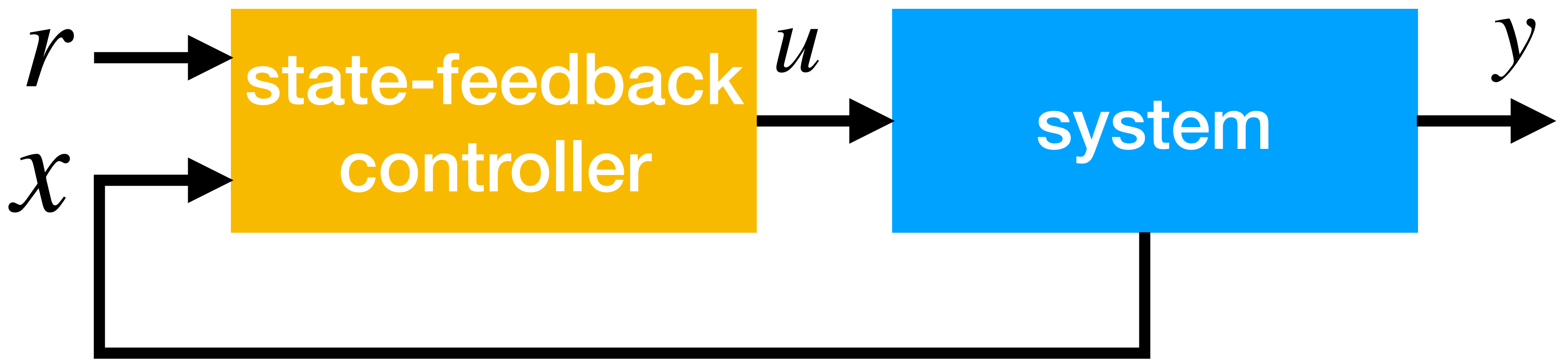

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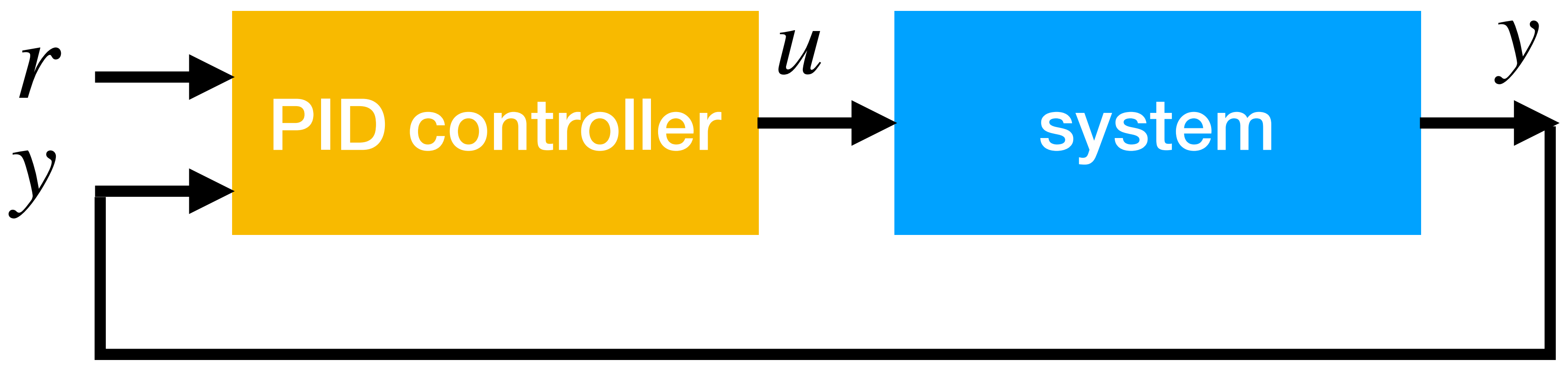

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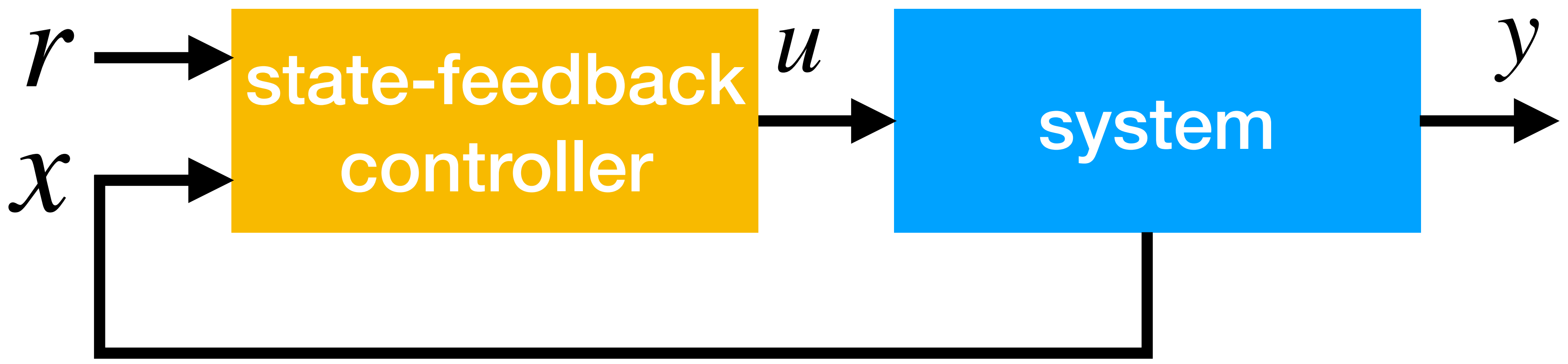

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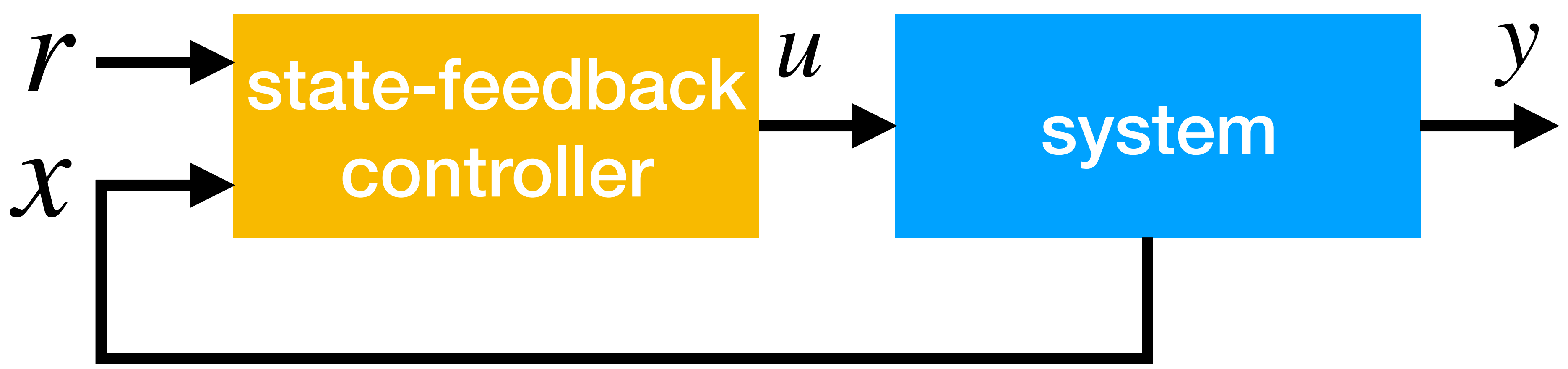

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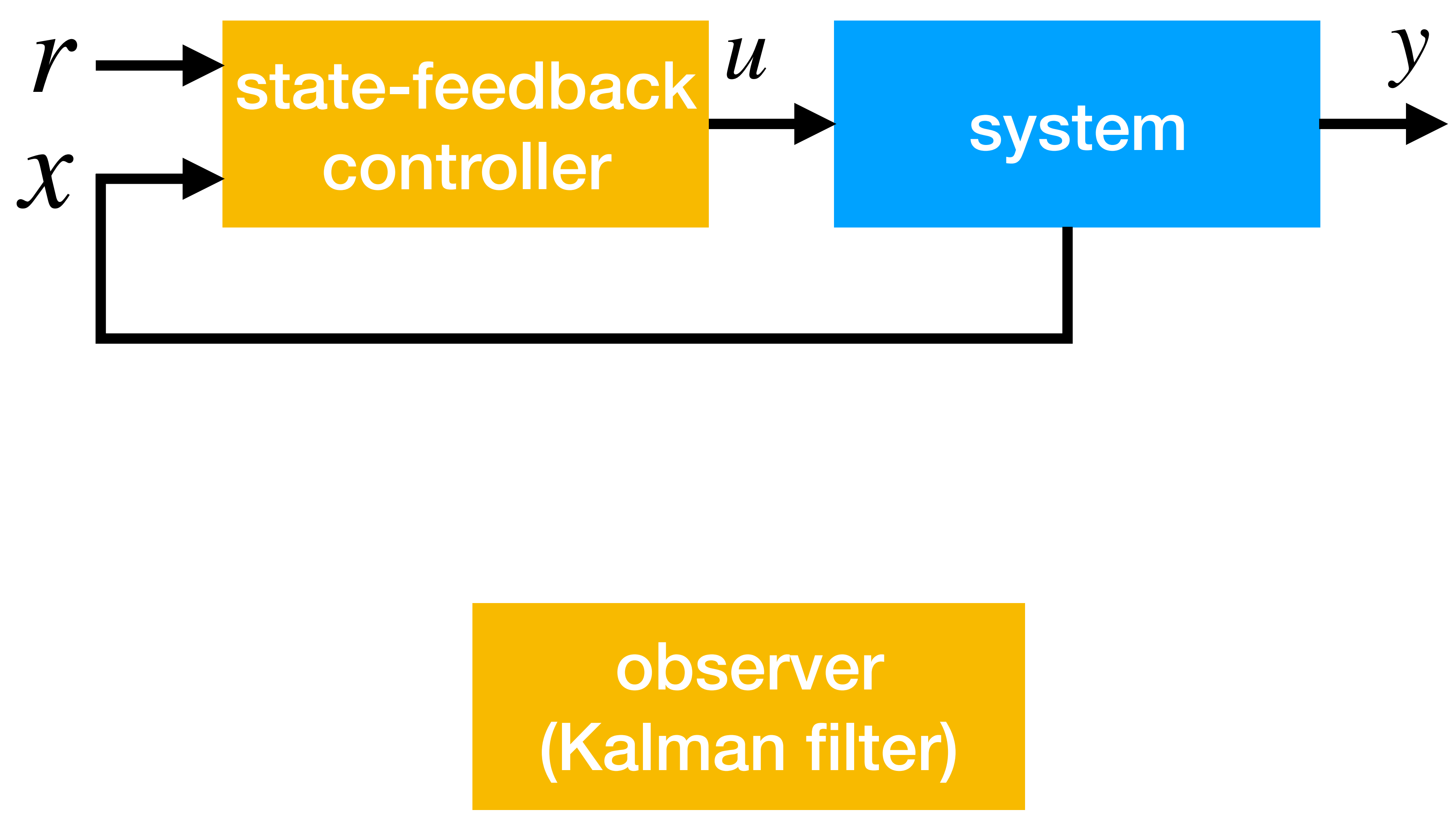

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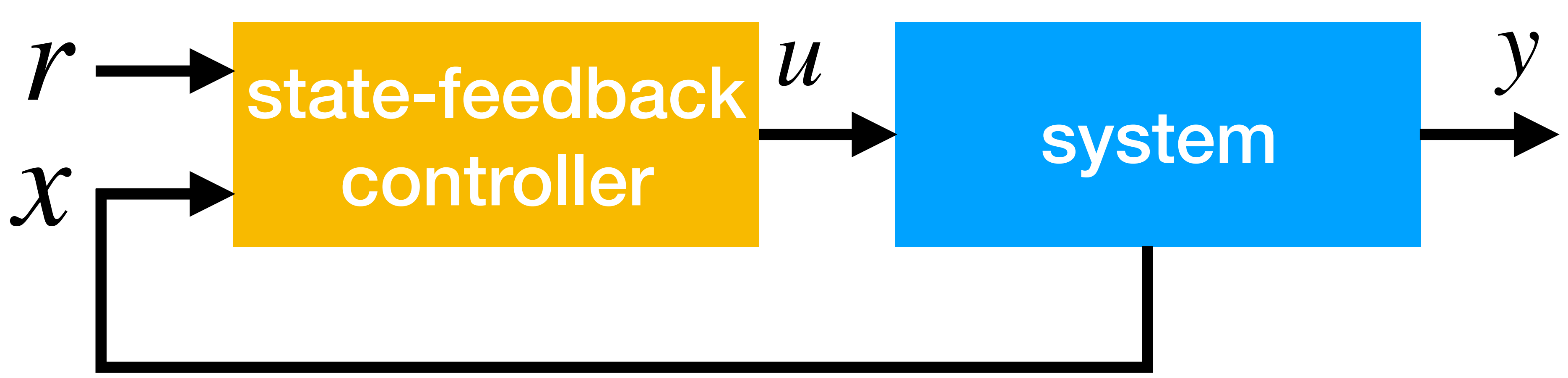

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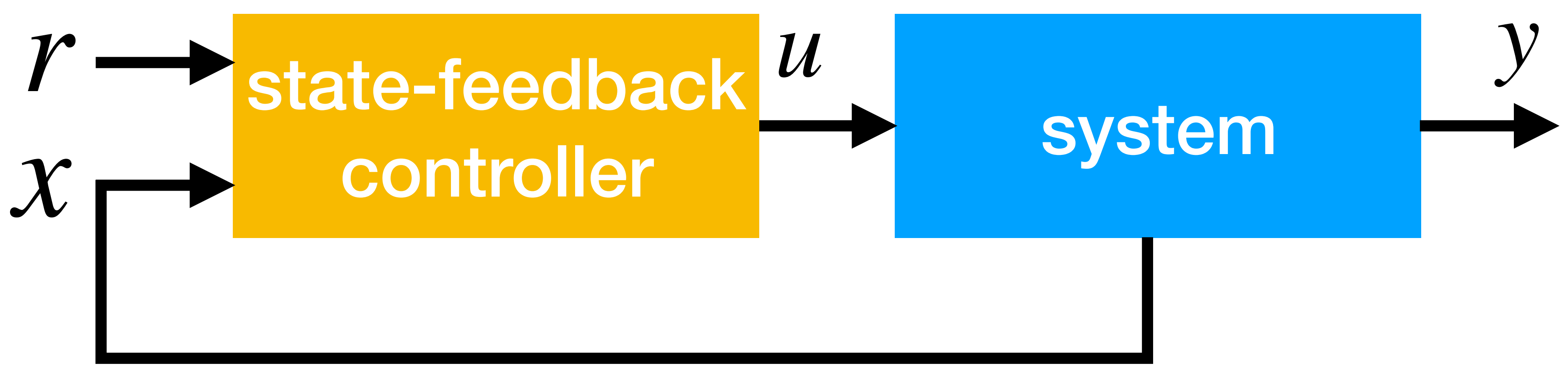

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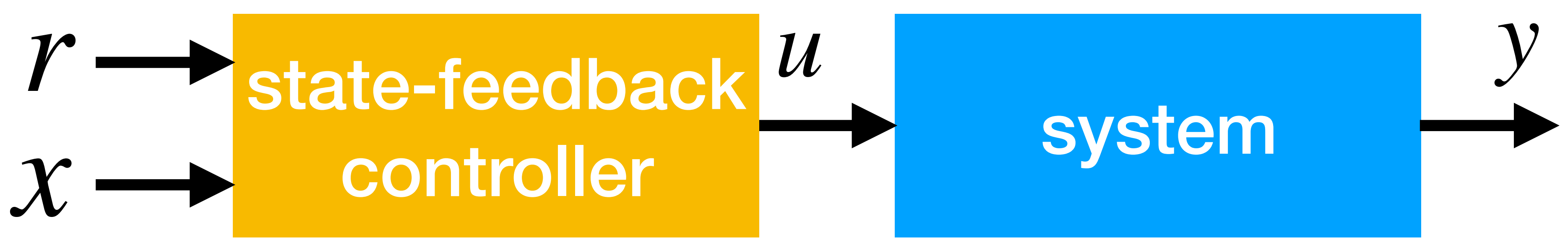

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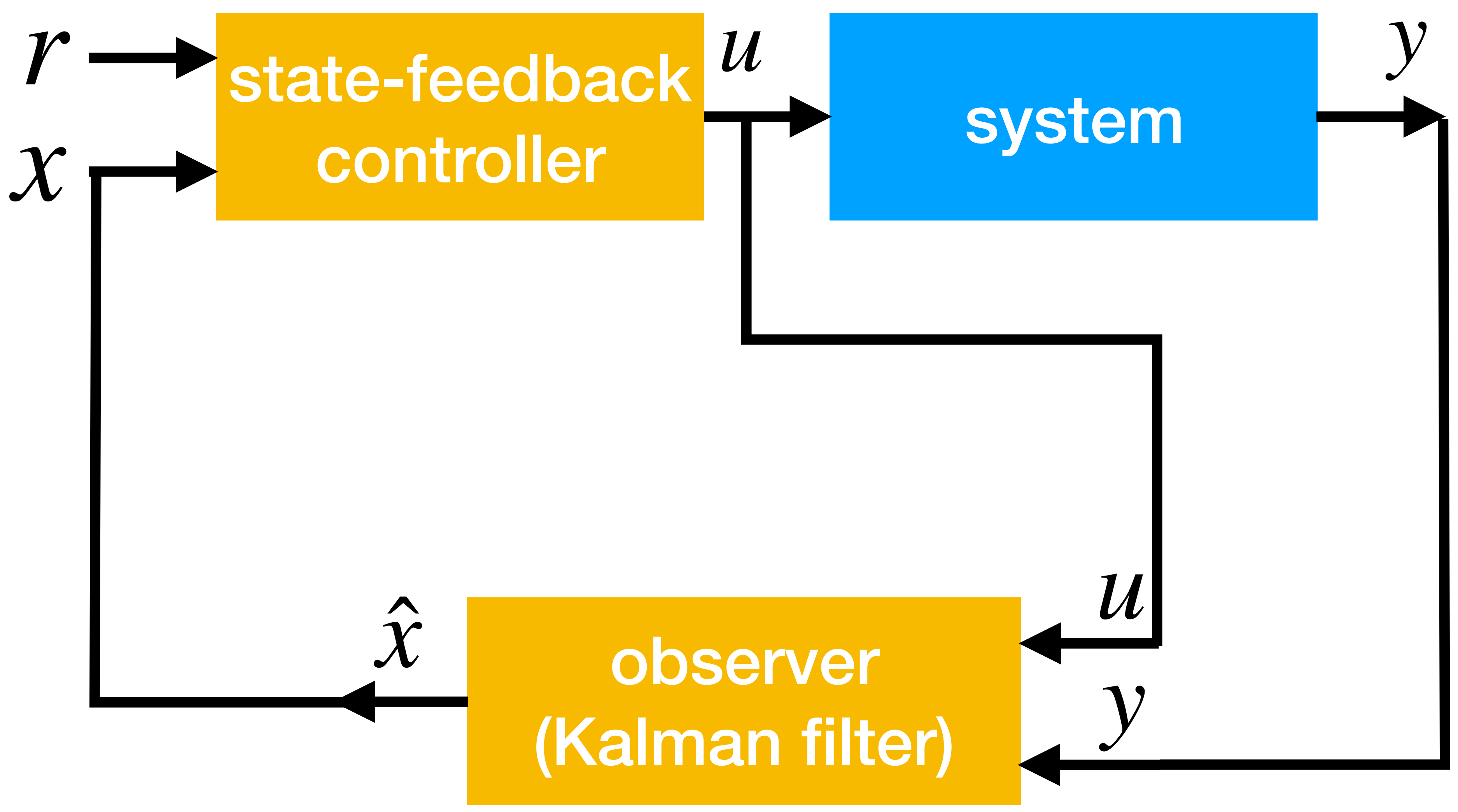

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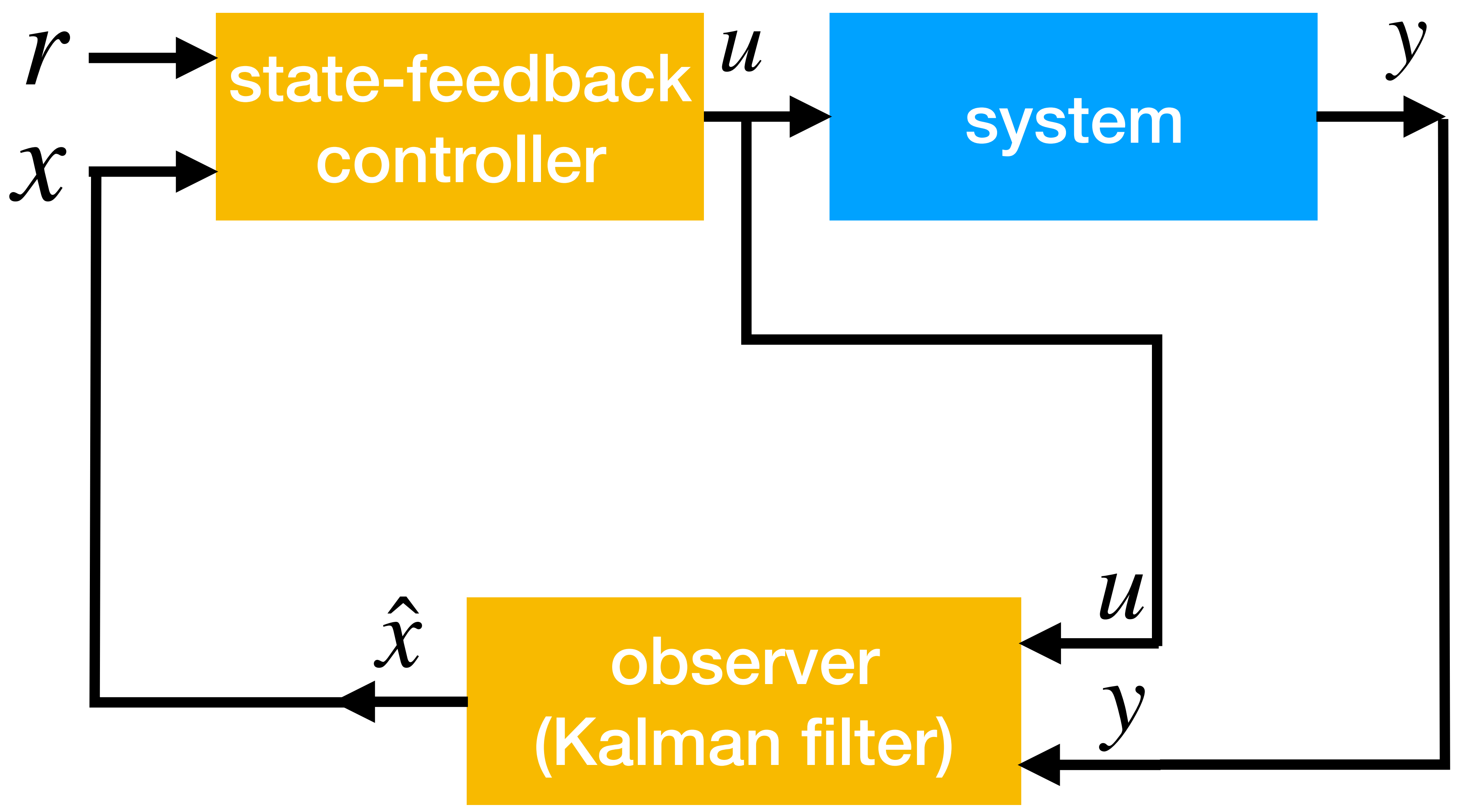

$$\dot{\hat{x}} = A\hat{x} + Bu + K(y - \hat{y})$$

$$\hat{y} = C\hat{x}$$

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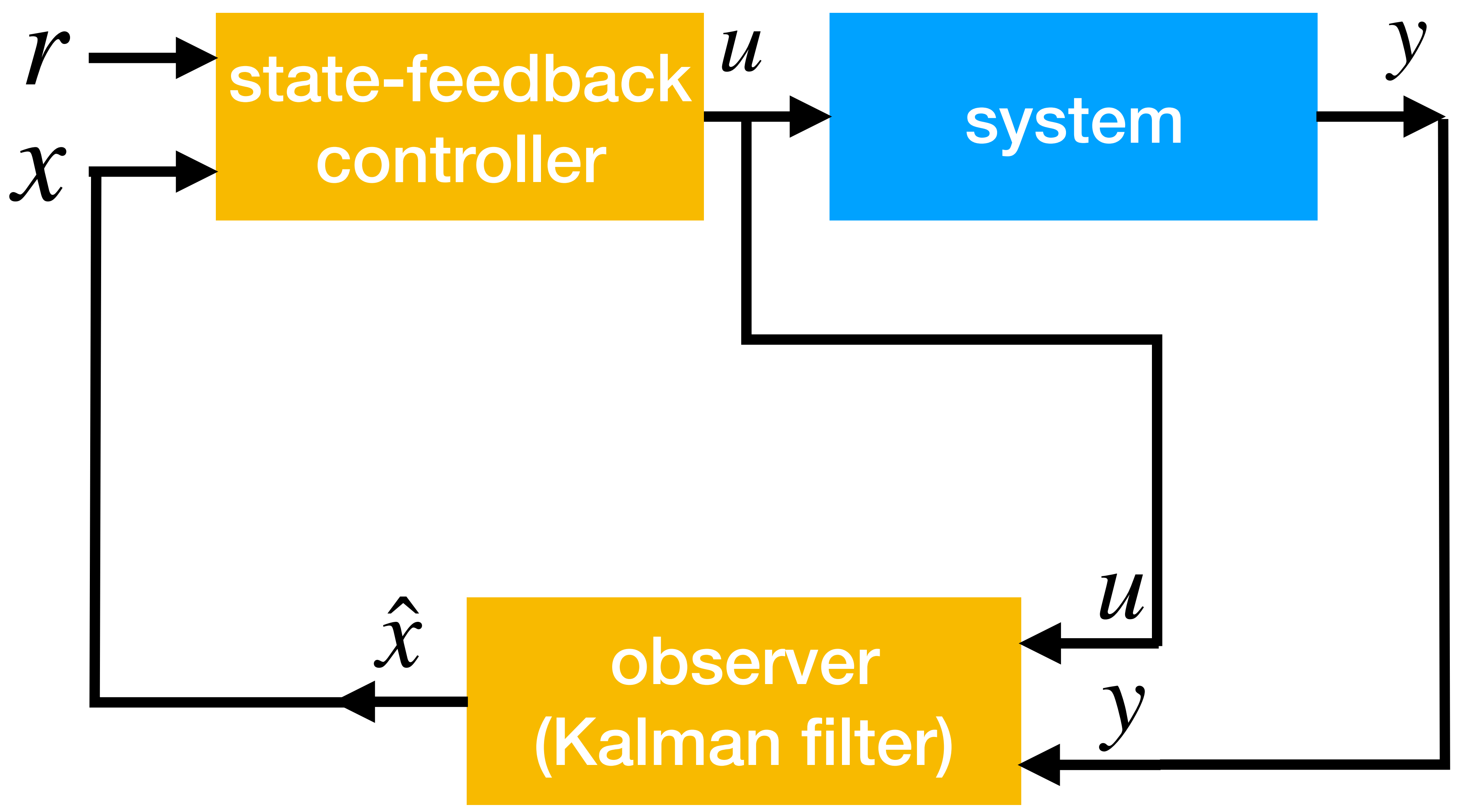

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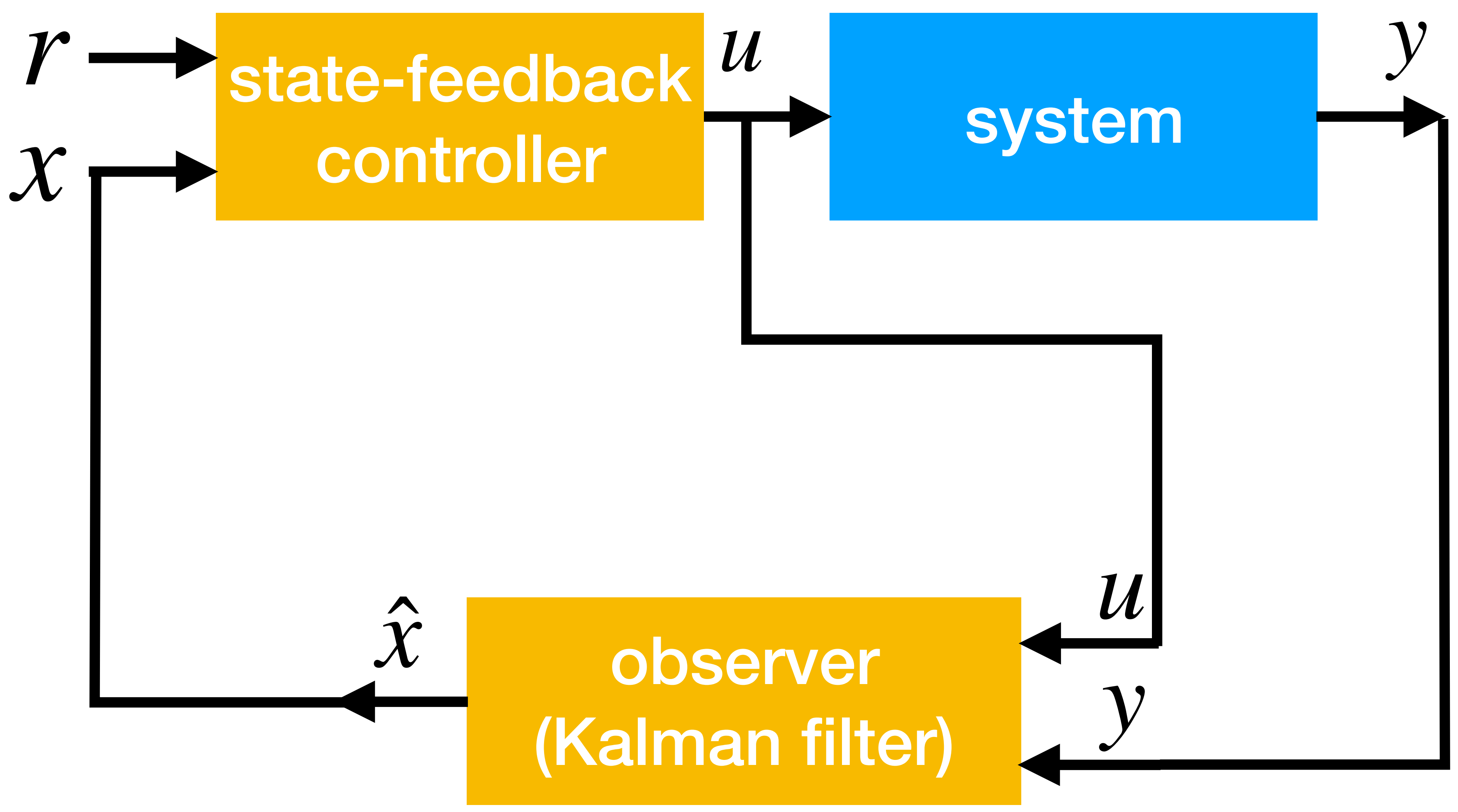

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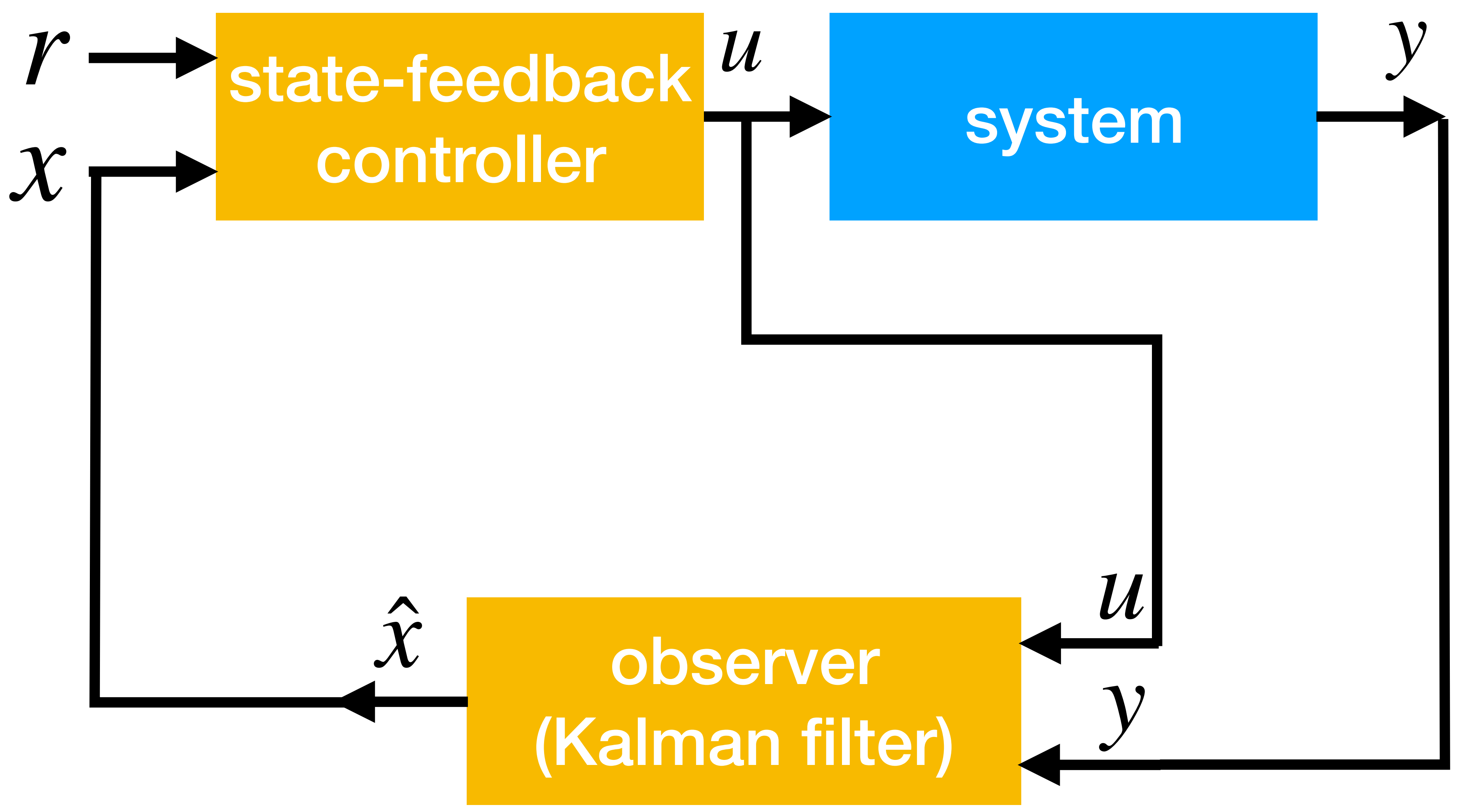

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Can we always use an observer?

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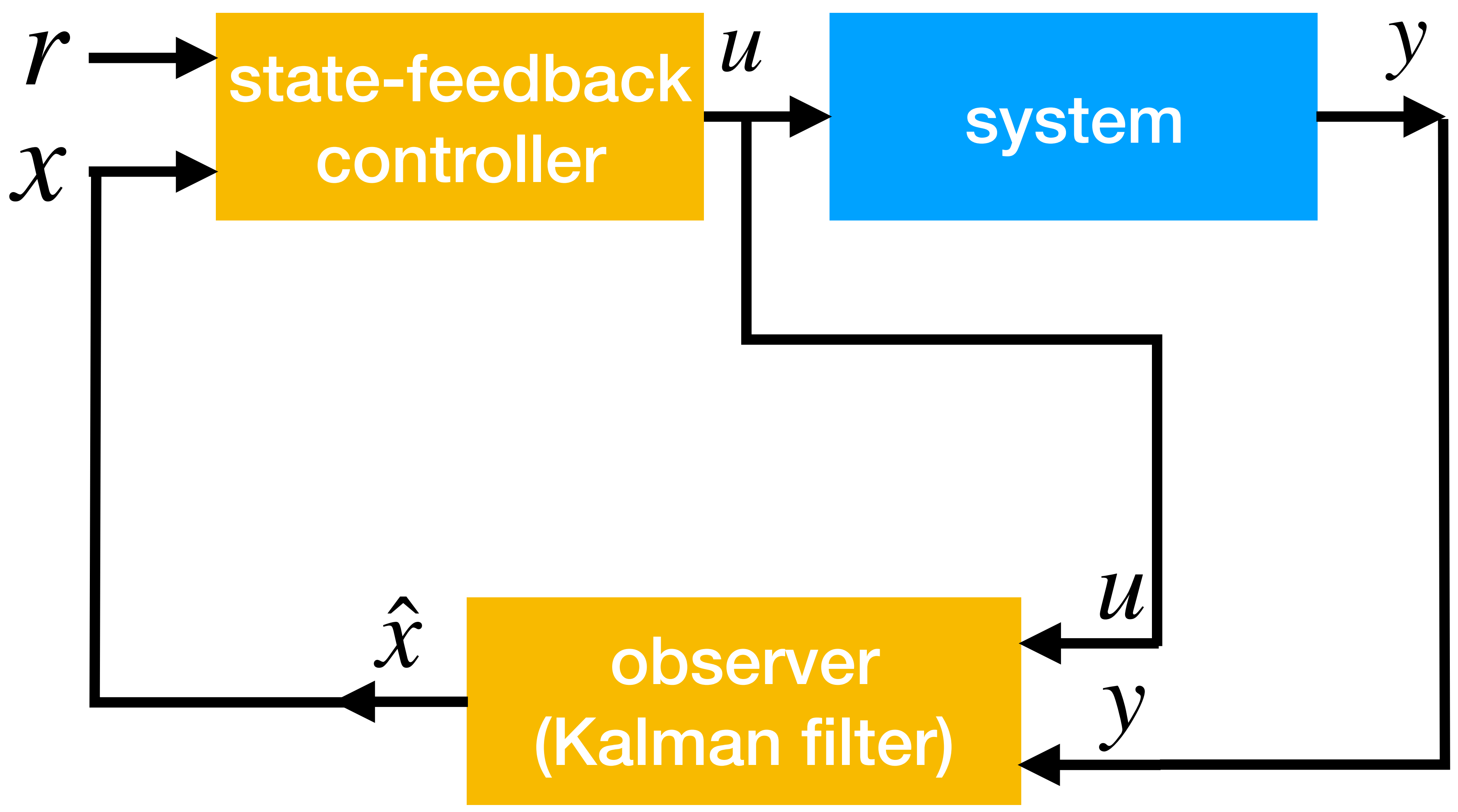

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$$W_o = \begin{bmatrix} C \\ CA \\ CA^2 \\ CA^3 \end{bmatrix}$$

Observability matrix

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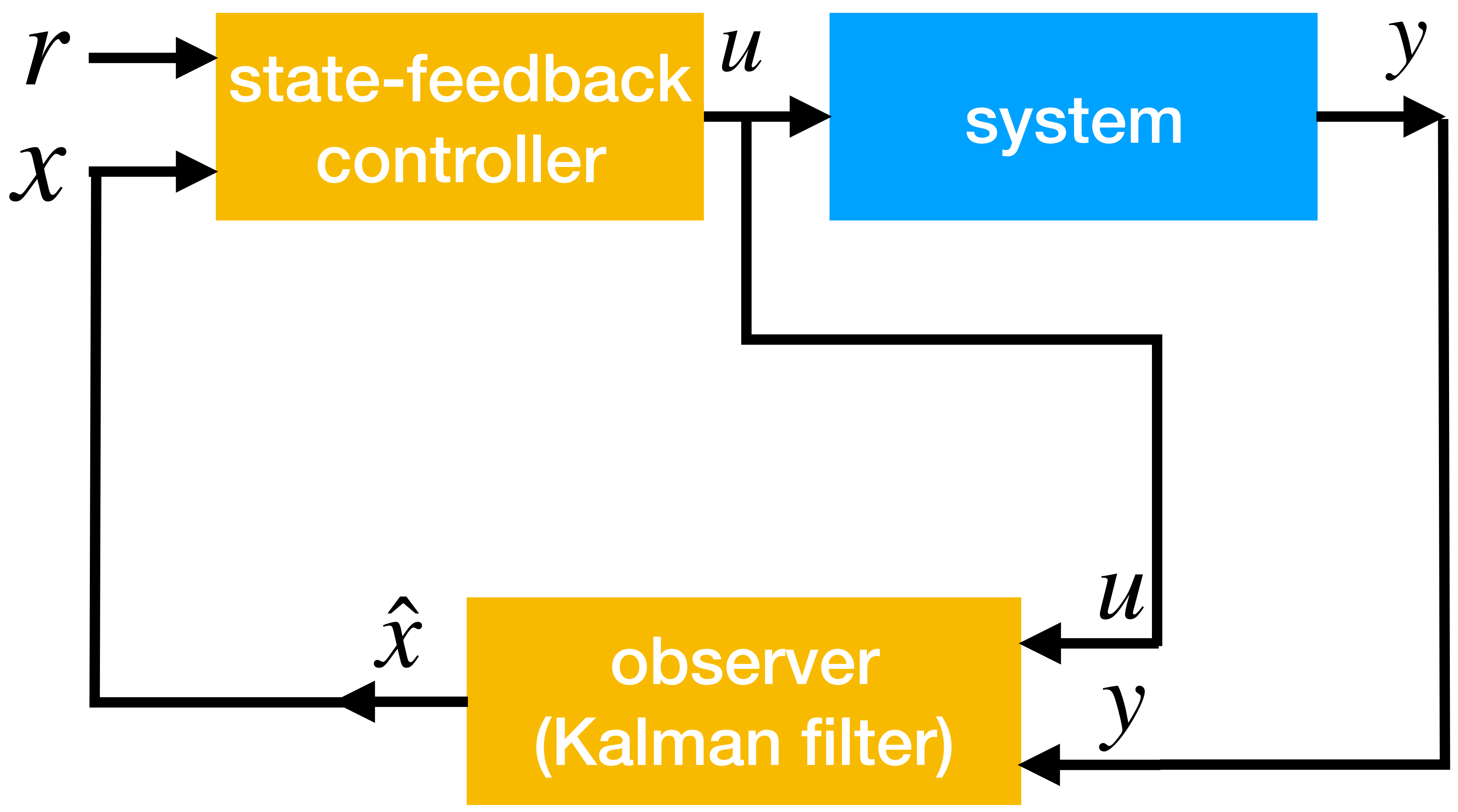

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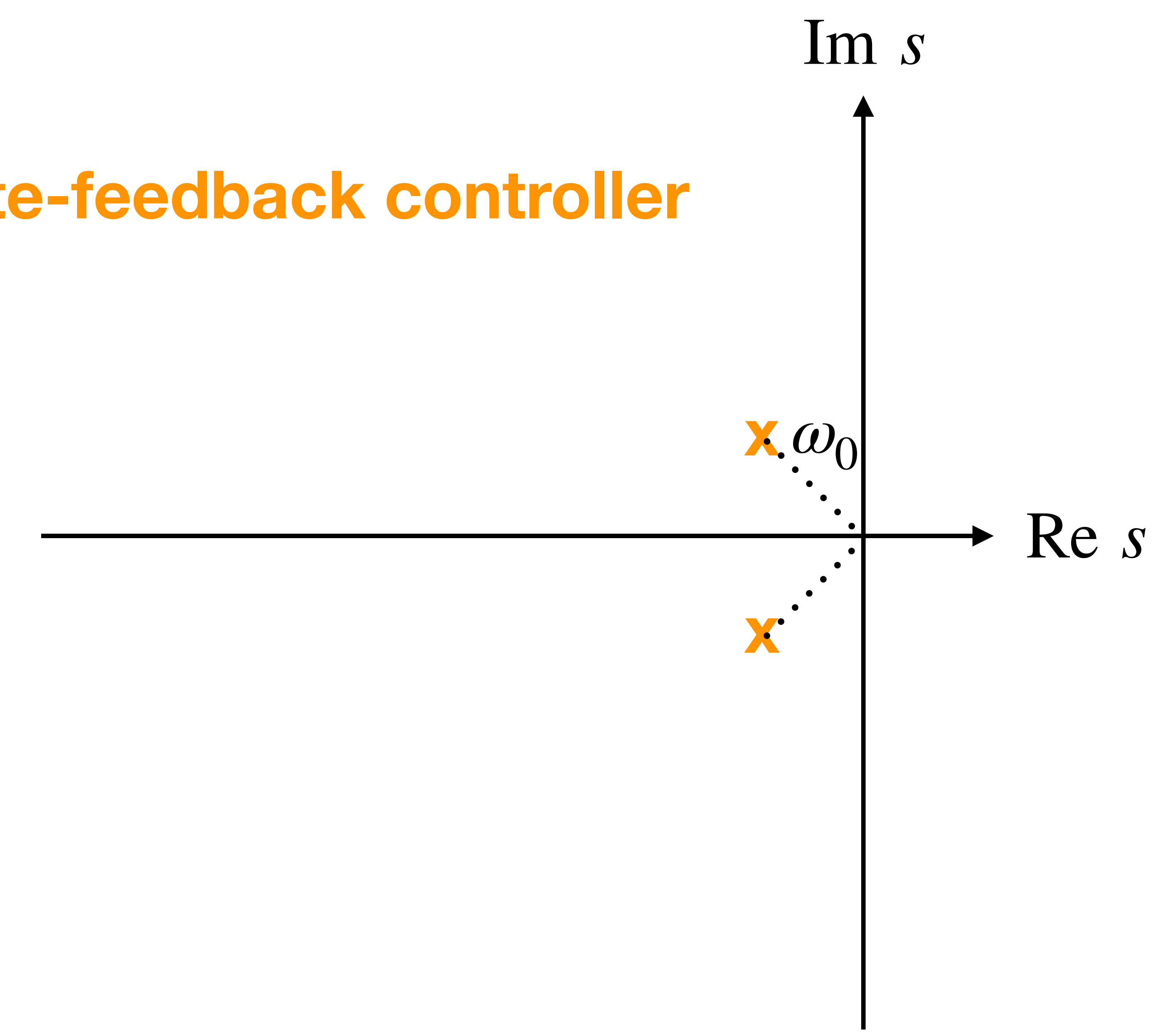
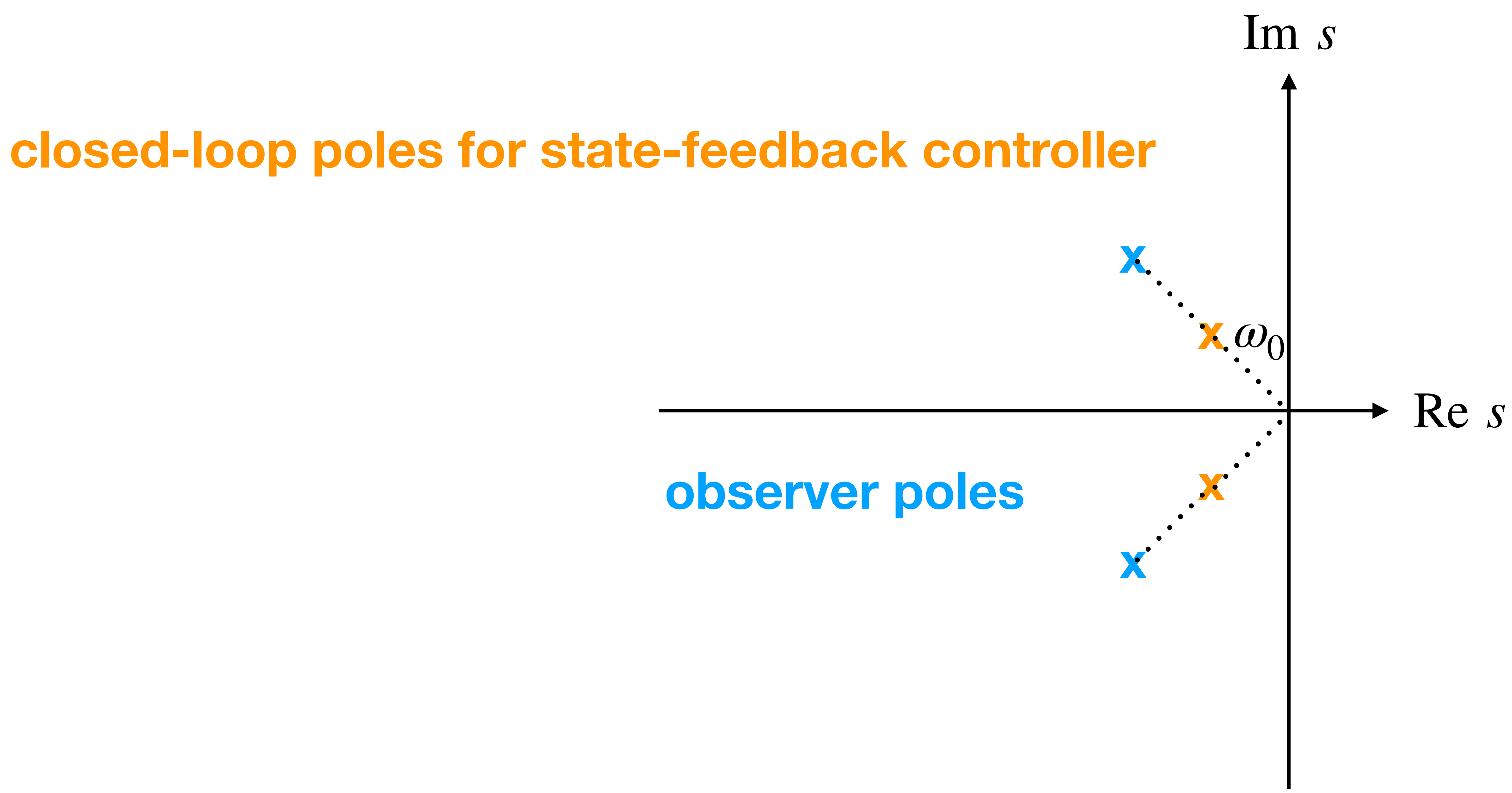
Where should we place the poles for the observer?

closed-loop poles for state-feedback controller



Where should we place the poles for the observer?



How can we add integral action to the controller?

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before

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$$u = -Lx + l_r r$$

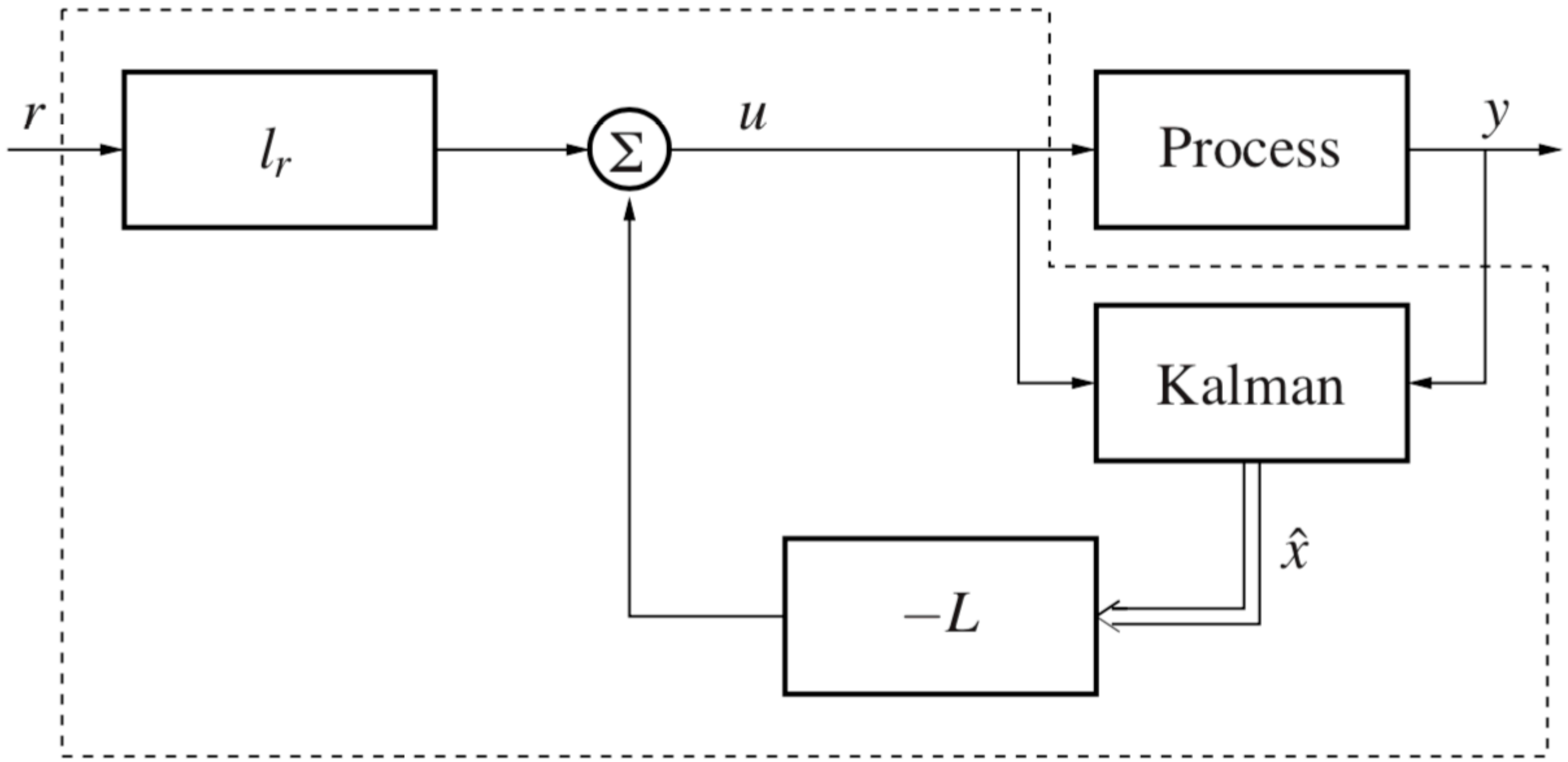
before

$$u = -Lx - l_i x_i + l_r r$$

after

How many states does the closed-loop system have?

$$Y(s) = G_{cl}(s)R(s)$$



How many states does the controller with integral action have? What are they?

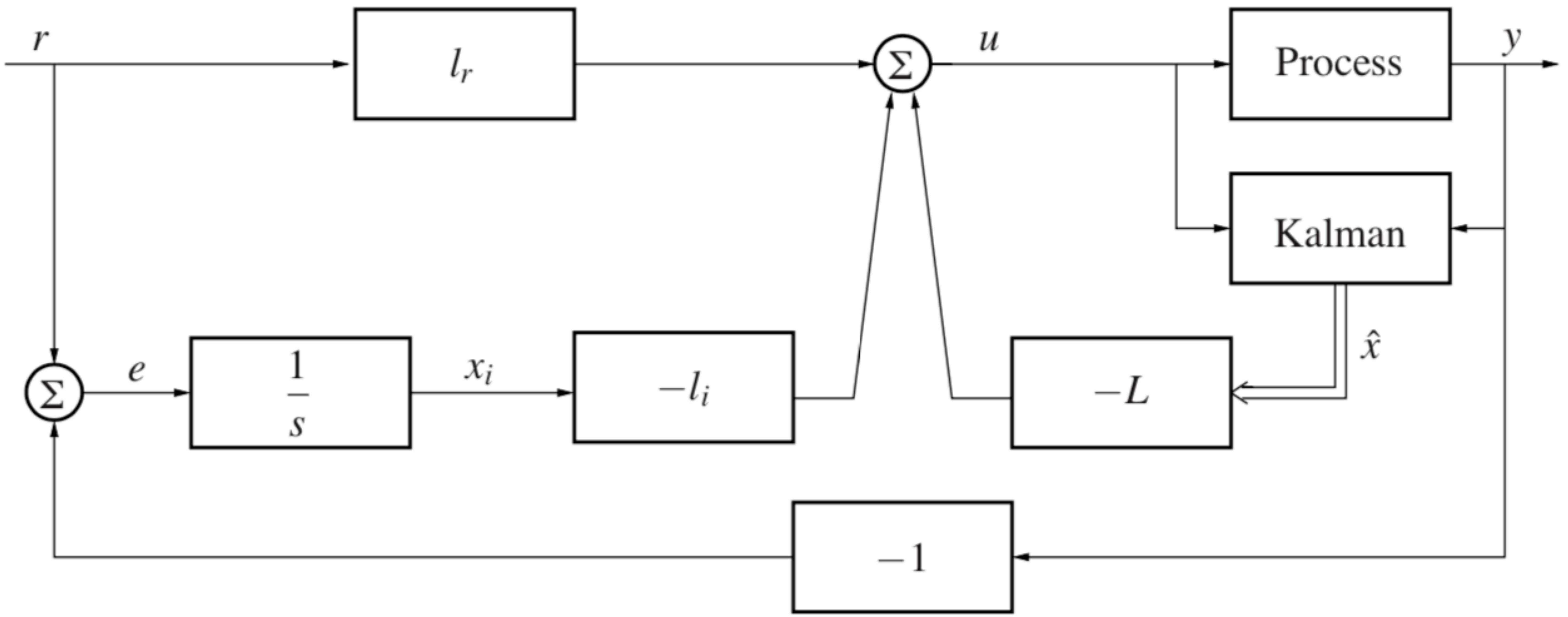


Figure 14 Feedback from estimated states with integral action.

How can we see in the Bode plot of the controller if it has integral action or not?

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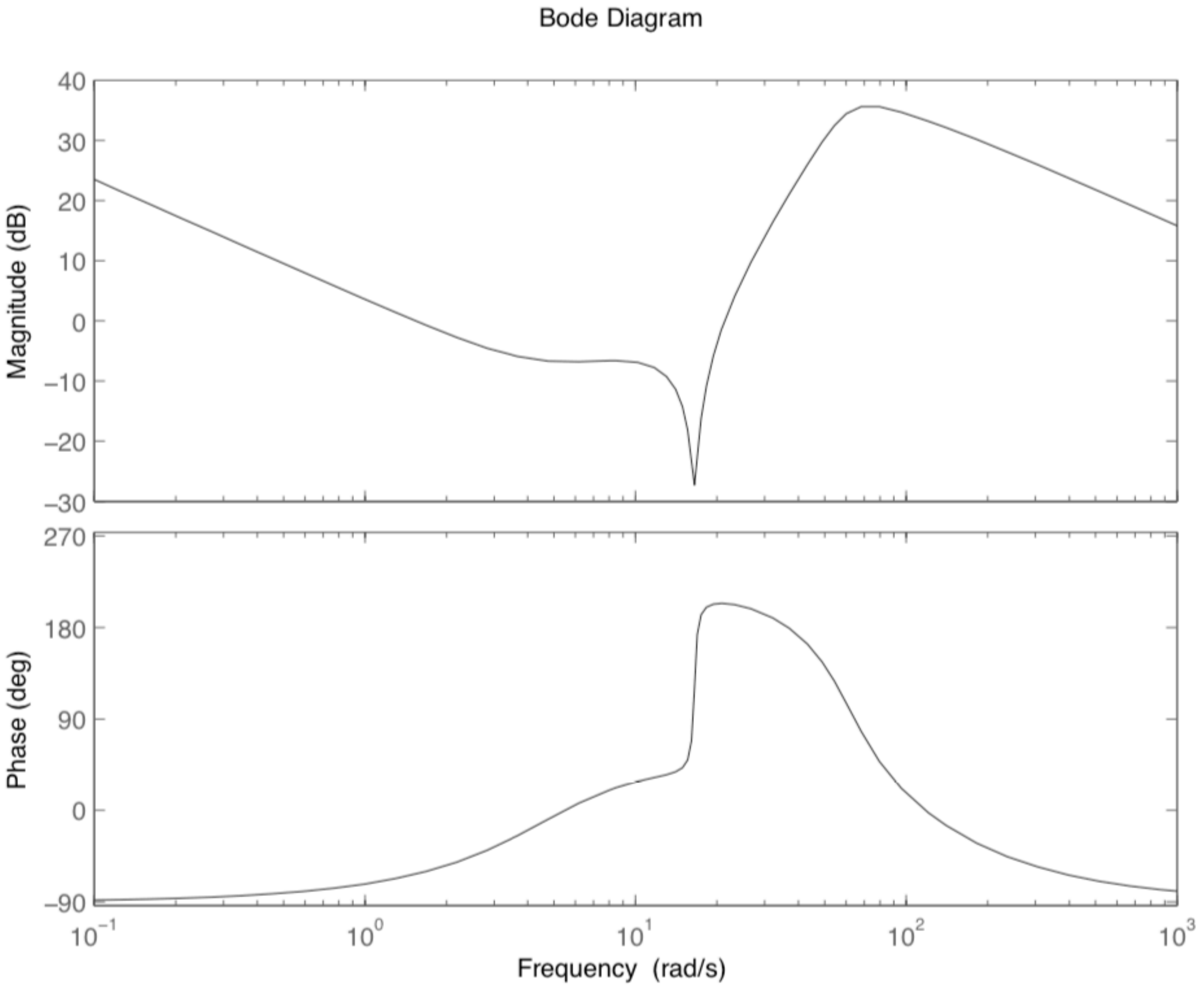

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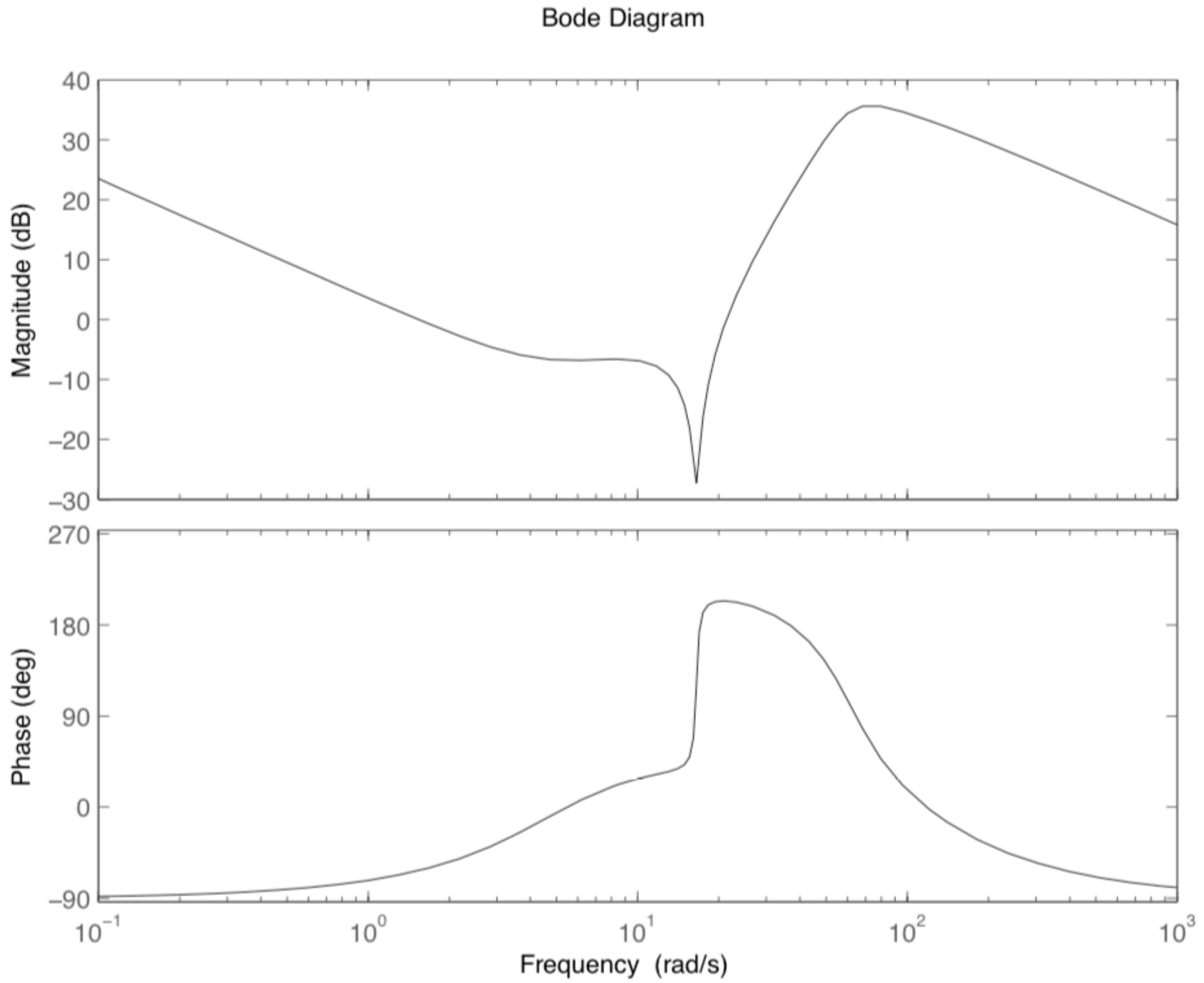

$$G(s) = \frac{1}{s} \Rightarrow |G(i\omega)| = \frac{1}{\omega}$$

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