

Ingénierie Electronique pour le Traitement de l'Information

TD5 – S6

Corriger un « vrai » système

Julien VILLEMEJANE



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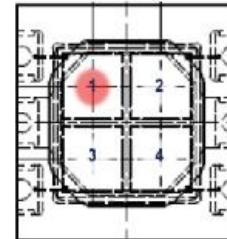
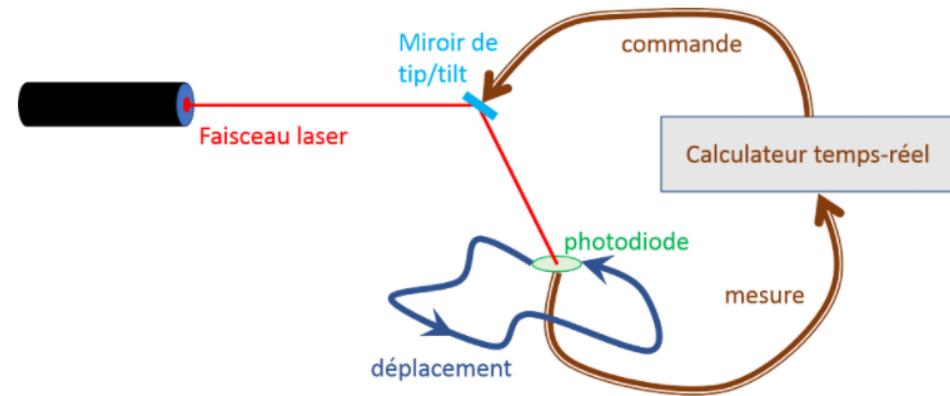


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Bordeaux

- Asservissement de la position d'un faisceau LASER



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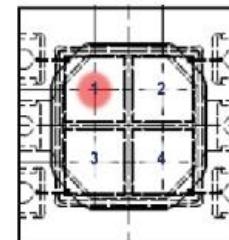
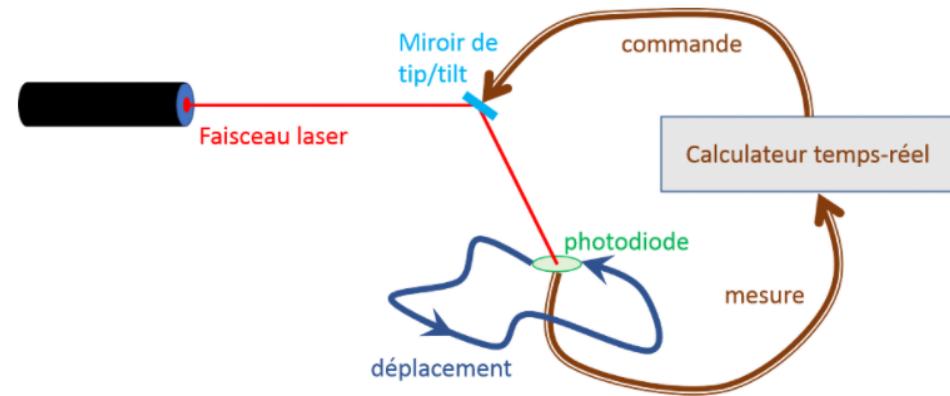
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- Asservissement de la position d'un faisceau LASER

$$T(p) = \frac{G_0}{1 + \frac{2 \cdot m \cdot p}{w_c} + \frac{p^2}{w_c^2}}$$



$$K_{capt} = 10$$



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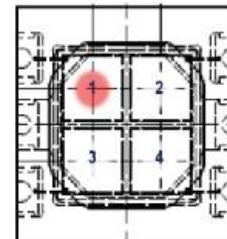
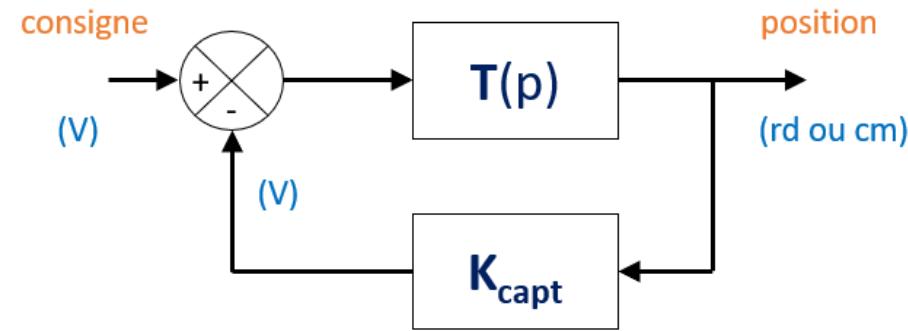
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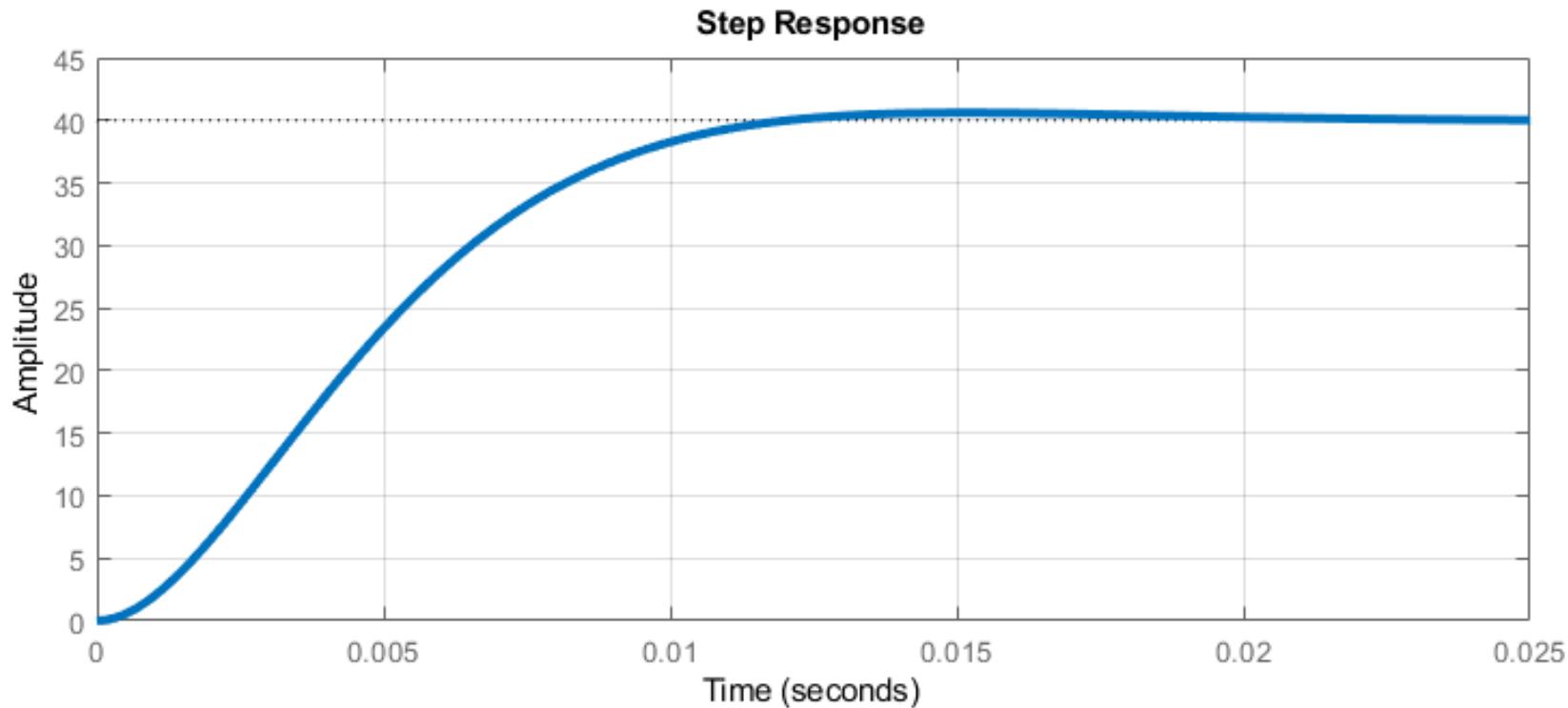


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- Exercice 1 / Réponse à un échelon



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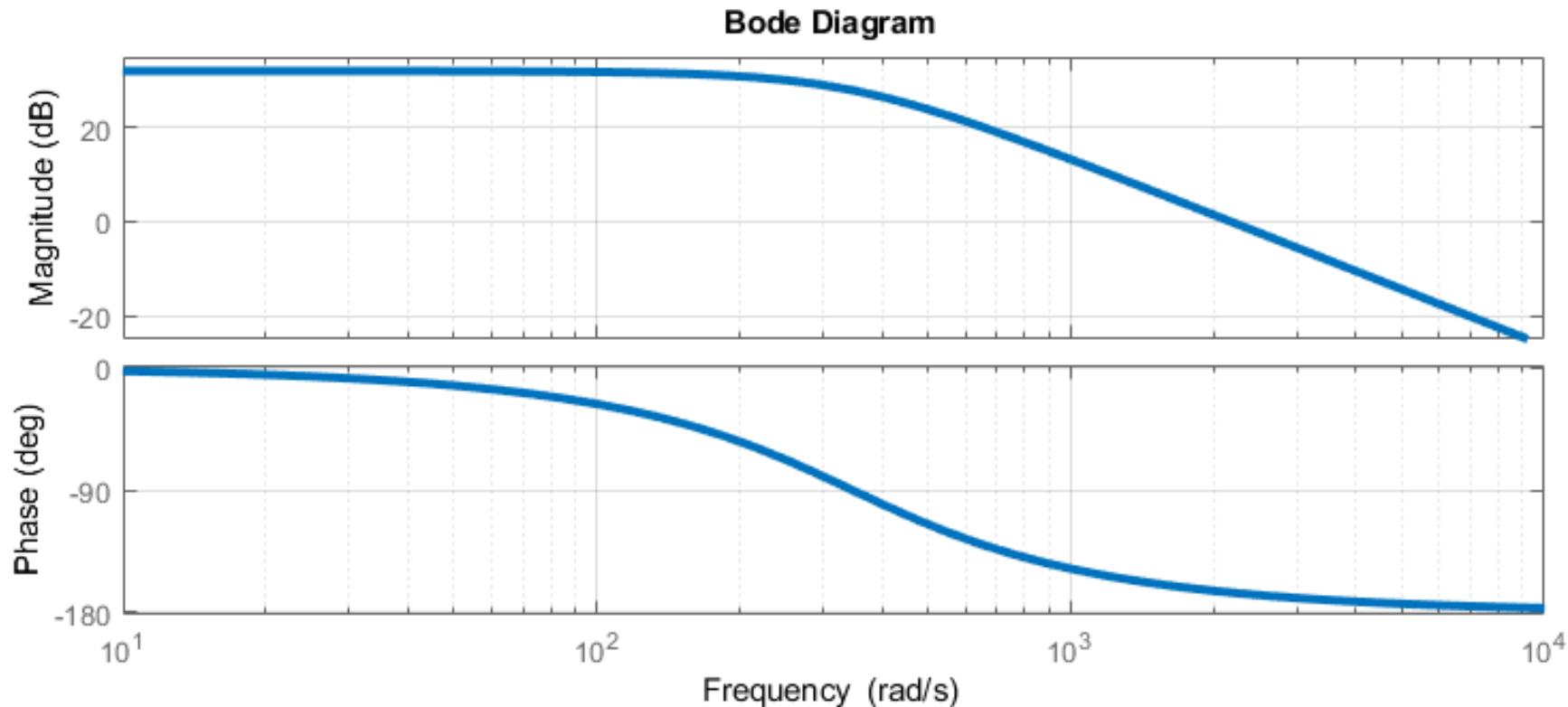
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- **Exercice 1 / Diagramme de Bode**

$$\begin{aligned}G_0 &= 40 \\f_c &= 55 \text{ Hz} \\m &= 0.8\end{aligned}$$



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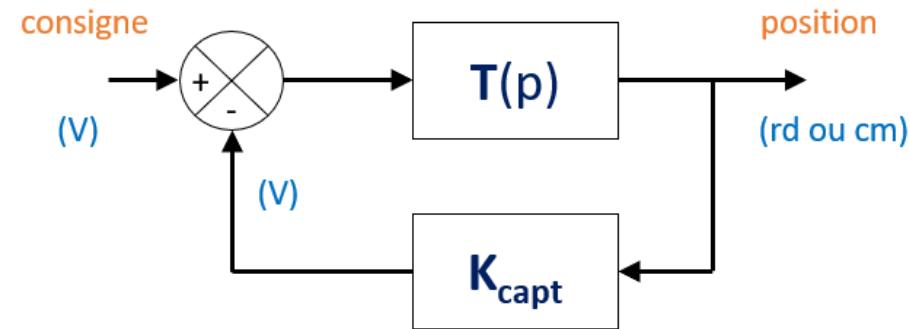


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- **Exercice 2 / Système asservi**



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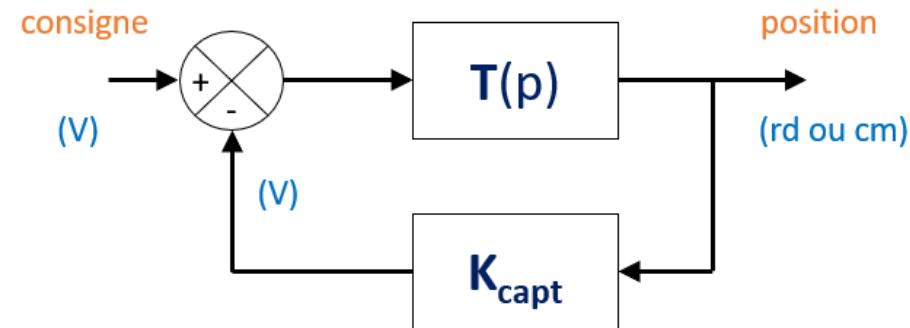
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- Exercice 2 / Système asservi

$$T_{BF}(p) = \frac{T(p)}{1 + T(p) \cdot K_{capt}}$$



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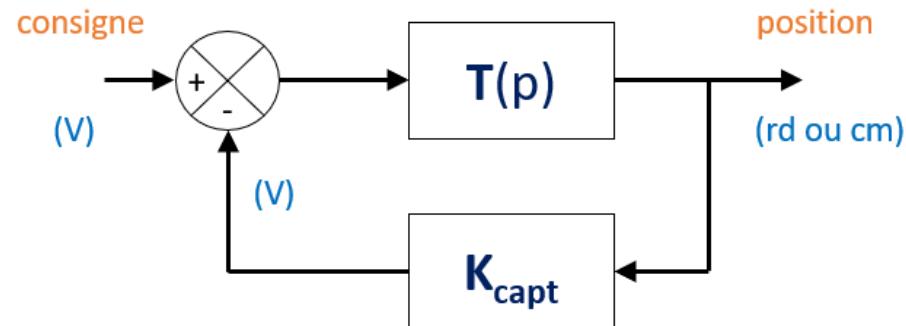
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- Exercice 2 / Système asservi

$$T_{BF}(p) = \frac{T(p)}{1 + T(p) \cdot K_{capt}}$$



$$T_{BF}(p) = \frac{G_0}{1 + G_0 \cdot K_{capt}} \cdot \frac{1}{1 + \frac{2 \cdot m \cdot p}{\omega_c \cdot (1 + G_0 \cdot K_{capt})} + \frac{p^2}{\omega_c^2 \cdot (1 + G_0 \cdot K_{capt})}}$$



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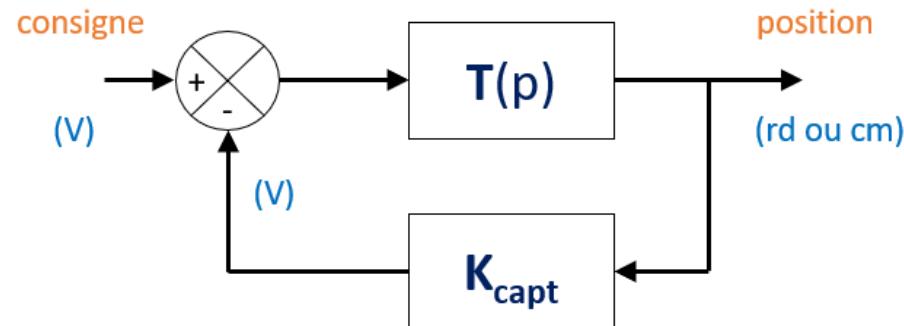
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G_{0BF}

0.0998

m_{BF}

0.04

W_{CBF}

1100 Hz



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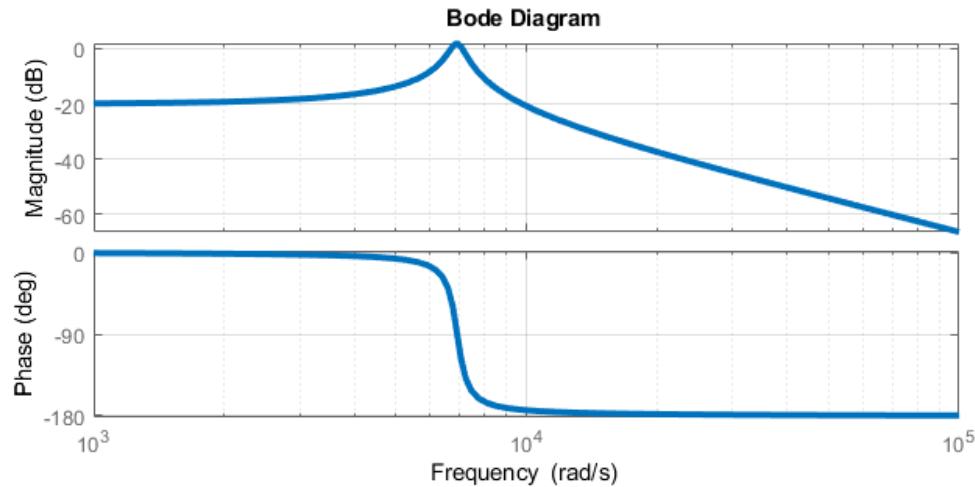
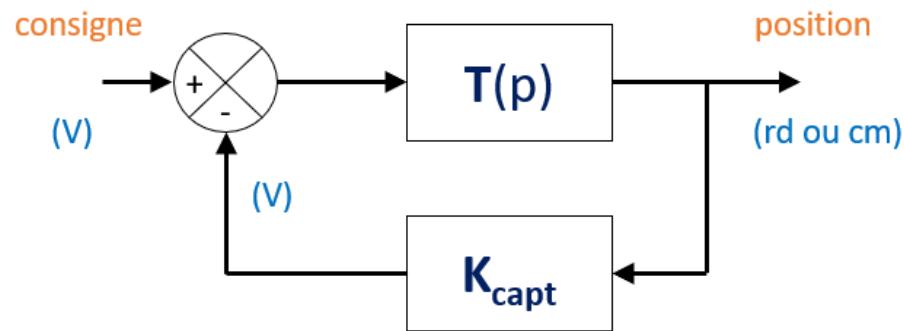
$$T_{BF}(p) = \frac{T(p)}{1 + T(p) \cdot K_{capt}}$$



$$G_{0BF} = \frac{G_0}{1 + G_0 \cdot K_{capt}} = 0.0998$$

$$f_{cBF} = f_c \cdot \sqrt{1 + G_0 \cdot K_{capt}} = 1100 \text{ Hz}$$

$$m_{BF} = \frac{m}{\sqrt{1 + G_0 \cdot K_{capt}}} = 0.04$$



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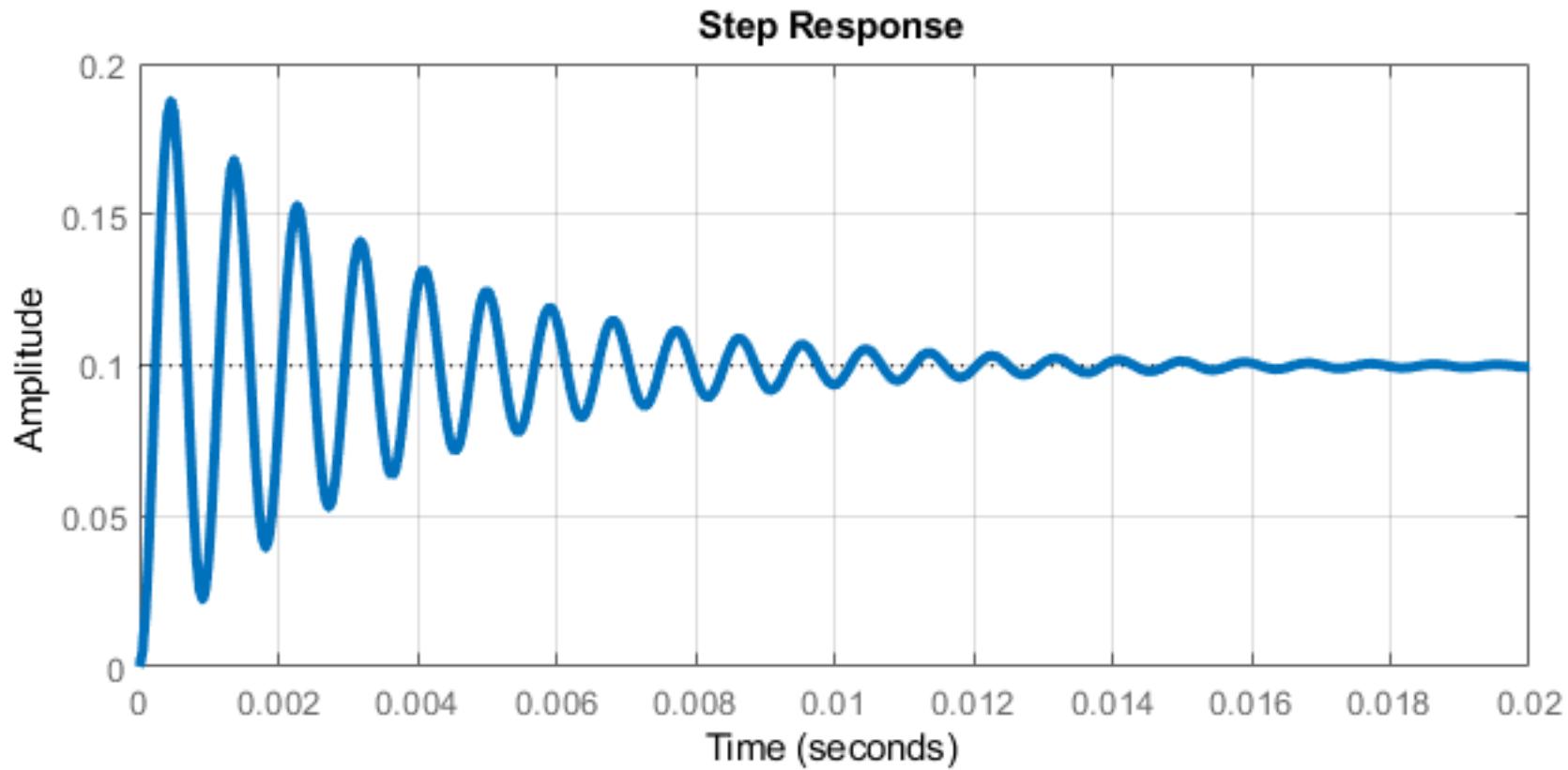


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- Exercice 2 / Système asservi



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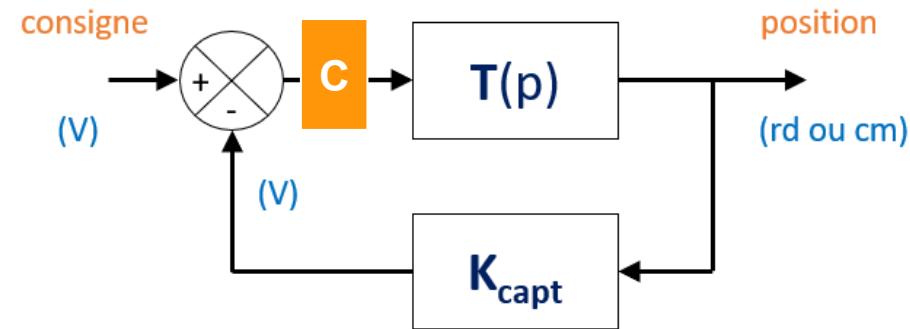


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- Exercice 3 / Système corrigé

Proportionnel Intégral Dérivé (PID)

$$C(p) = K \cdot \left(1 + \frac{1}{K_i \cdot p} + K_d \cdot p\right)$$



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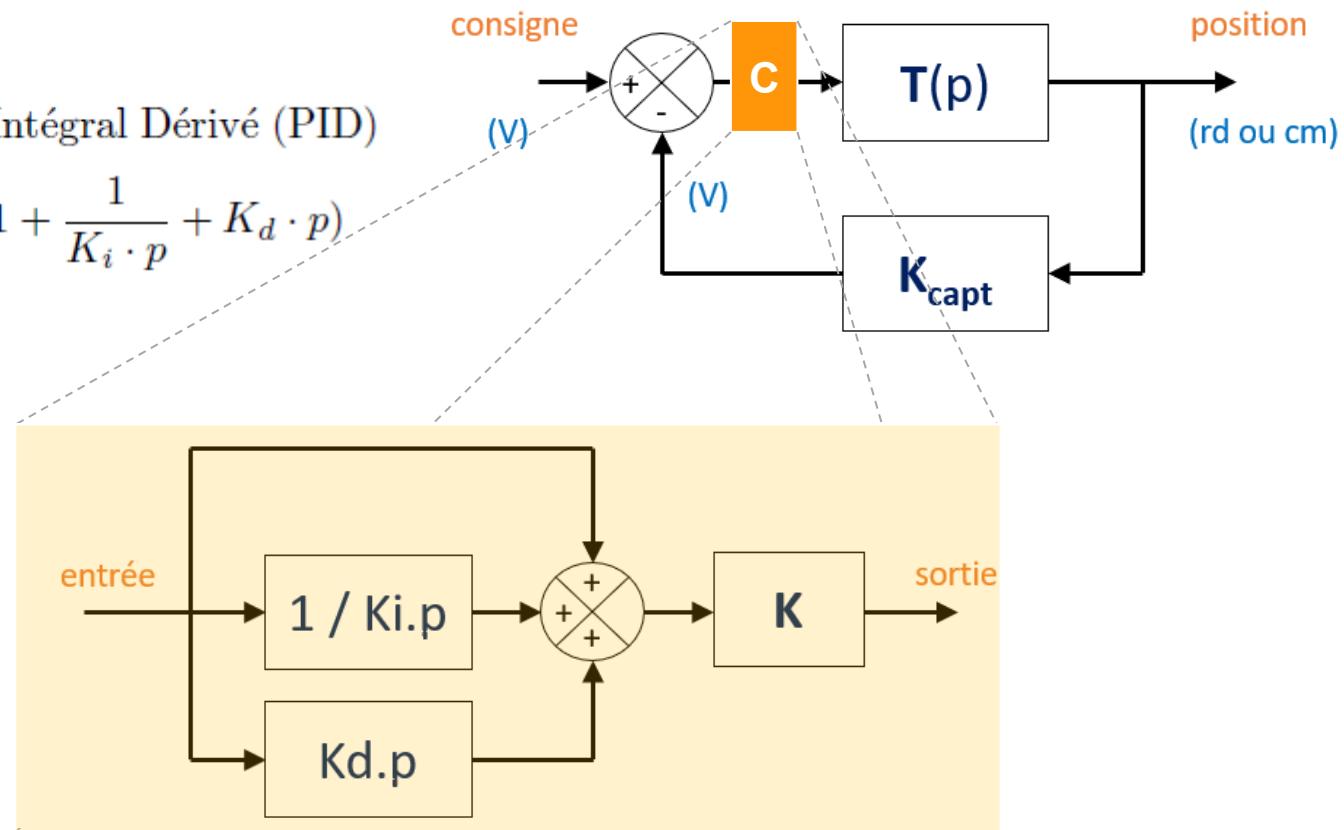


Bordeaux

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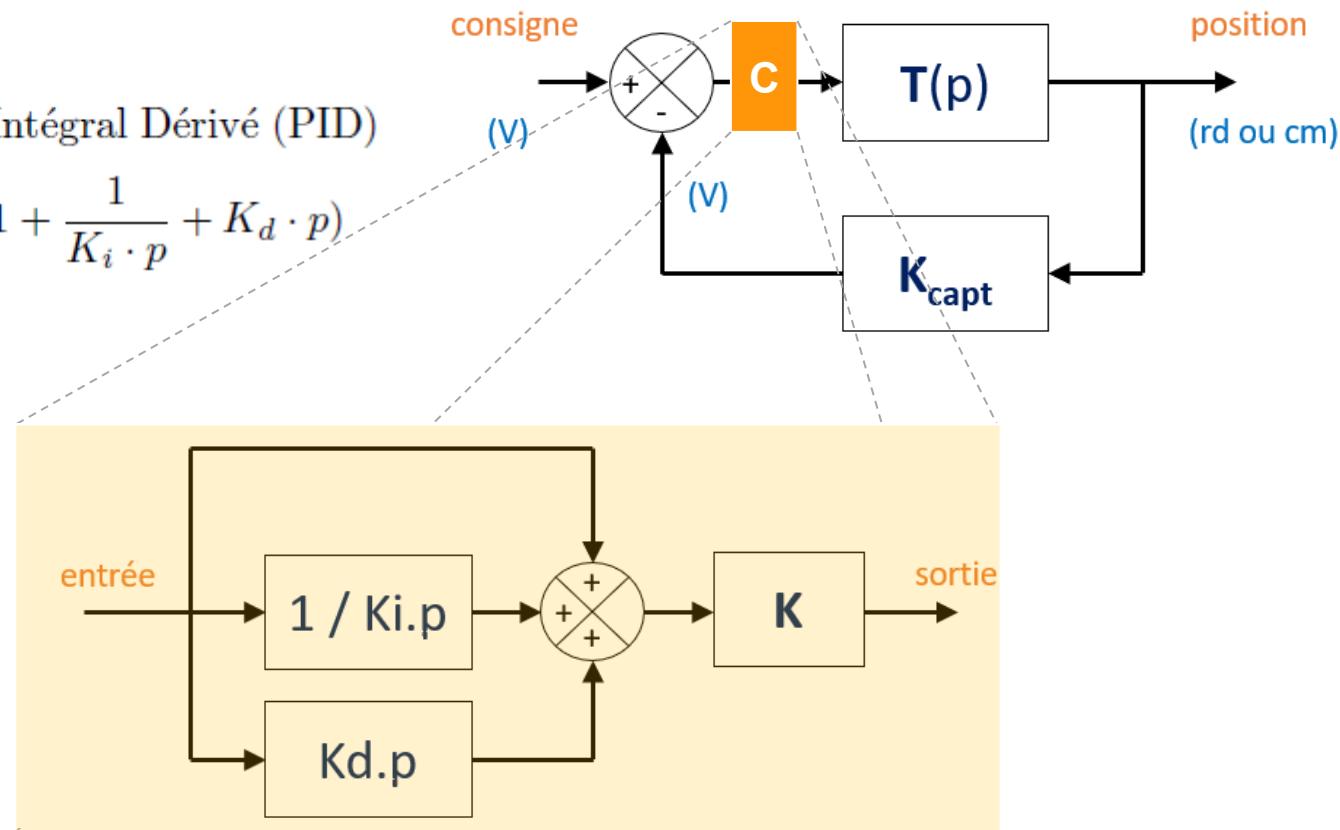


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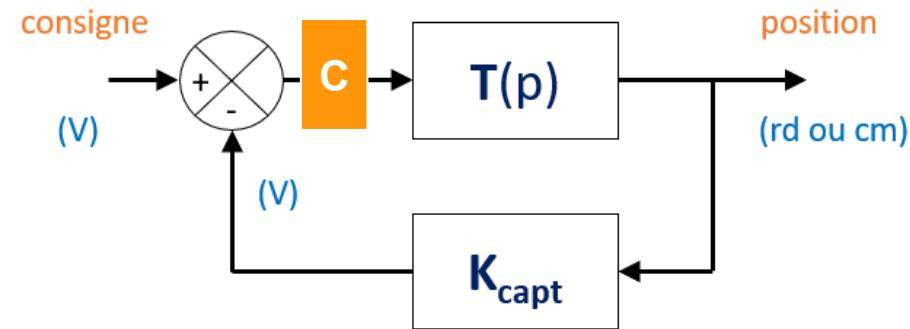


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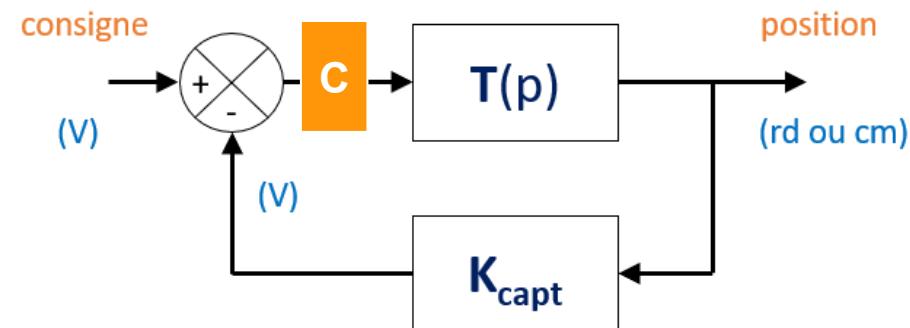


Bordeaux

- Exercice 3 / Système corrigé

Proportionnel Intégral Dérivé (PID)

$$C(p) = K \cdot \left(1 + \frac{1}{K_i \cdot p} + K_d \cdot p \right)$$



$$T_{BF}(p) = \frac{K \cdot T(p)}{1 + K \cdot T(p) \cdot K_{capt}}$$



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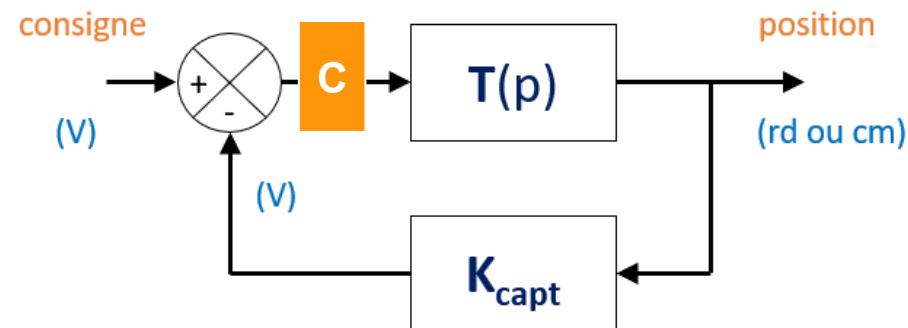


Bordeaux

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$$T_{BF}(p) = \frac{K \cdot T(p)}{1 + K \cdot T(p) \cdot K_{capt}}$$

$$T_{BF}(p) = \frac{K \cdot G_0}{1 + K \cdot G_0 \cdot K_{capt}} \cdot \frac{1}{1 + \frac{2 \cdot m \cdot p}{\omega_c \cdot (1 + G_0 \cdot K \cdot K_{capt})} + \frac{p^2}{\omega_c^2 \cdot (1 + G_0 \cdot K \cdot K_{capt})}}$$



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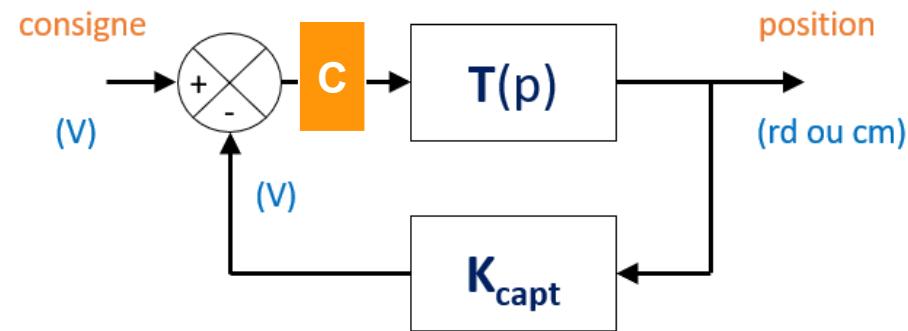


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$$G_{0BF} = \frac{K \cdot G_0}{1 + K \cdot G_0 \cdot K_{capt}}$$

$$f_{cBF} = f_c \cdot \sqrt{1 + G_0 \cdot K \cdot K_{capt}}$$

$$m_{BF} = \frac{m}{\sqrt{1 + G_0 \cdot K \cdot K_{capt}}}$$



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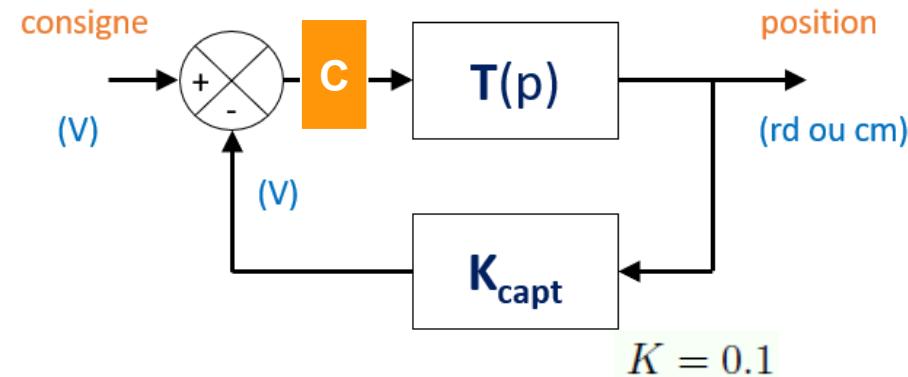
- Exercice 3 / Système corrigé

Proportionnel Intégral Dérivé (PID)

$$C(p) = K \cdot \left(1 + \frac{1}{K_i \cdot p} + K_d \cdot p \right)$$



$$K = 10$$



$$G_{0BF} = \frac{K \cdot G_0}{1 + K \cdot G_0 \cdot K_{capt}} = 0.1$$

$$f_{cBF} = f_c \cdot \sqrt{1 + G_0 \cdot K \cdot K_{capt}} = 3.48 \text{ kHz}$$

$$m_{BF} = \frac{m}{\sqrt{1 + G_0 \cdot K \cdot K_{capt}}} = 0.0126$$

$$G_{0BF} = \frac{K \cdot G_0}{1 + K \cdot G_0 \cdot K_{capt}} = 0.0976$$

$$f_{cBF} = f_c \cdot \sqrt{1 + G_0 \cdot K \cdot K_{capt}} = 352 \text{ kHz}$$

$$m_{BF} = \frac{m}{\sqrt{1 + G_0 \cdot K \cdot K_{capt}}} = 0.125$$



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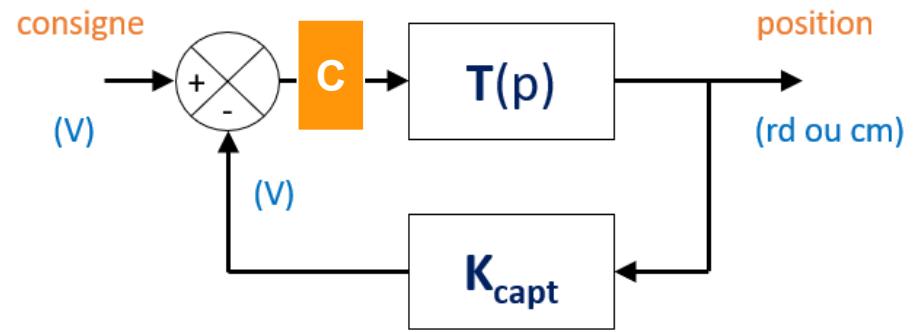
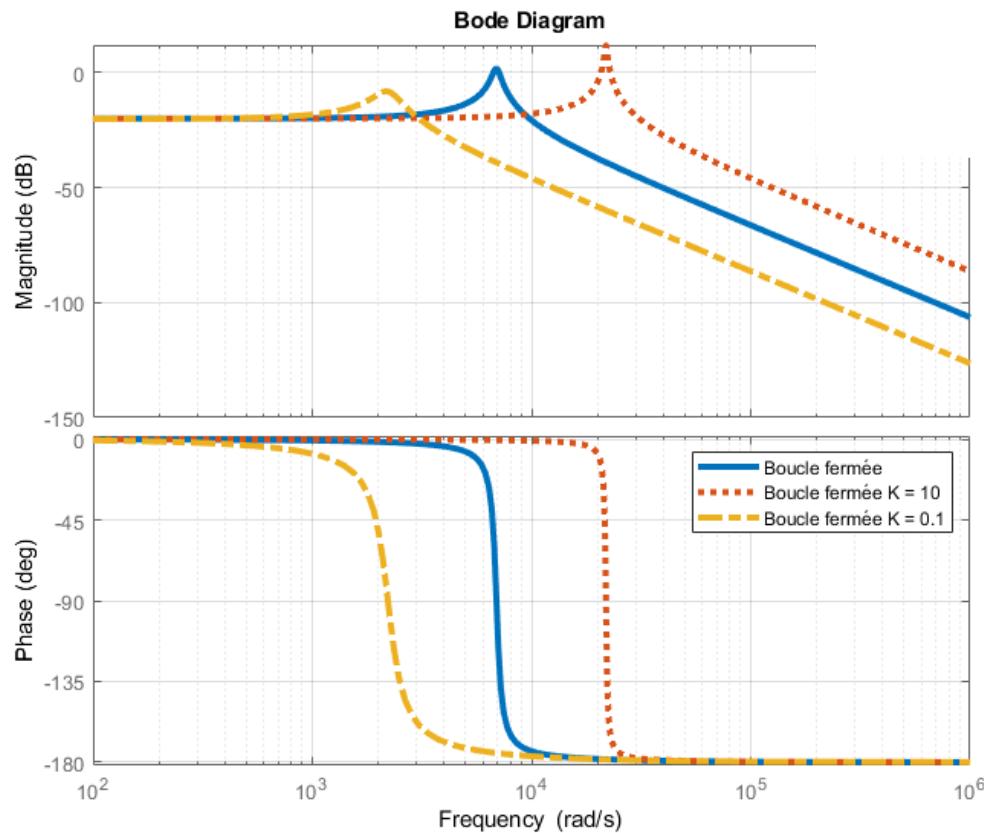


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- Exercice 3 / Système corrigé



Proportionnel Intégral Dérivé (PID)

$$C(p) = K \cdot \left(1 + \frac{1}{K_i \cdot p} \right) + K_d \cdot p$$



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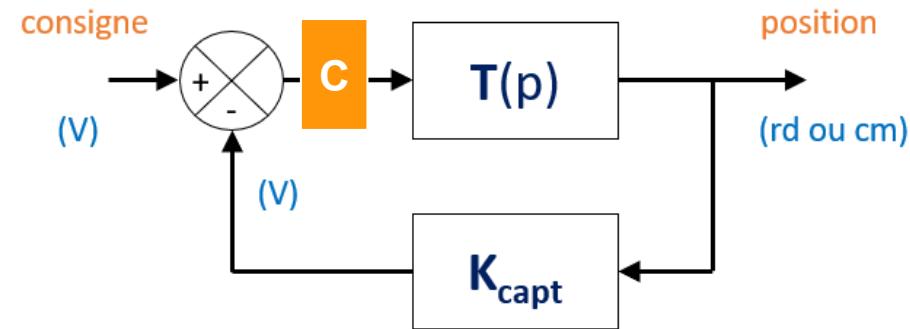


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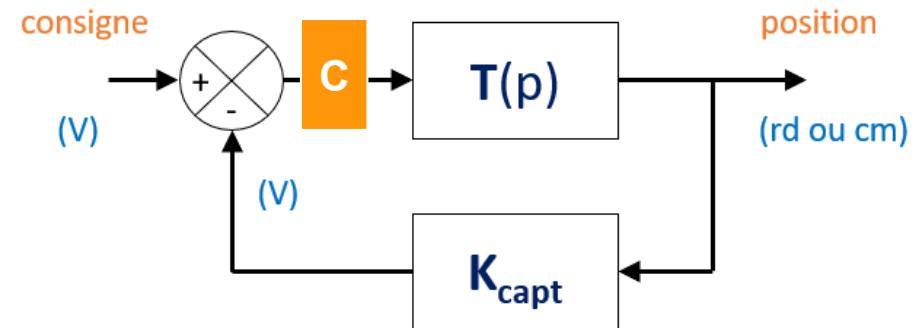
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$$T_{BF}(p) = \frac{C(p) \cdot T(p)}{1 + K_{capt} \cdot C(p) \cdot T(p)}$$



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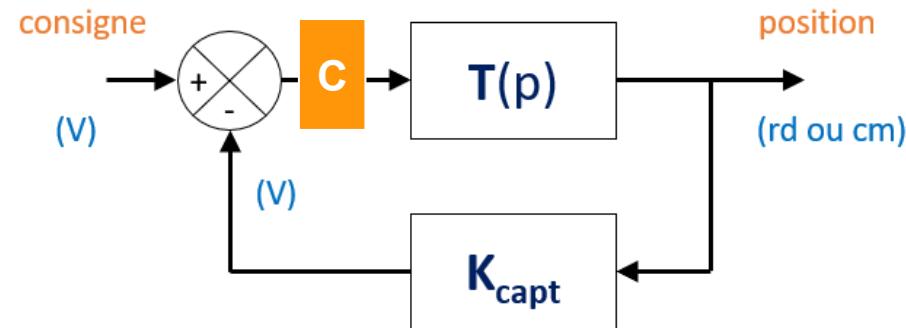
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$$T_{BF}(p) = \frac{C(p) \cdot T(p)}{1 + K_{capt} \cdot C(p) \cdot T(p)}$$



$$M = K_{capt} \cdot K \cdot G_0$$



$$T_{BF}(p) = \frac{K \cdot G_0}{1 + M} \cdot \frac{1 + \tau_i \cdot p}{1 + \frac{p}{1+M} \cdot \left(\frac{2 \cdot m}{\omega_c} + \tau_i \cdot M\right) + \frac{p^2}{\omega_c^2 \cdot (1+M)}}$$



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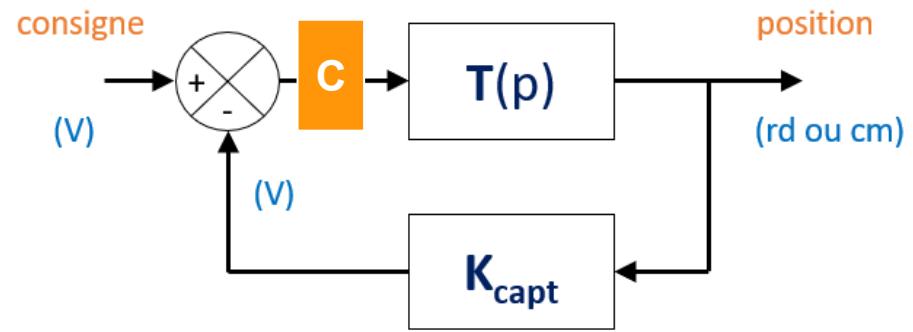
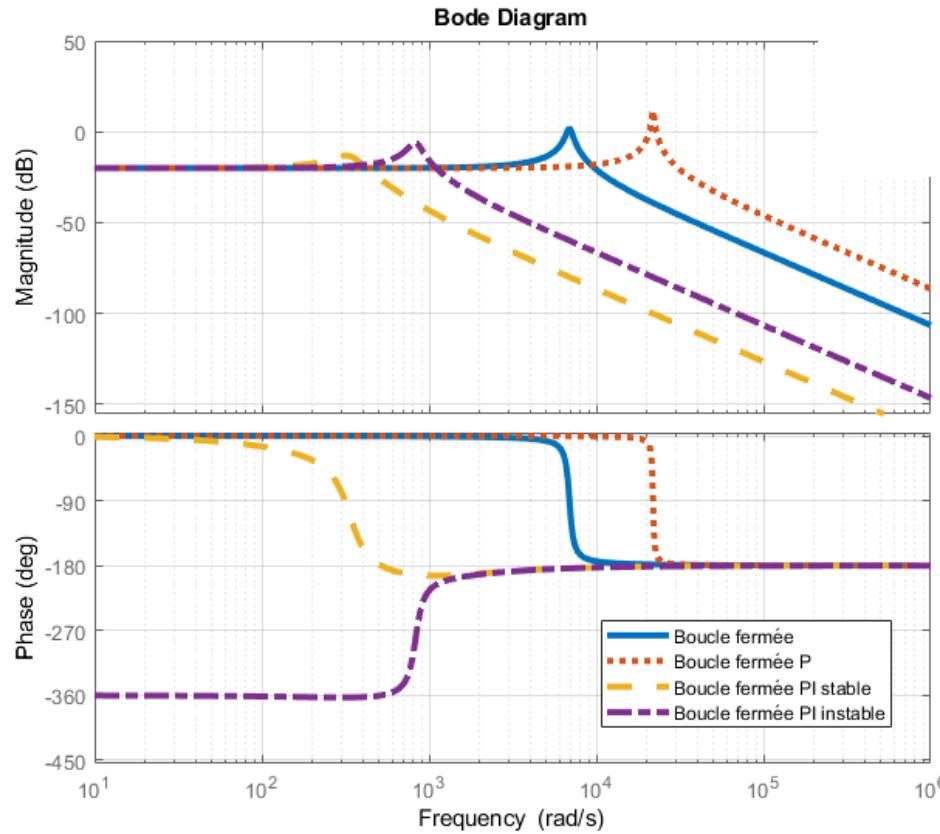


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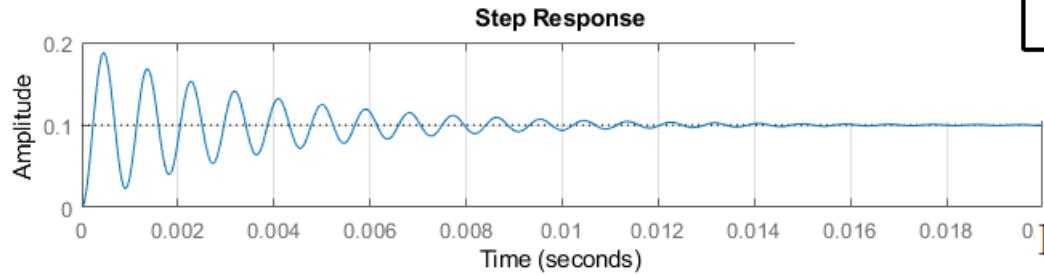
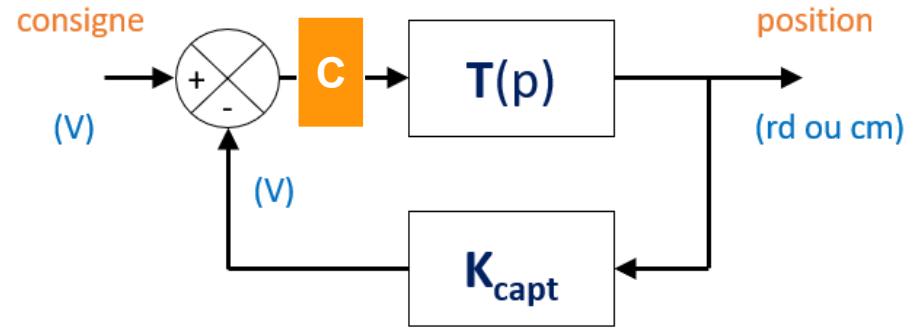


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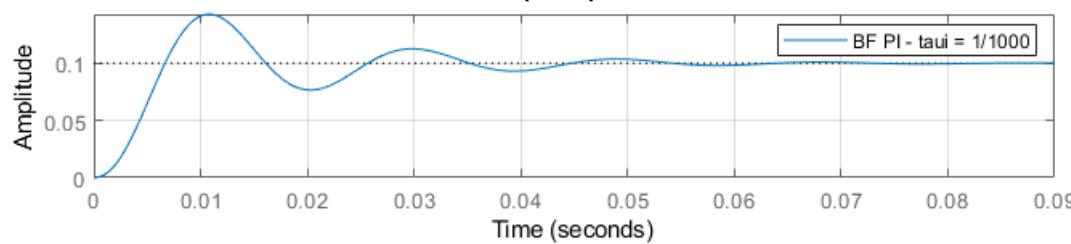
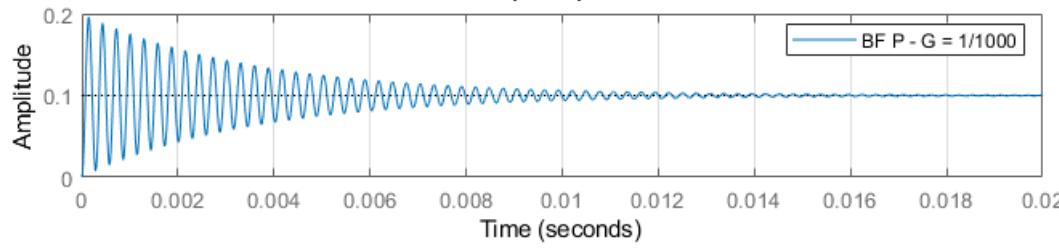
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