

Quit[]

(\* Ziegler-Nichols metodo stabilità limite o banda proporz pendolazione \*)

$$Ga[s_] = \frac{1}{\tau s + 1}; \quad Gc[s_] = kp; \quad u0 = 1.;$$

$$\tau = .1; \quad m = 1; \quad r = 2; \quad k = 40; \quad kp = 32;$$

$$G[s_] = \frac{1}{m s^2 + r s + k};$$

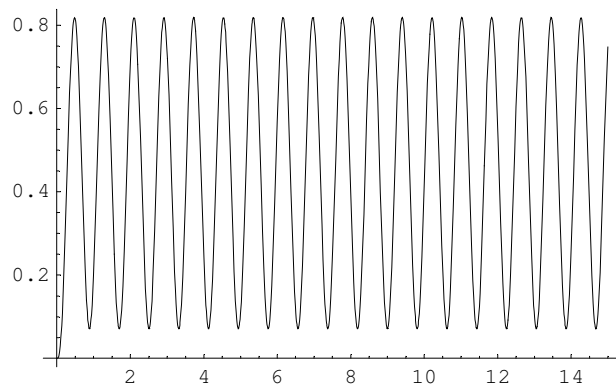
$$x[s_] = \left( \frac{Gc[s] Ga[s] G[s]}{1 + Gc[s] Ga[s] G[s]} \right) u0 / s$$

$$\frac{32.}{(1 + 0.1 s) s (40 + 2 s + s^2) \left( 1 + \frac{32}{(1 + 0.1 s) (40 + 2 s + s^2)} \right)}$$

**xdit[t\_] = InverseLaplaceTransform[x[s], s, t]**

$$32. (0.0138889 - 0.00408497 e^{-12. t} - (0.00980392 + 0. i) \cos[7.74597 t] - (0.0063284 + 0. i) \sin[7.74597 t])$$

**Plot[xdit[t], {t, 0, 15}, PlotPoints -> 100]**



- Graphics -

(\* quad stat kp/(k\*(1+k/kp))/N \*)

$$\text{Denominator}\left[\frac{Gc[s] Ga[s] G[s]}{1 + Gc[s] Ga[s] G[s]}\right] // \text{Simplify}$$

$$0.1 (12. + s) (60. + s^2)$$

$$\text{sol} = \text{Solve}\left[\text{Denominator}\left[\frac{Gc[s] Ga[s] G[s]}{1 + Gc[s] Ga[s] G[s]}\right] == 0, s\right]$$

$$\{\{s \rightarrow -12.\}, \{s \rightarrow -1.86424 \times 10^{-16} - 7.74597 i\}, \{s \rightarrow -1.86424 \times 10^{-16} + 7.74597 i\}\}$$

**Chop[%]**

$$\{\{s \rightarrow -12.\}, \{s \rightarrow -7.74597 i\}, \{s \rightarrow 7.74597 i\}\}$$

**Clear[kp]**

$$\text{sol} = \text{Solve}\left[\text{Denominator}\left[\frac{\text{Gc}[s] \text{Ga}[s] \text{G}[s]}{1 + \text{Gc}[s] \text{Ga}[s] \text{G}[s]}\right] == 0, s\right]$$

$$\left\{ \left\{ s \rightarrow -4. + \frac{7.55953 - 13.0935 i}{\left(-7776. - 270. kp + 270. \sqrt{832. + 57.6 kp + 1. kp^2}\right)^{1/3}} - \right. \right.$$

$$\left. (0.132283 + 0.229122 i) \left(-7776. - 270. kp + 270. \sqrt{832. + 57.6 kp + 1. kp^2}\right)^{1/3} \right\},$$

$$\left\{ s \rightarrow -4. + \frac{7.55953 + 13.0935 i}{\left(-7776. - 270. kp + 270. \sqrt{832. + 57.6 kp + 1. kp^2}\right)^{1/3}} - \right.$$

$$\left. (0.132283 - 0.229122 i) \left(-7776. - 270. kp + 270. \sqrt{832. + 57.6 kp + 1. kp^2}\right)^{1/3} \right\},$$

$$\left\{ s \rightarrow -4. - \frac{15.1191}{\left(-7776. - 270. kp + 270. \sqrt{832. + 57.6 kp + 1. kp^2}\right)^{1/3}} + \right.$$

$$\left. 0.264567 \left(-7776. - 270. kp + 270. \sqrt{832. + 57.6 kp + 1. kp^2}\right)^{1/3} \right\}$$

$$\text{p3} = s /. \text{sol}[[3]]$$

$$-4. - \frac{15.1191}{\left(-7776. - 270. kp + 270. \sqrt{832. + 57.6 kp + 1. kp^2}\right)^{1/3}} +$$

$$0.264567 \left(-7776. - 270. kp + 270. \sqrt{832. + 57.6 kp + 1. kp^2}\right)^{1/3}$$

$$\text{p1} = s /. \text{sol}[[1]]$$

$$-4. + \frac{7.55953 - 13.0935 i}{\left(-7776. - 270. kp + 270. \sqrt{832. + 57.6 kp + 1. kp^2}\right)^{1/3}} -$$

$$(0.132283 + 0.229122 i) \left(-7776. - 270. kp + 270. \sqrt{832. + 57.6 kp + 1. kp^2}\right)^{1/3}$$

$$\text{p2} = s /. \text{sol}[[2]]$$

$$-4. + \frac{7.55953 + 13.0935 i}{\left(-7776. - 270. kp + 270. \sqrt{832. + 57.6 kp + 1. kp^2}\right)^{1/3}} -$$

$$(0.132283 - 0.229122 i) \left(-7776. - 270. kp + 270. \sqrt{832. + 57.6 kp + 1. kp^2}\right)^{1/3}$$

$$(* \text{ parte Re comune a p1 e p2 } *)$$

$$(\text{p1} + \text{p2}) / 2 // \text{Simplify}$$

$$-4. + \frac{7.55953 + 0. i}{\left(-7776. - 270. kp + 270. \sqrt{832. + 57.6 kp + 1. kp^2}\right)^{1/3}} -$$

$$(0.132283 + 0. i) \left(-7776. - 270. kp + 270. \sqrt{832. + 57.6 kp + 1. kp^2}\right)^{1/3}$$

$$\text{Chop}[(\text{p1} + \text{p2}) / 2]$$

$$\frac{1}{2} \left( -8. + \frac{15.1191}{\left(-7776. - 270. kp + 270. \sqrt{832. + 57.6 kp + 1. kp^2}\right)^{1/3}} - \right.$$

$$\left. 0.264567 \left(-7776. - 270. kp + 270. \sqrt{832. + 57.6 kp + 1. kp^2}\right)^{1/3} \right)$$

```
Solve[p1 + p2 == 0, kp]
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```
{{kp -> 32.}, {kp -> 32.}}
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```
kp = 32
```

```
32
```

```
 $\omega = ((p2 - p1) / (2 I))$ 
```

```
7.74597 + 0. i
```

```
Chop[%]
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```
7.74597
```

```
 $f = \% / (2 \text{ Pi})$ 
```

```
1.23281
```

```
 $T = 1 / f$ 
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```
0.811156
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