Révisions SUP

Theme 1 TD0

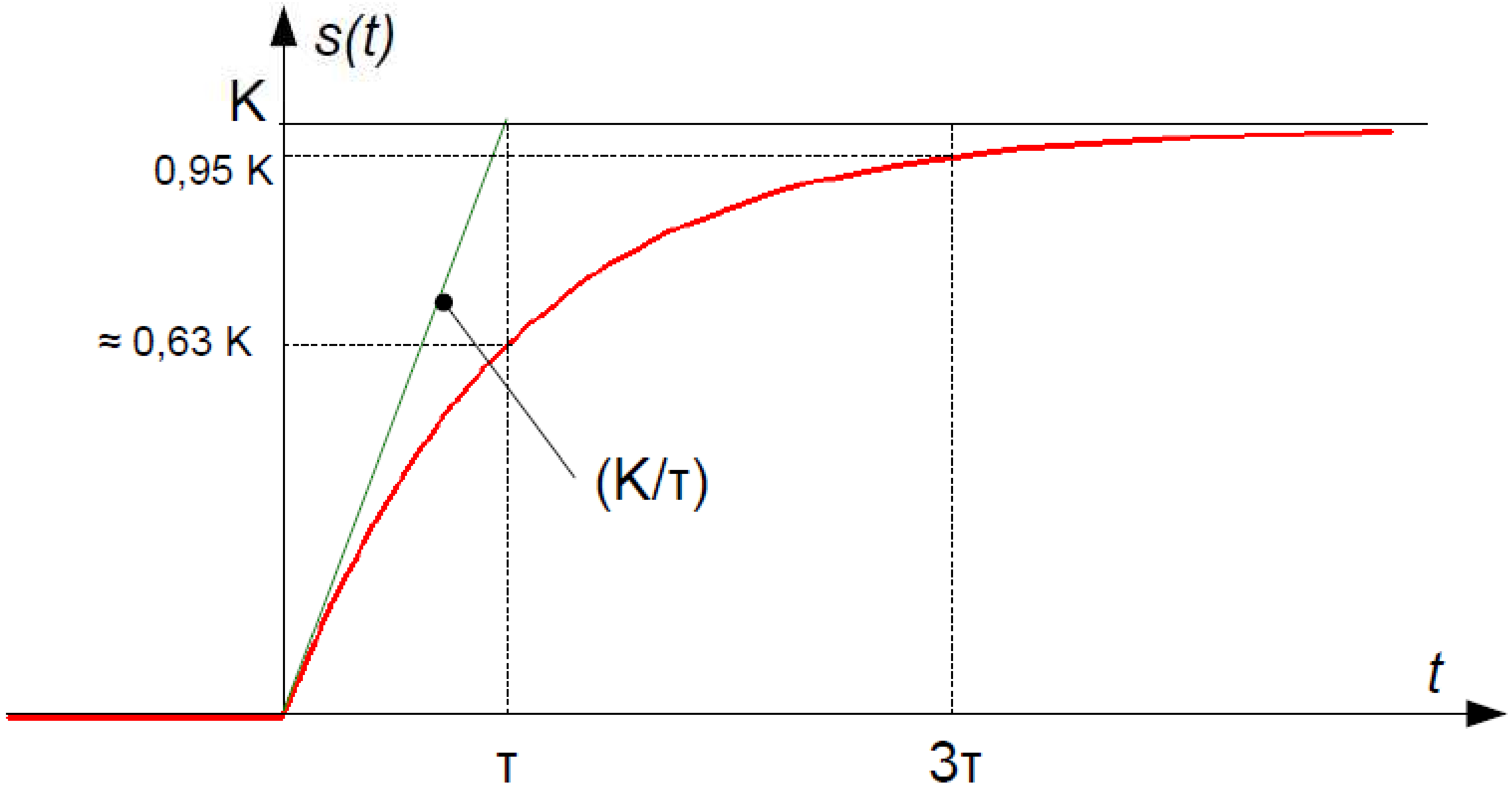
Identifications temporelles

RAPPEL : Système du 1er ordre

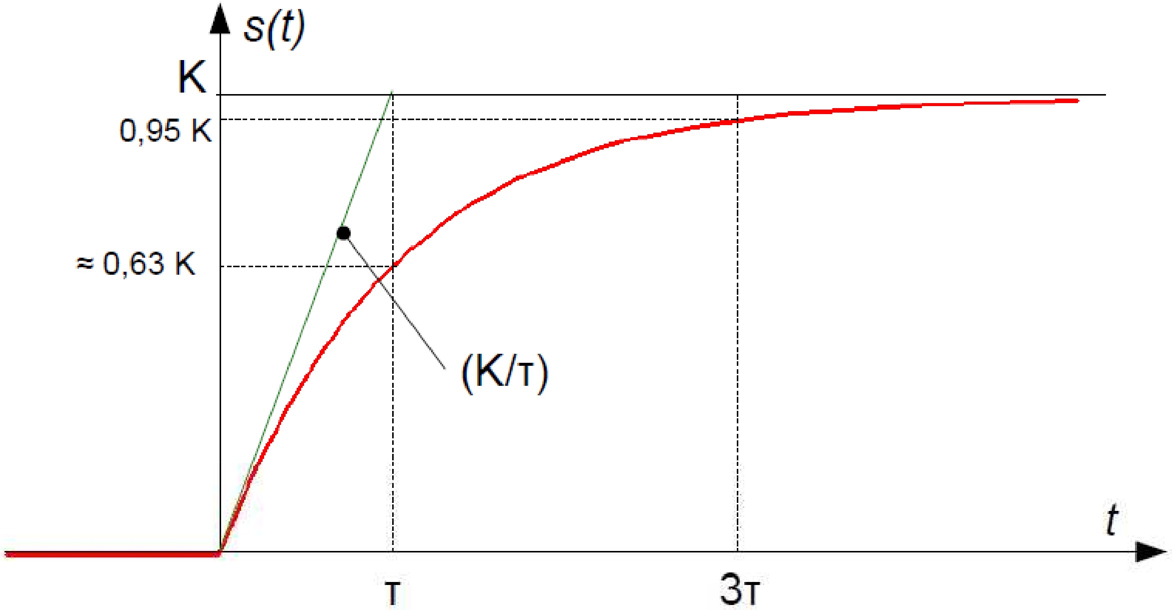
Fonction de transfert : $H(p) = \dfrac{K}{1+\tau p}$

Réponse indicielle : $\boxed{s(t) = K\left(1 - e^{-t/\tau}\right) \cdot u(t)}$

Tracé :

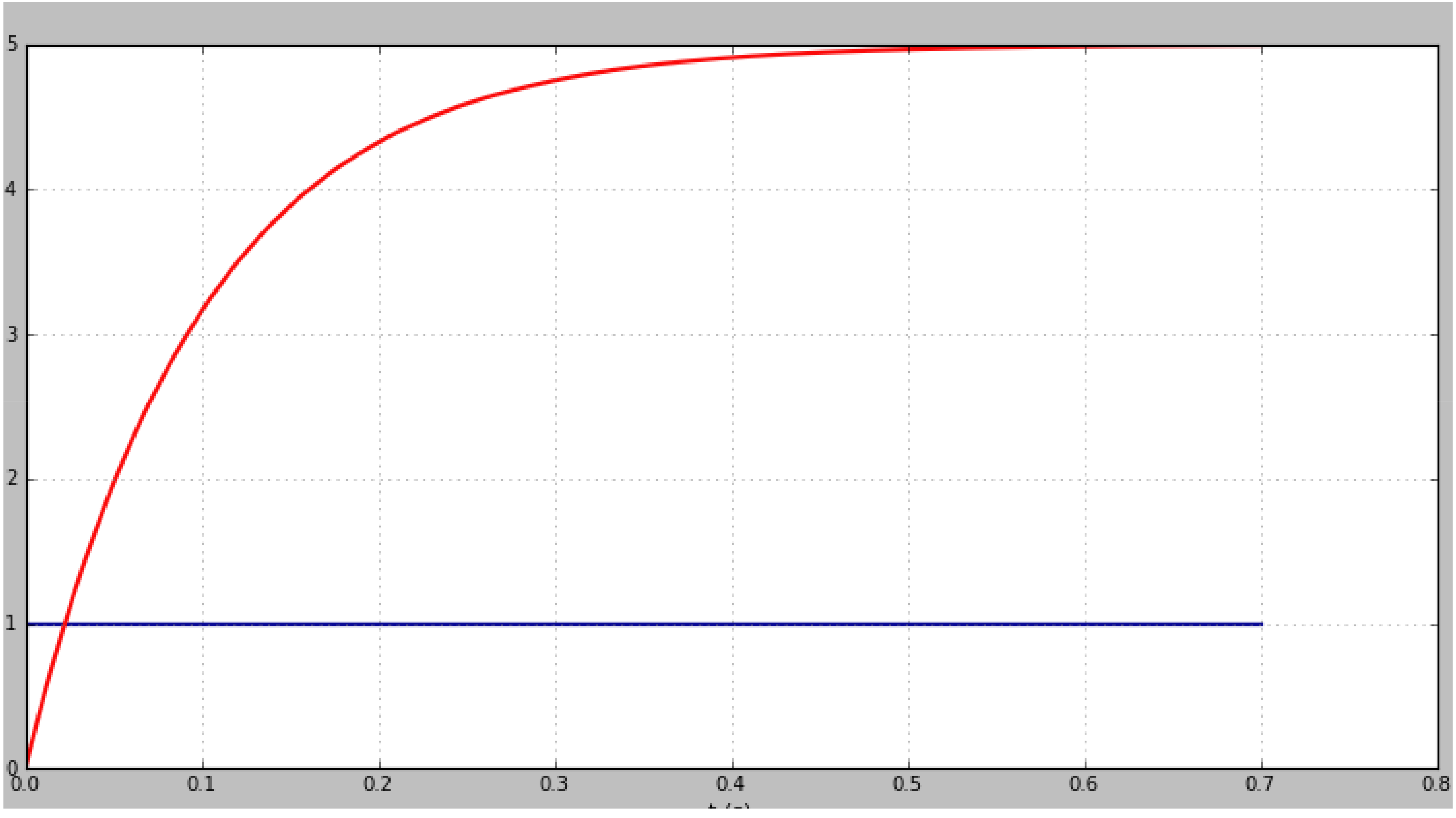


RAPPEL : Système du 1er ordre

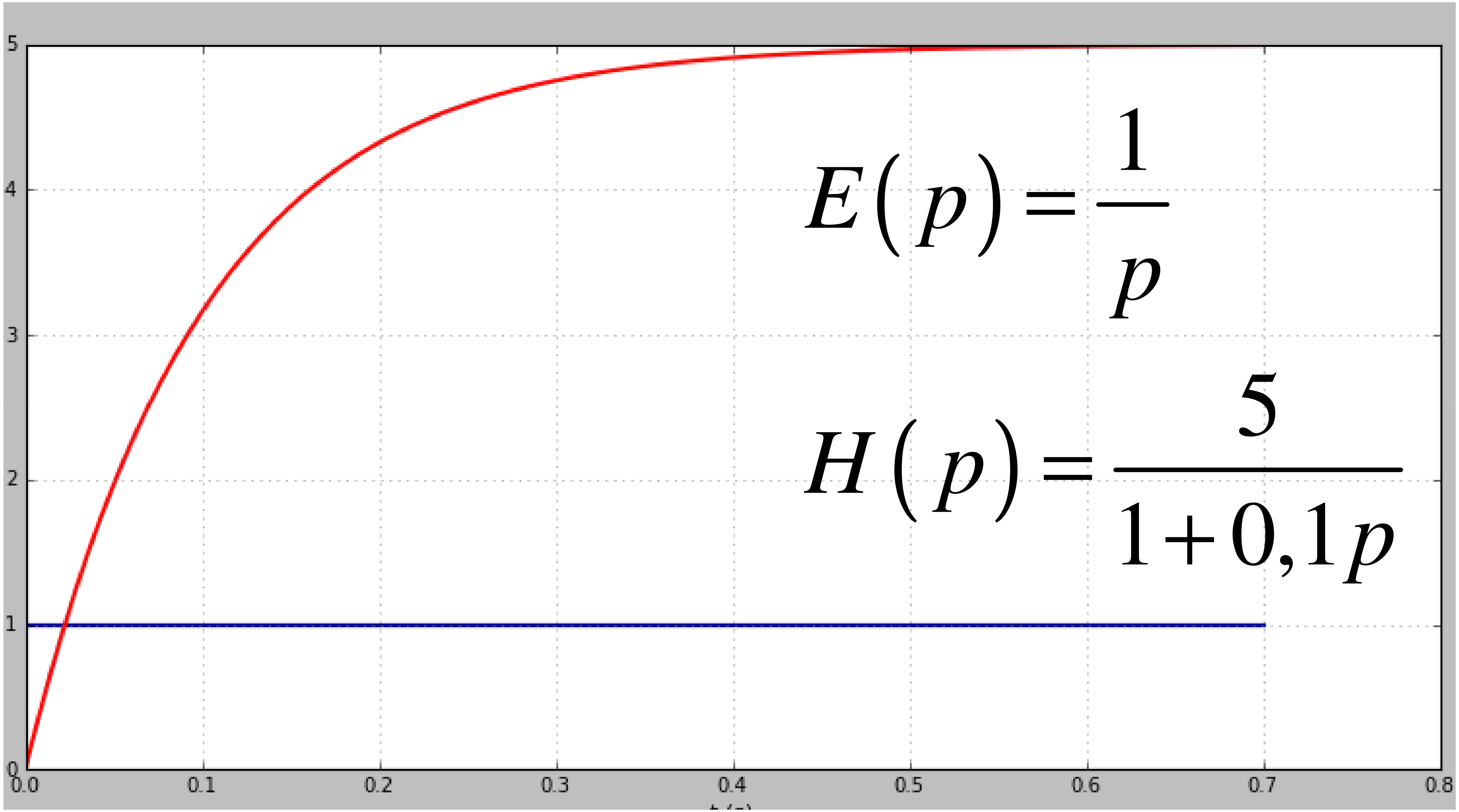


Propriétés :

- $s(0)=0$
- Tangente à l'origine de pente $\frac{K}{\tau}$.
- $\lim_{t \to +\infty} s(t)=K$ (asymptote horizontale en $+\infty$, **permet de déterminer K**).
- Croissance monotone (pas de dépassement ni d'oscillations).
- $s(\tau) \approx 0{,}63\ K$.
- $t_{5\%} \approx 3\ \tau$.

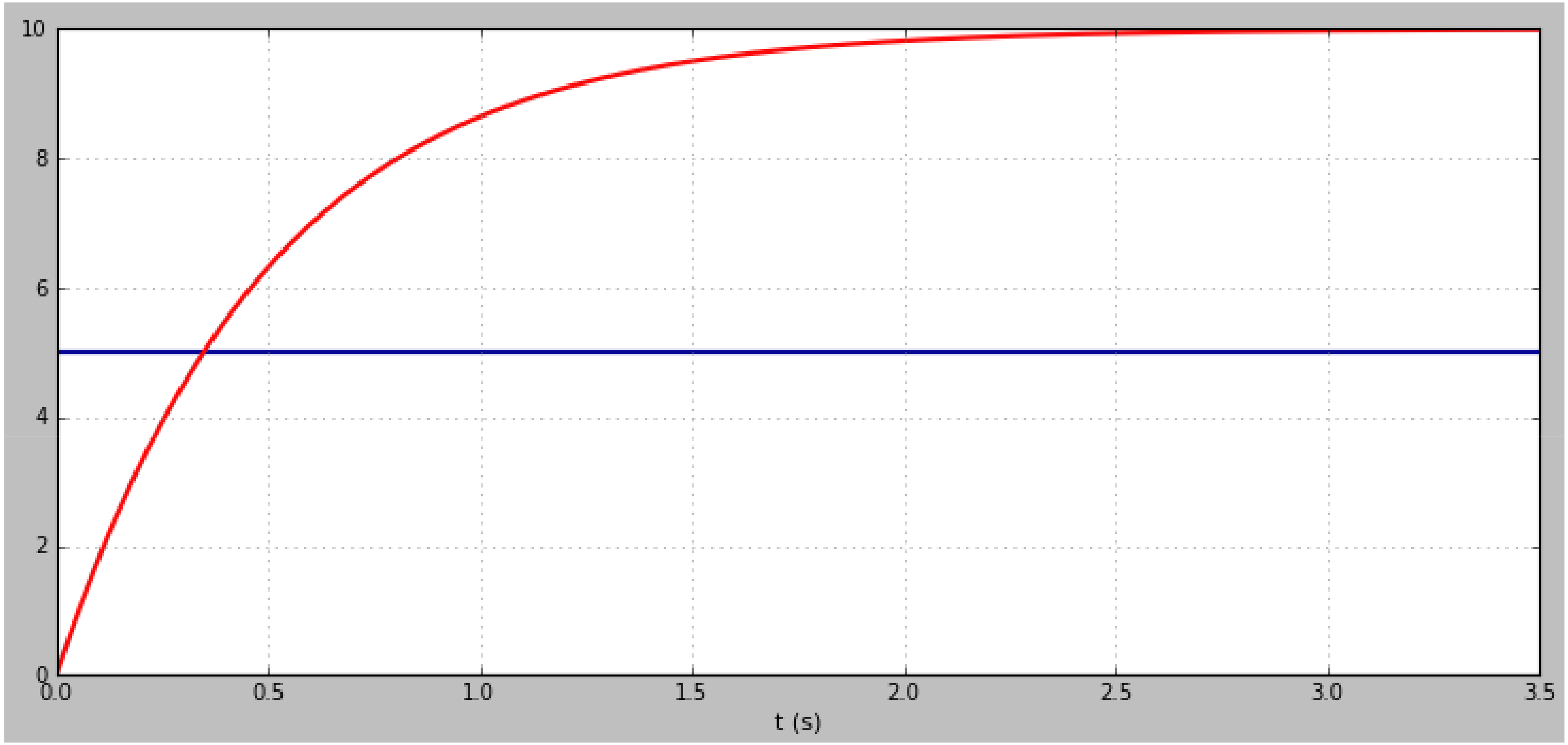


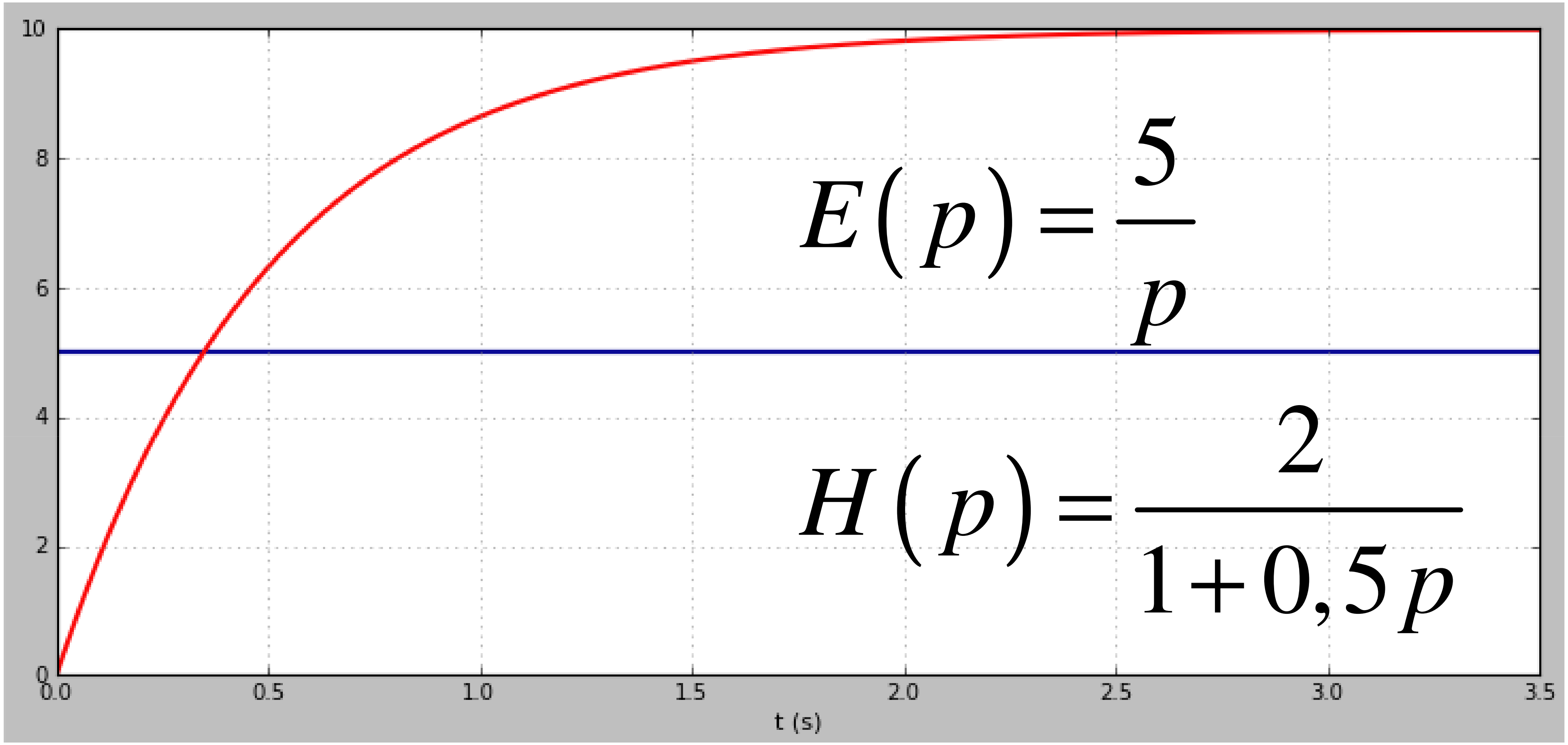
5
4
3
2
1
0
0.0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8



$$E(p) = \frac{1}{p}$$

$$H(p) = \frac{5}{1+0{,}1p}$$


10
8
6
4
2
0
0.0
0.5
1.0
1.5
2.0
2.5
3.0
3.5
t (s)



$E(p) = \frac{5}{p}$
$H(p) = \frac{2}{1+0,5p}$
10
8
6
4
2
0
0.0
0.5
1.0
1.5
2.0
2.5
3.0
3.5
t (s)

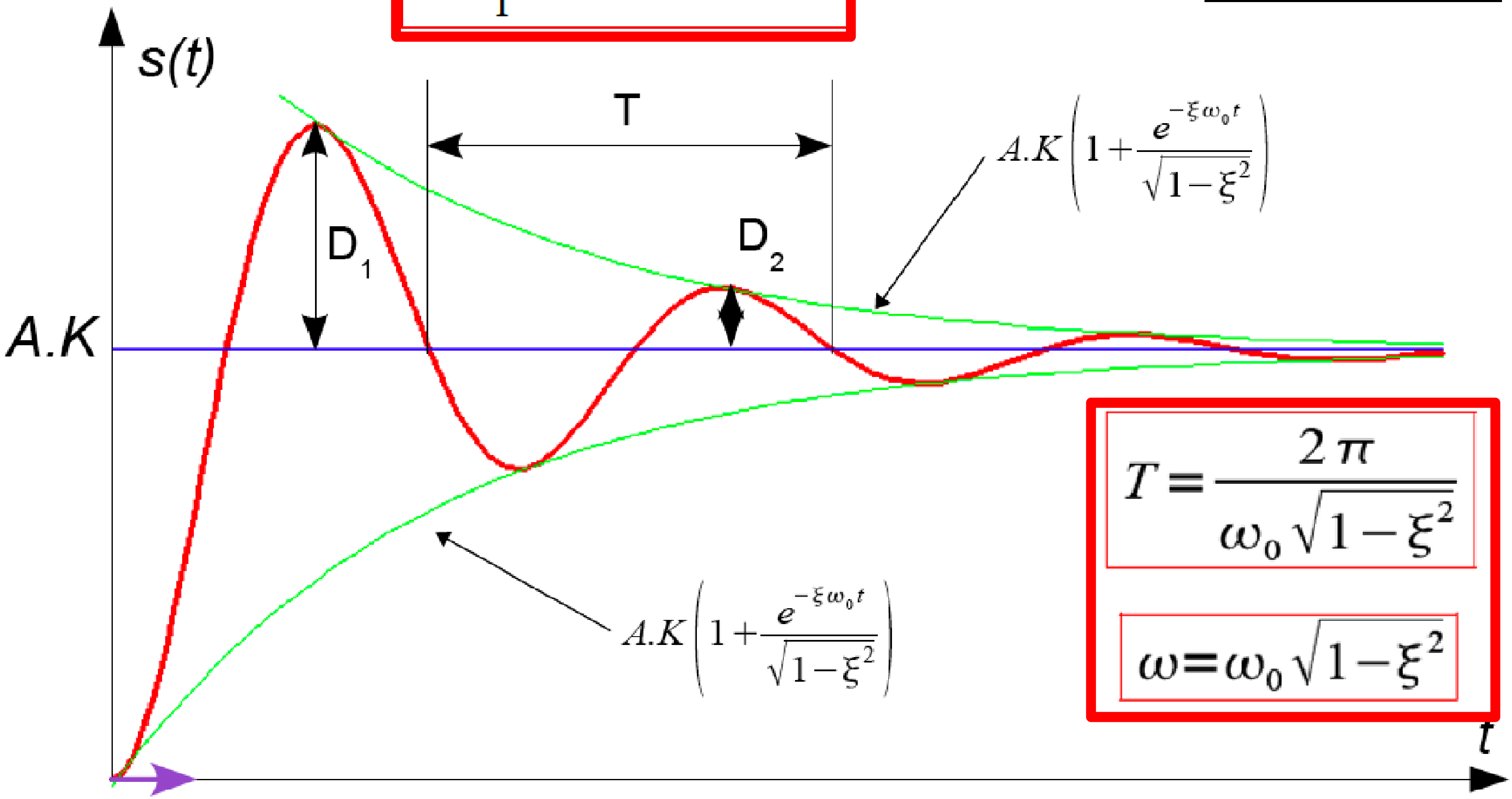
RAPPEL : Système du second ordre

- Réponse indicielle : *e(t) = A.u(t)*

$\xi < 1$

Système peu amorti oscillant

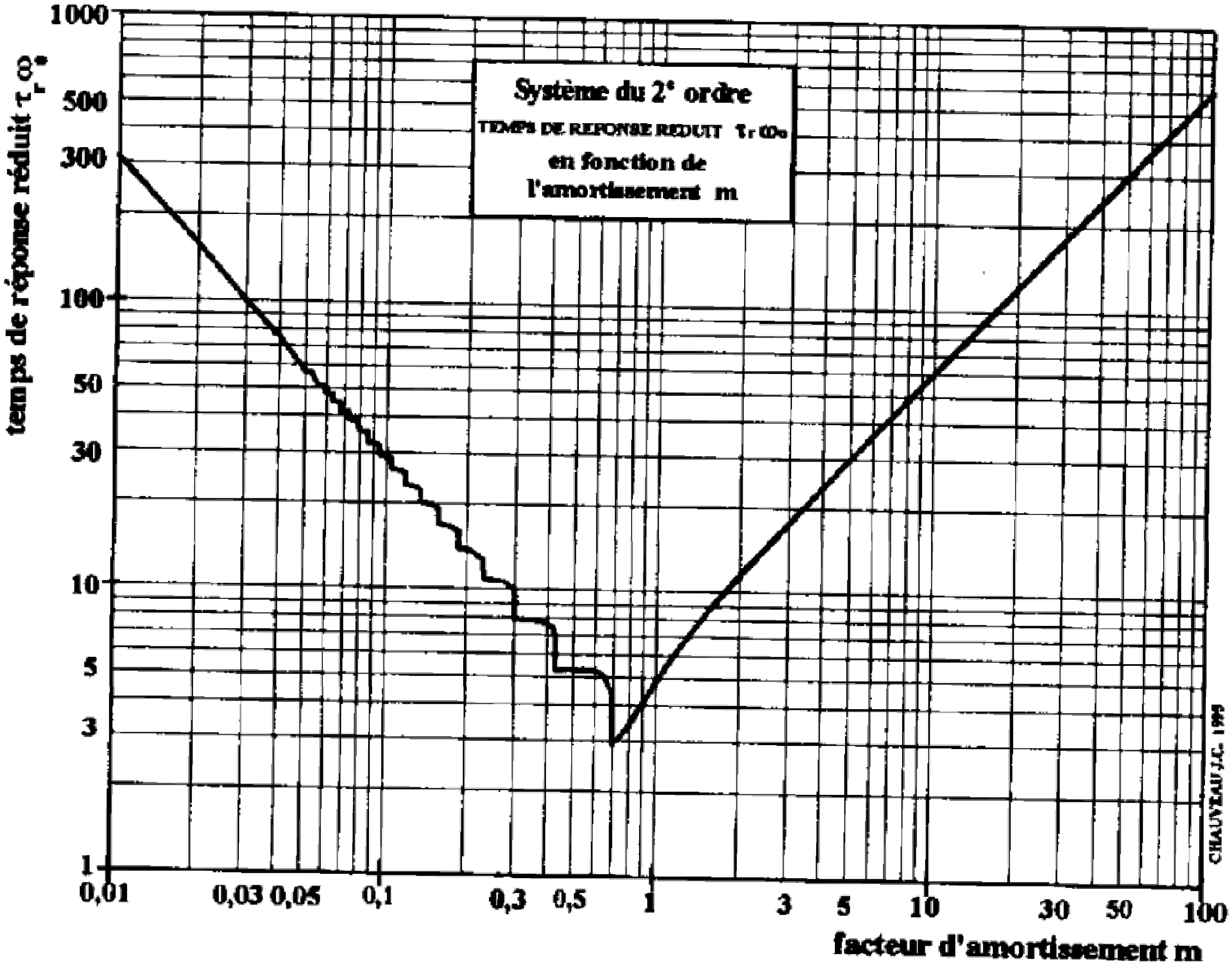
$$D_1 = AK\, e^{\frac{-\pi\xi}{\sqrt{1-\xi^2}}}$$

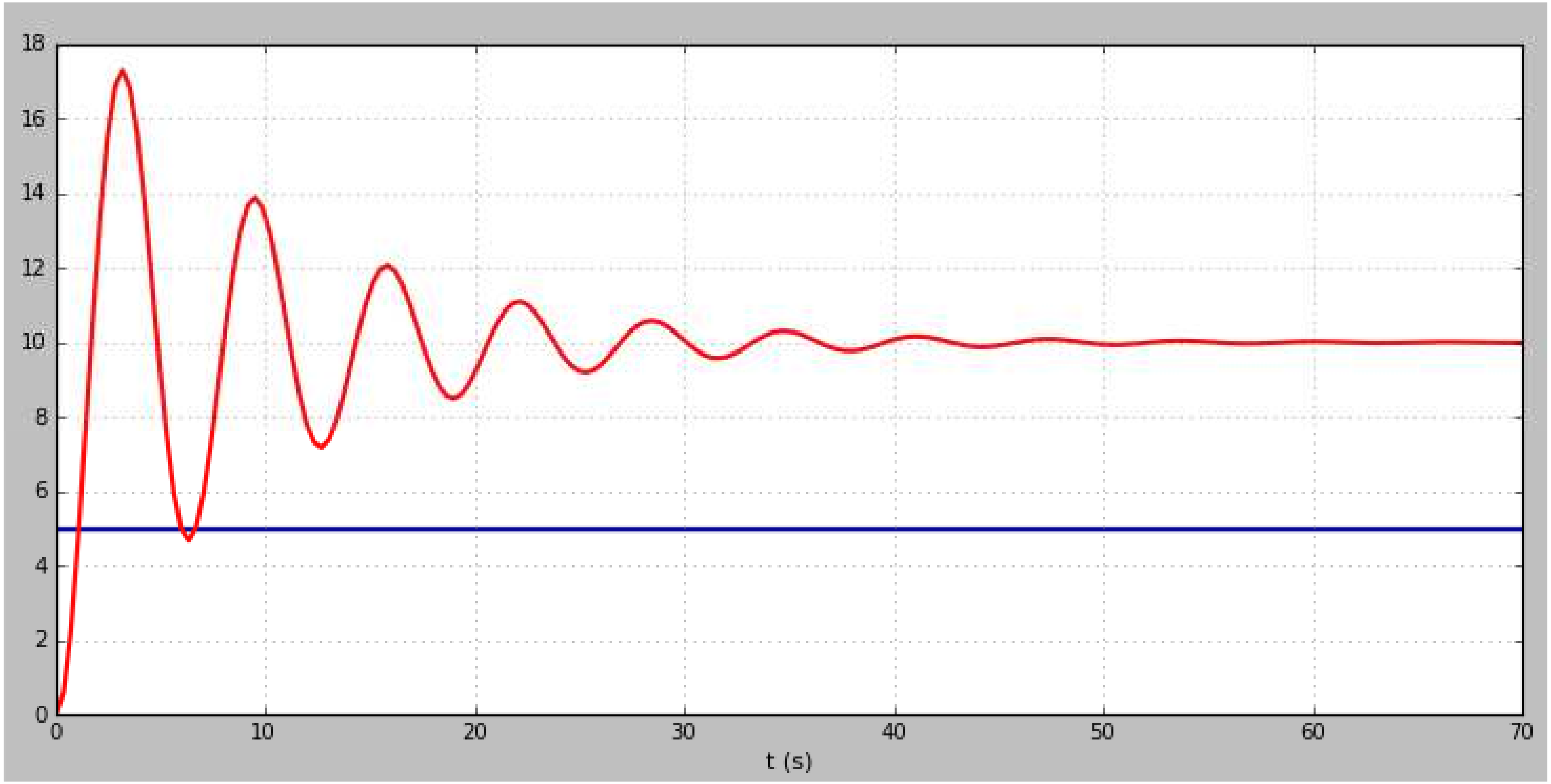


$$T = \frac{2\pi}{\omega_0\sqrt{1-\xi^2}}$$

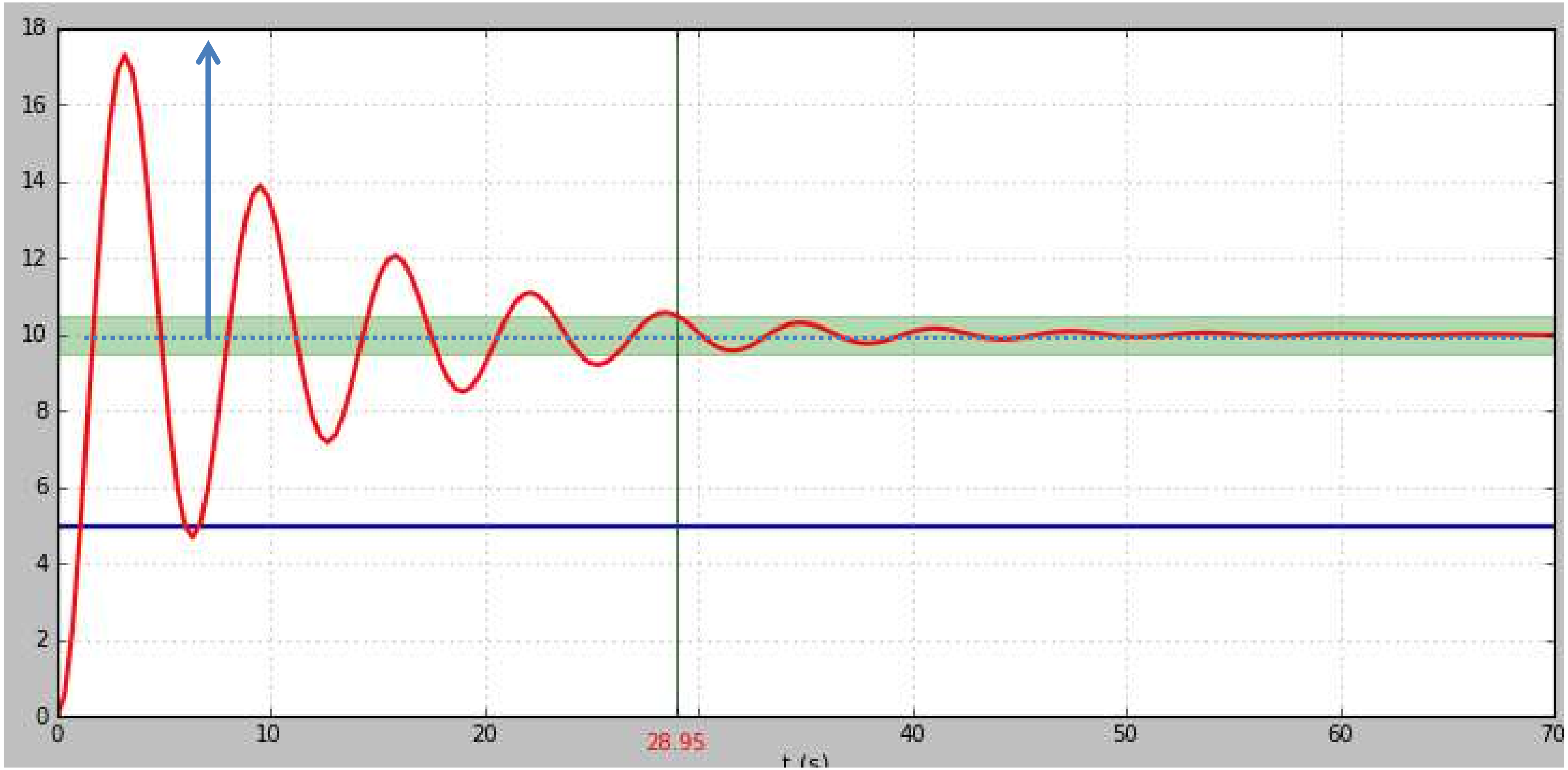
$$\omega = \omega_0\sqrt{1-\xi^2}$$

RAPPEL : Système du second ordre




18
16
14
12
10
8
6
4
2
0
0
10
20
30
40
50
60
70
t (s)

$$D_1 = 10e^{-\frac{\pi\xi}{\sqrt{1-\xi^2}}} \approx 7 \to \xi \approx 0{,}1$$



A l'aide de la calculatrice

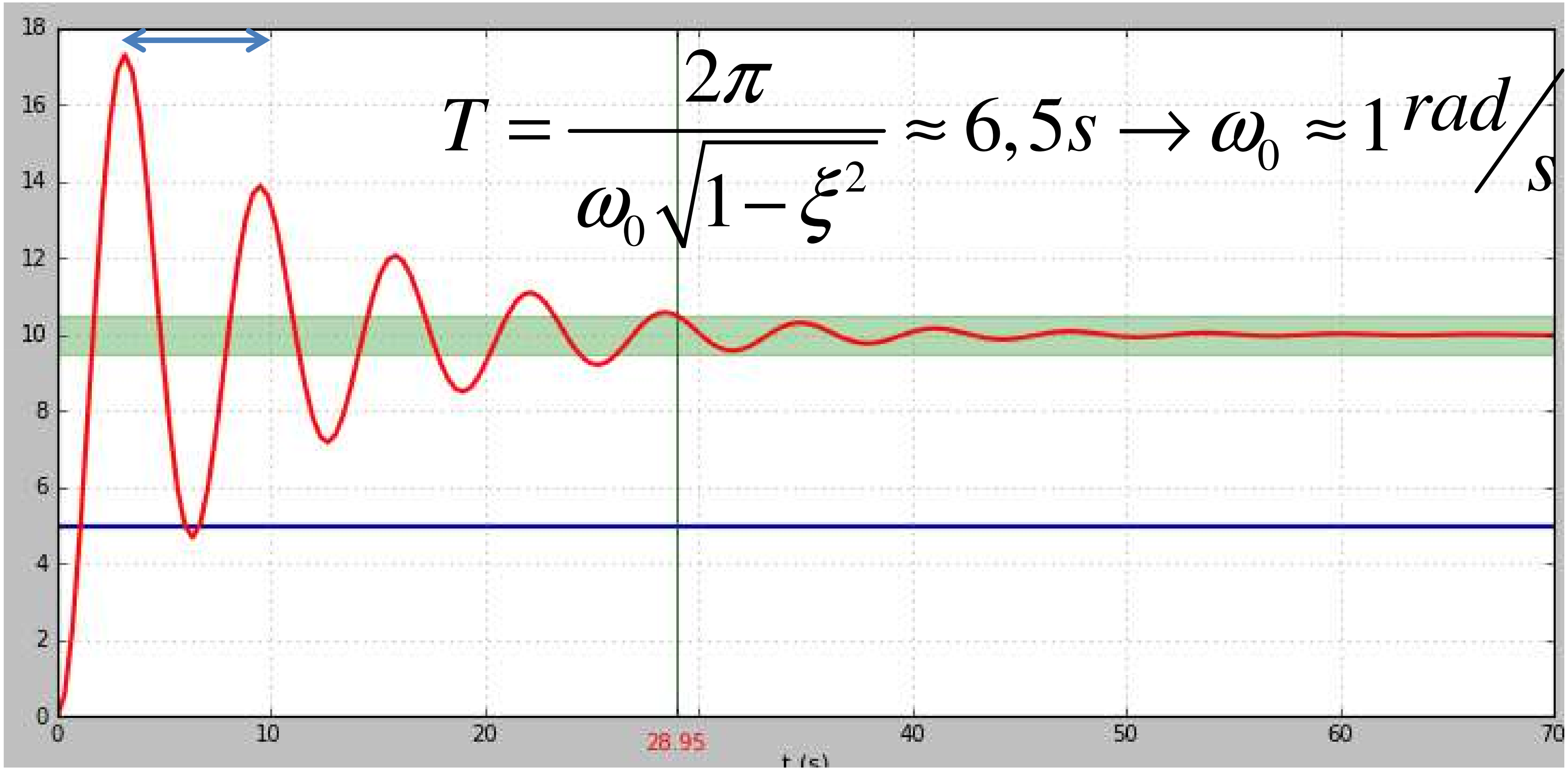
$$D_1 = 10e^{-\frac{\pi\xi}{\sqrt{1-\xi^2}}} \approx 7 \rightarrow \xi \approx 0{,}1$$

$$solve\left(10e^{-\frac{\pi x}{\sqrt{1-x^2}}} = 7, x\right)$$

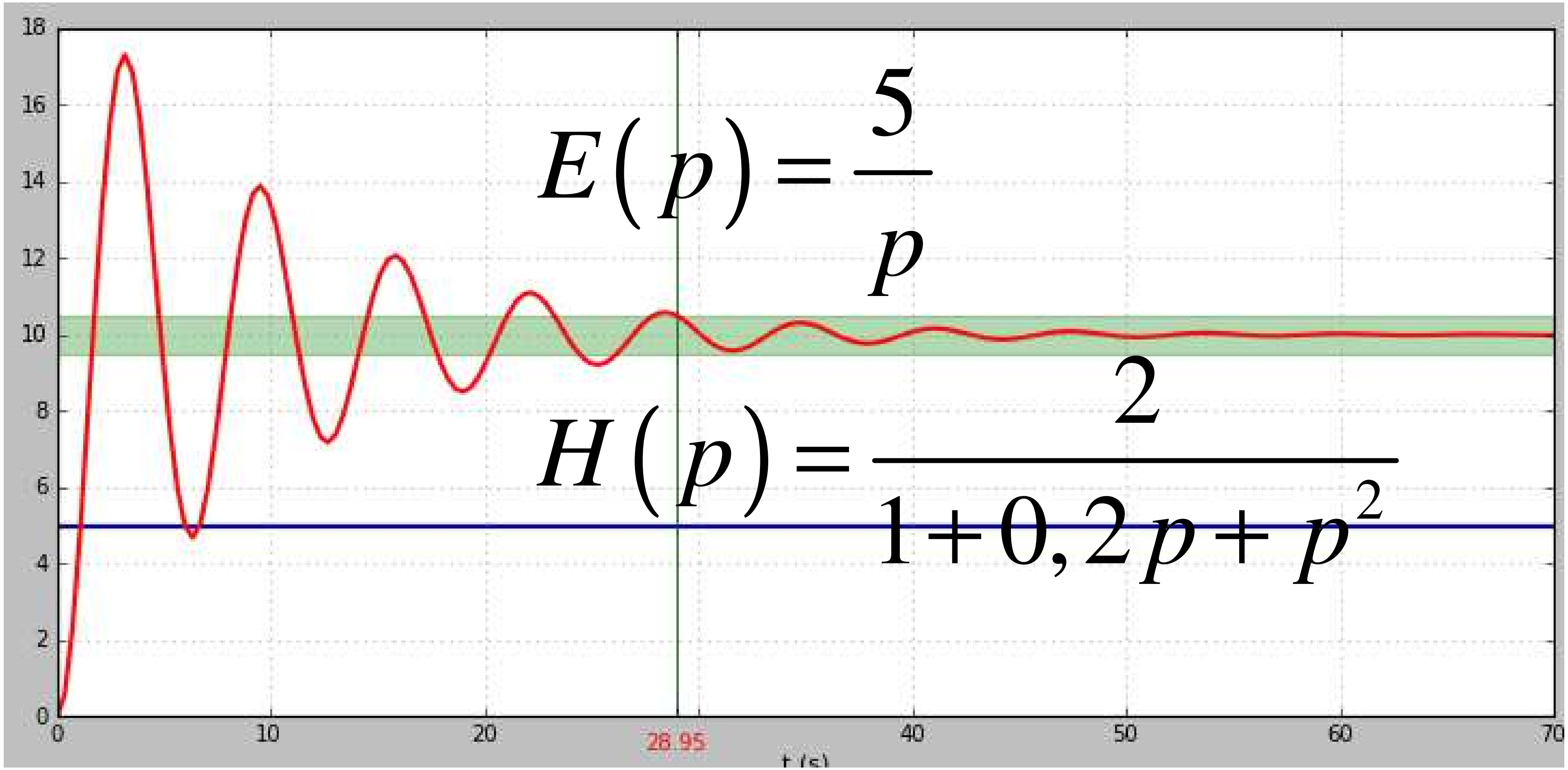
Bonne approximation à la main car beaucoup d'oscillations $\xi \ll 1$

$$D_1 = 10e^{-\frac{\pi\xi}{\sqrt{1-\xi^2}}} \approx 7 \rightarrow \xi \approx 0,1$$

$$\Leftrightarrow D_1 = 10e^{-\pi\xi} \approx 7 \rightarrow \xi \approx 0,1$$

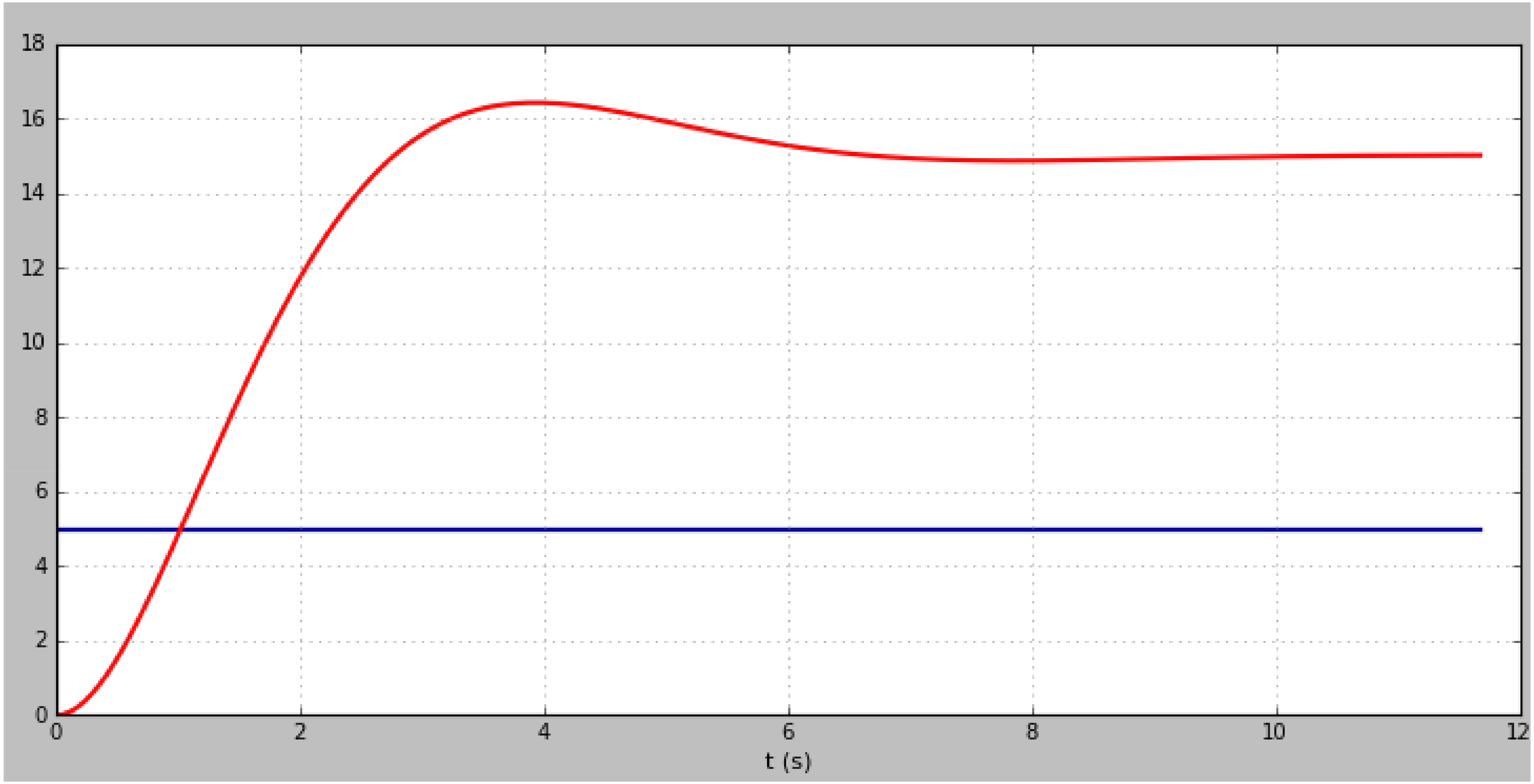


$$T = \frac{2\pi}{\omega_0\sqrt{1-\xi^2}} \approx 6,5s \rightarrow \omega_0 \approx 1 \, {}^{rad}\!/_{s}$$

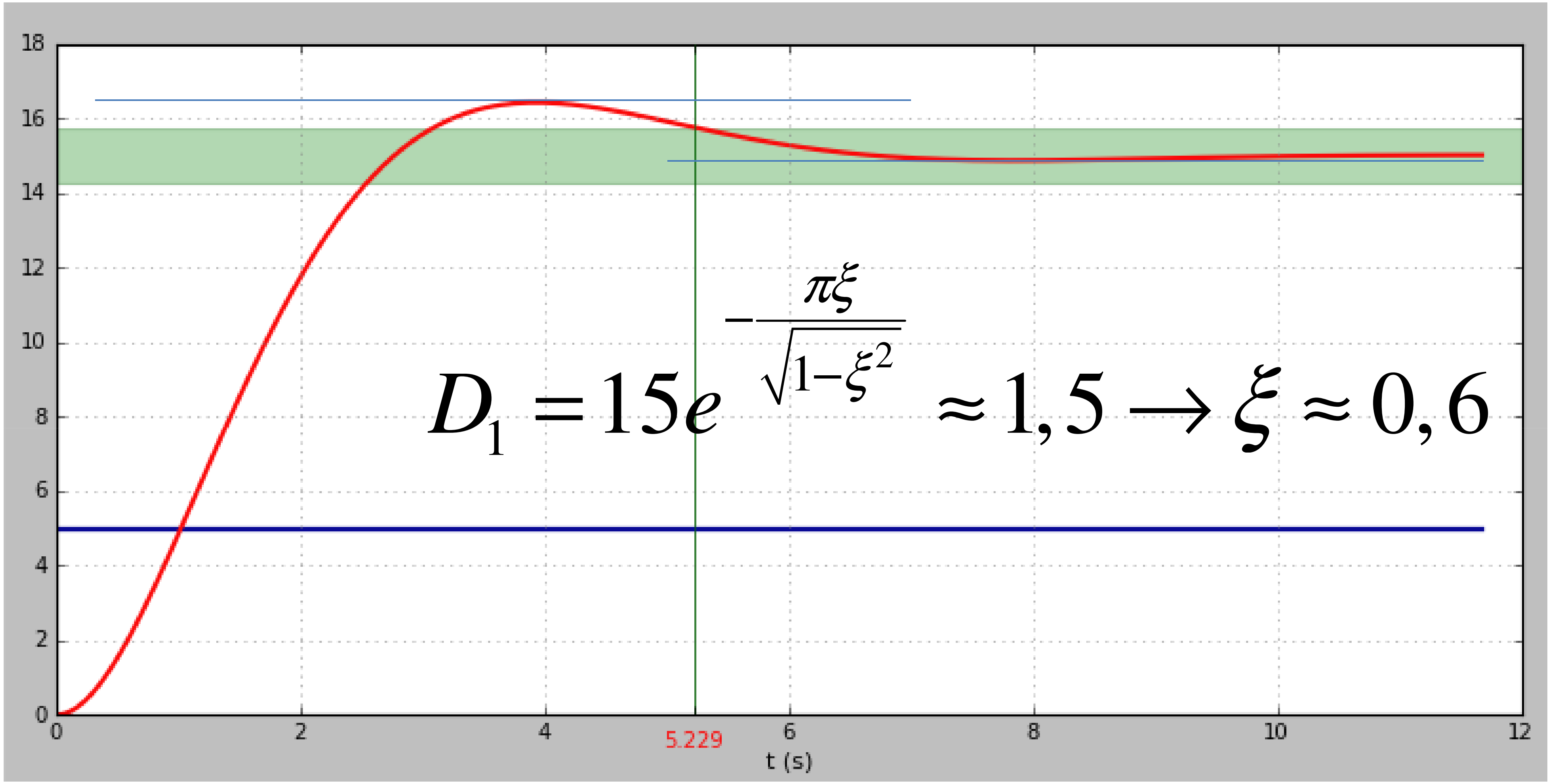


$$E(p) = \frac{5}{p}$$

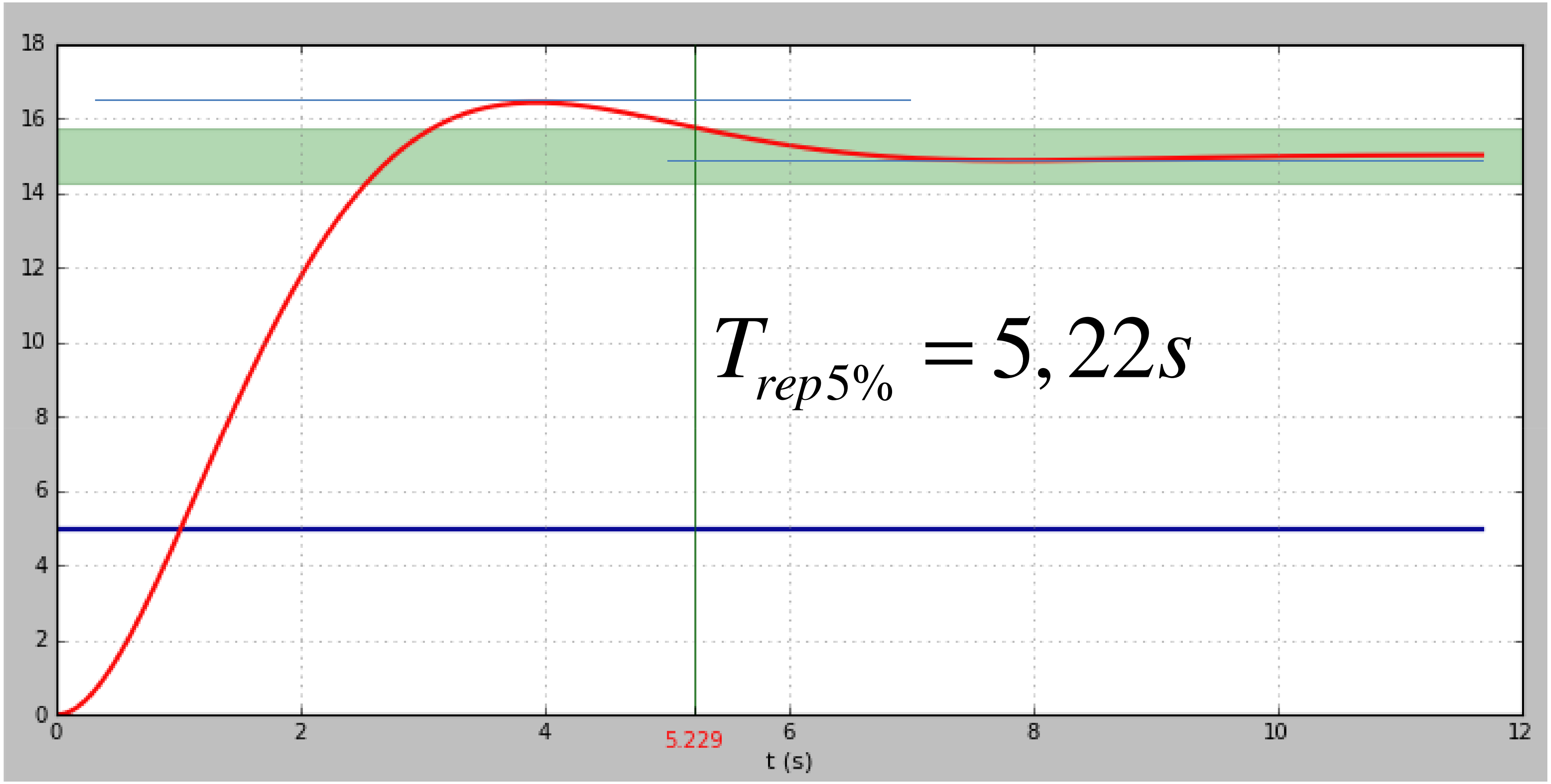
$$H(p) = \frac{2}{1 + 0,2p + p^2}$$



18
16
14
12
10
8
6
4
2
0
0
2
4
6
8
10
12
t (s)

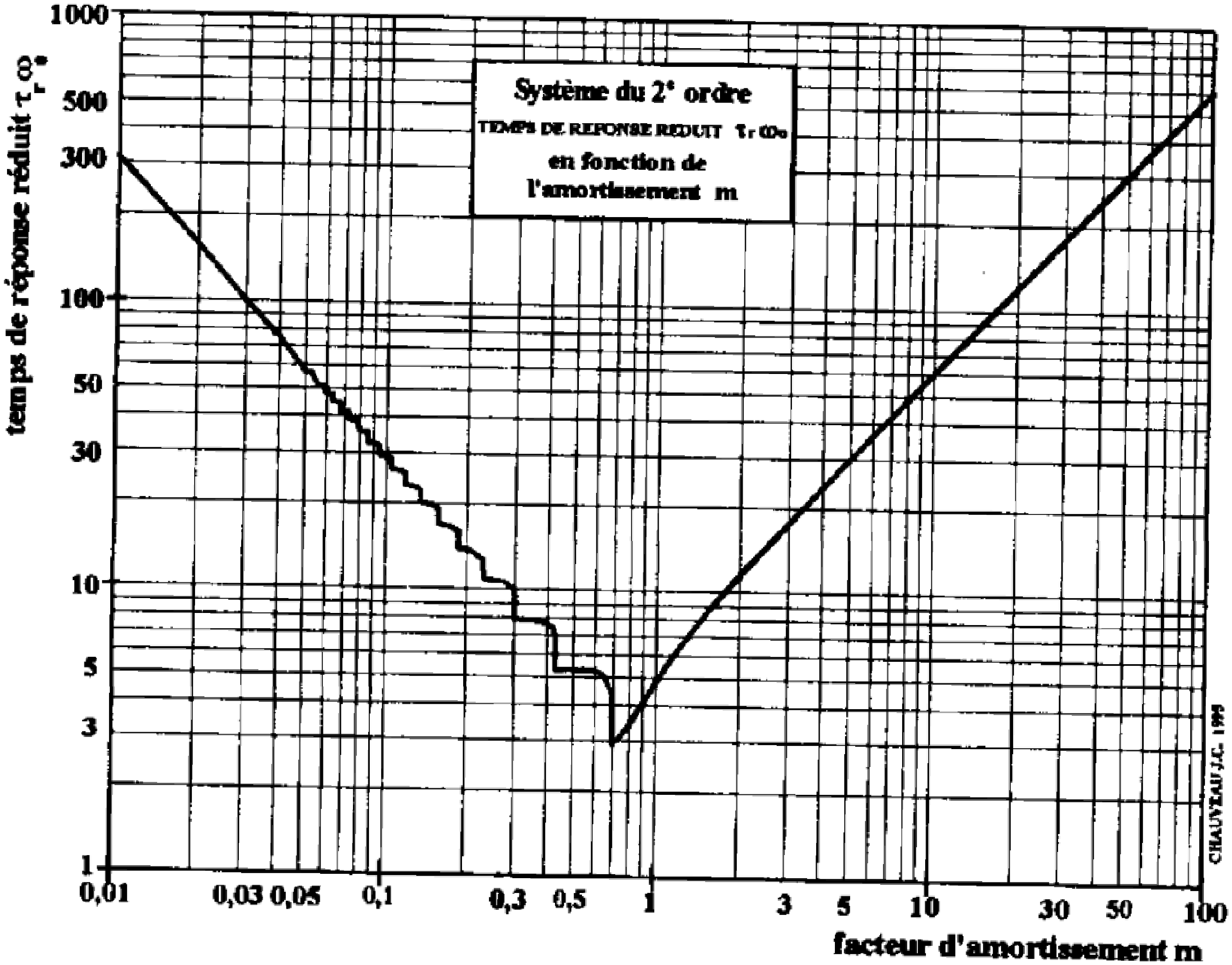


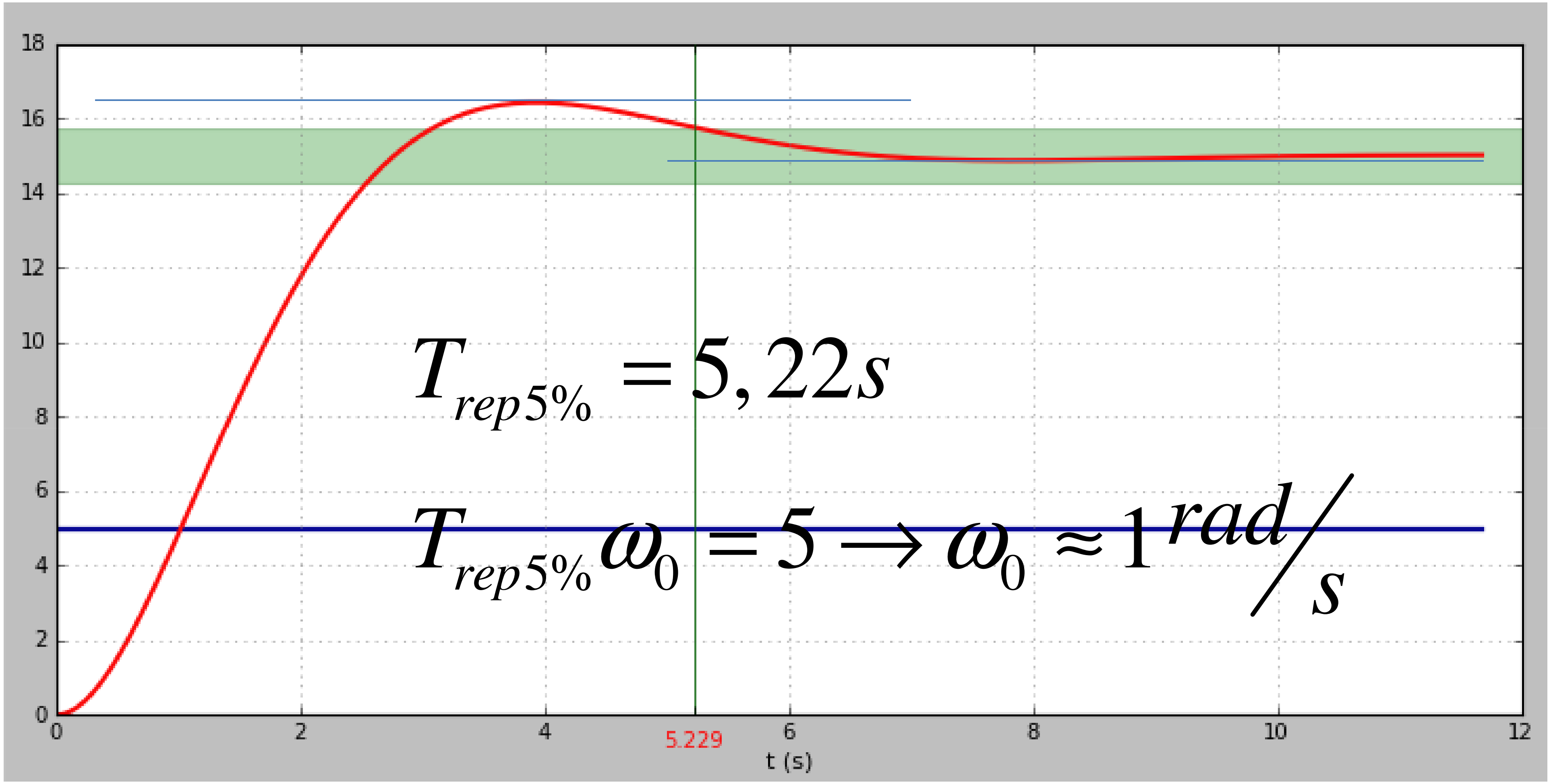
$$D_1 = 15e^{-\frac{\pi\xi}{\sqrt{1-\xi^2}}} \approx 1,5 \rightarrow \xi \approx 0,6$$



18
16
14
12
10
8
6
4
2
0
0
2
4
5.229
6
8
10
12
t (s)
$T_{rep5\%} = 5,22s$

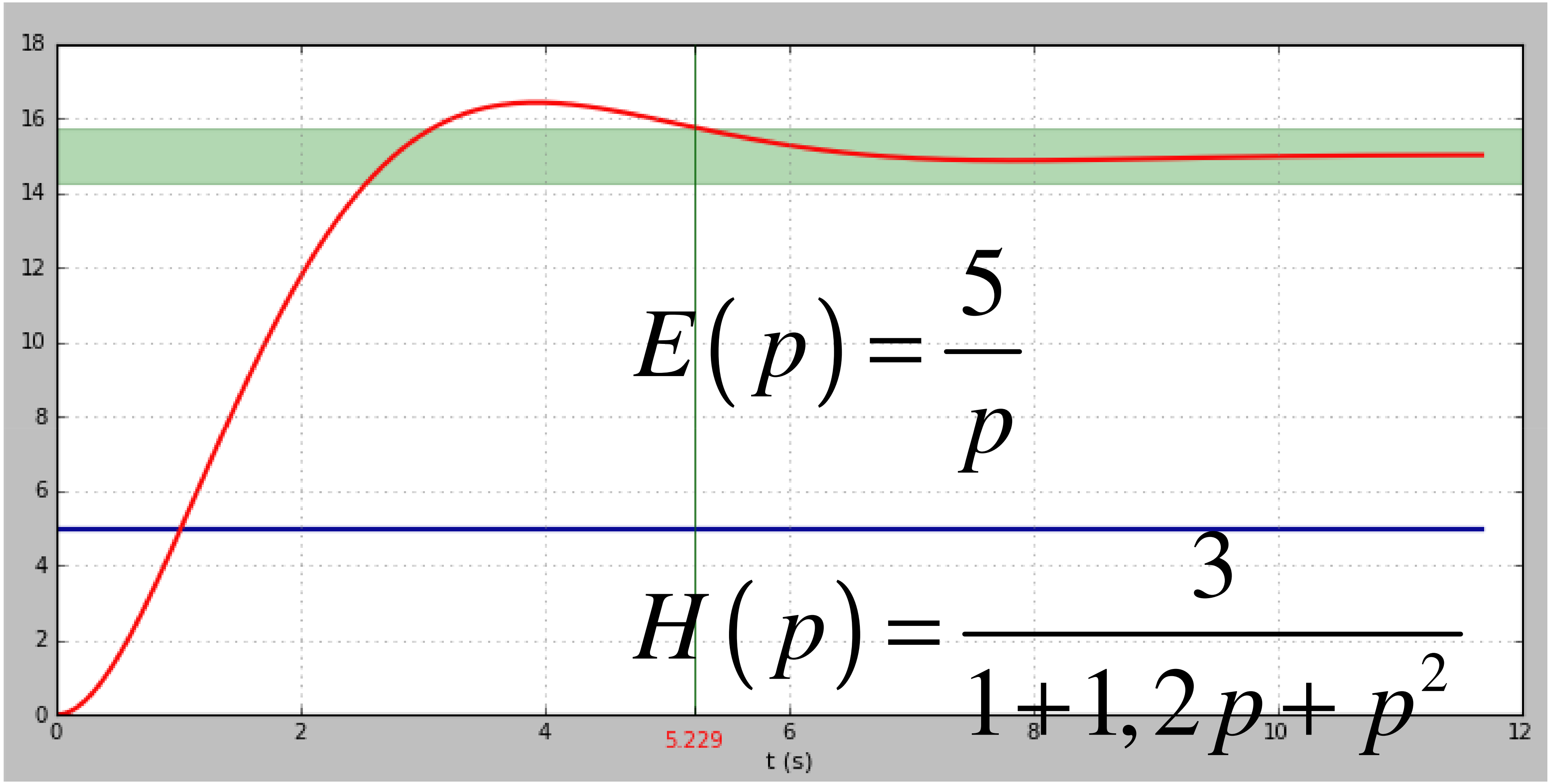
RAPPEL : Système du second ordre





$$T_{rep5\%} = 5,22s$$

$$T_{rep5\%}\,\omega_0 = 5 \rightarrow \omega_0 \approx 1 \,{}^{rad}\!/_{s}$$



$$E(p) = \frac{5}{p}$$

$$H(p) = \frac{3}{1+1,2\,p+p^2}$$