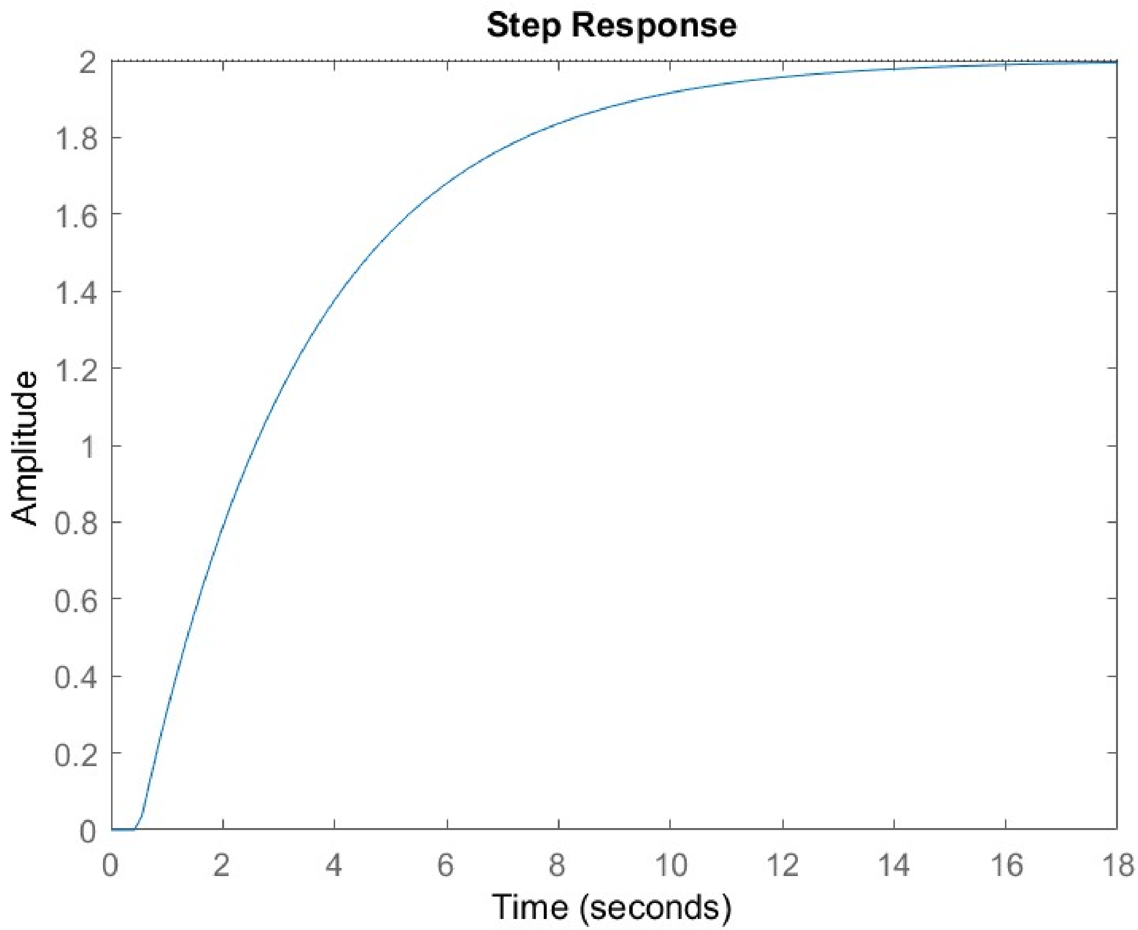
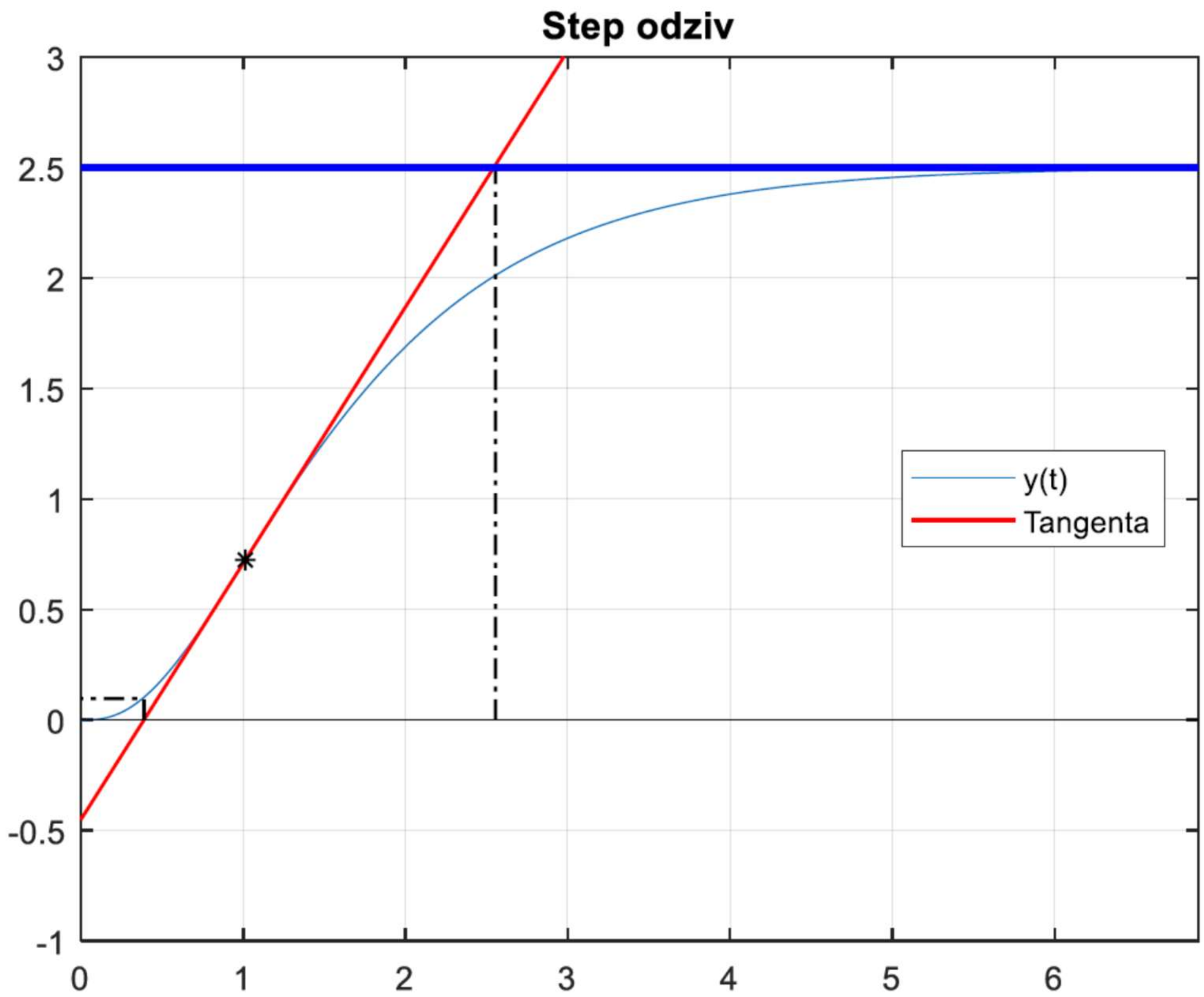
I labarotorijska vježba UTP

1) Neka je dat sistem $G(s) = \frac{2}{3s+1}e^{-0.5s}$

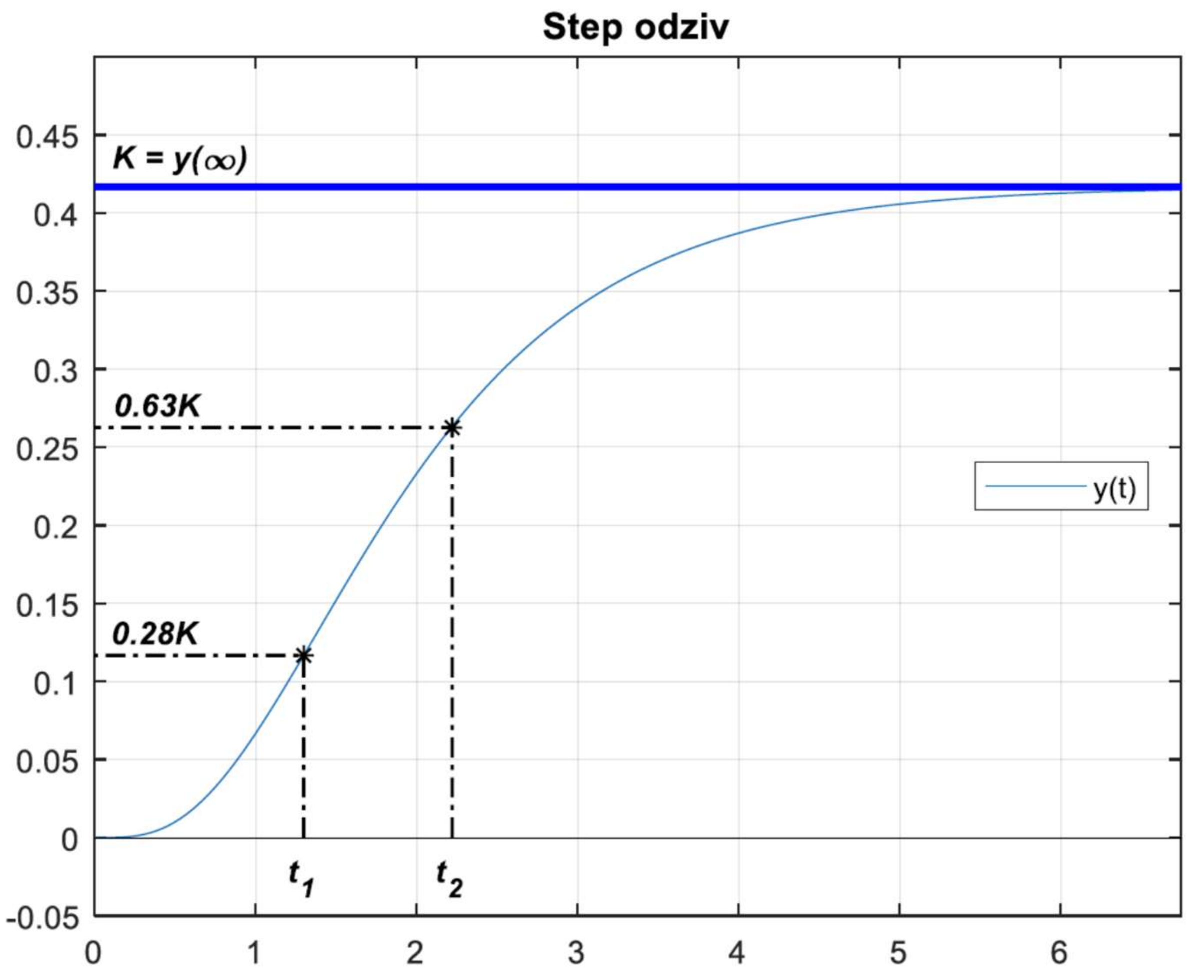
a) Modelirati dati sistem u MATLAB-u.
b) Sa grafika odziva na jediničnu pobudnu funkciju odrediti K_{ob}, T_{ob} i τ_{ob}.

```
>> s=tf('s')
>> G=2*exp(-0.5*s)/(3*s+1);
>> step(G)
>> Kob=dcgain(G)

Kob =

    2
```





Slika 1



Step odziv
K = y(∞)
0.63K
0.28K
y(t)
t1
t2
0.45
0.4
0.35
0.3
0.25
0.2
0.15
0.1
0.05
0
-0.05
0
1
2
3
4
5
6

U cilju identifikacije objekta može se primjeniti i drugačiji metod. Parametri se određuju na osnovu vremena t_1 i t_2 koja odgovaraju vrijednostima $y_1 = 0.28K$ i $y_2 = 0.63K$, gdje je $K = y(\infty)$.

Sa grafika prikazanog na slici 2, utvrđene su vrijednosti $t_1 = 1.31s$ i $t_2 = 2.21s$.

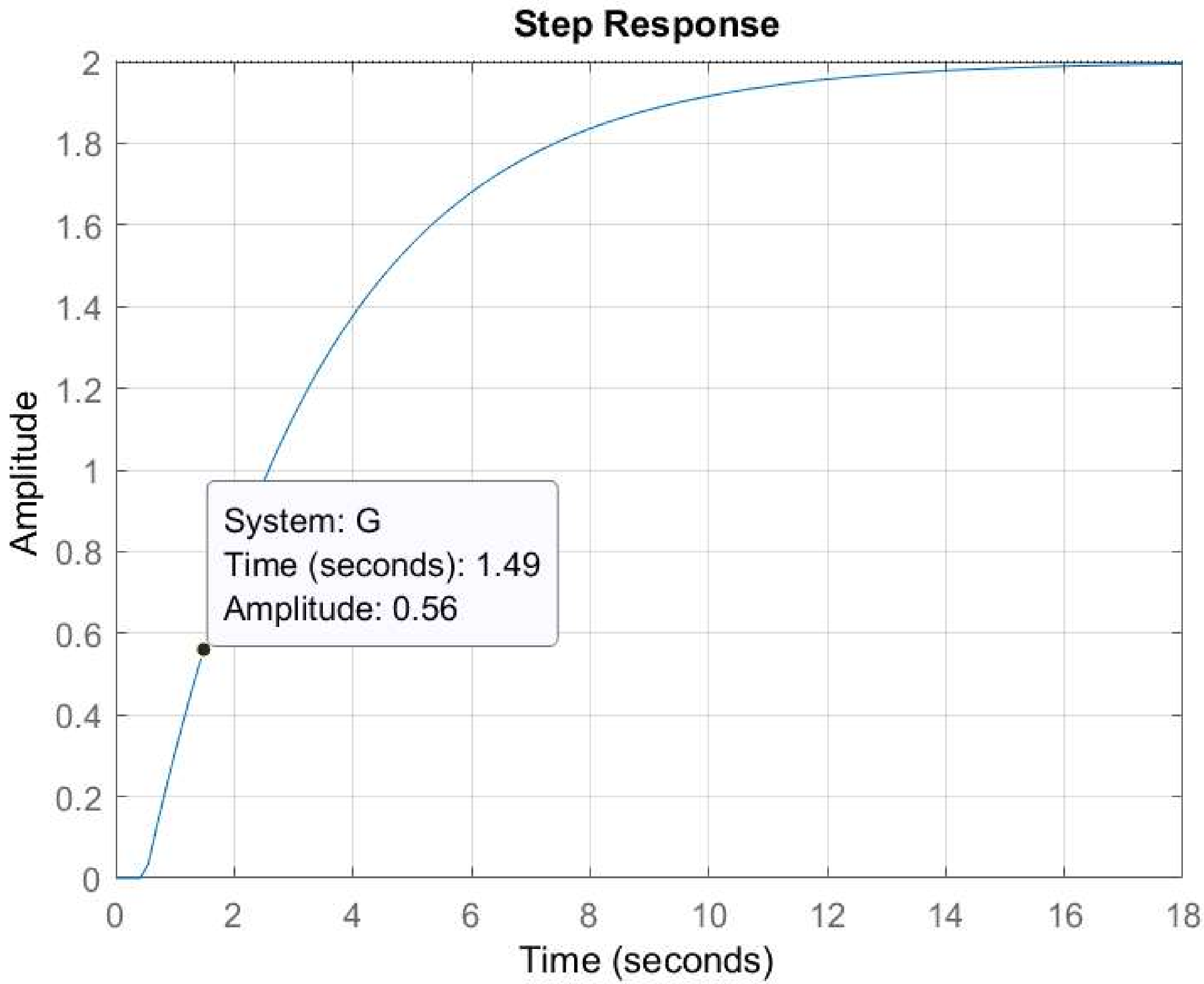
Vremenska konstanta i vijeme kašnjenja određuju se pomoću relacija:

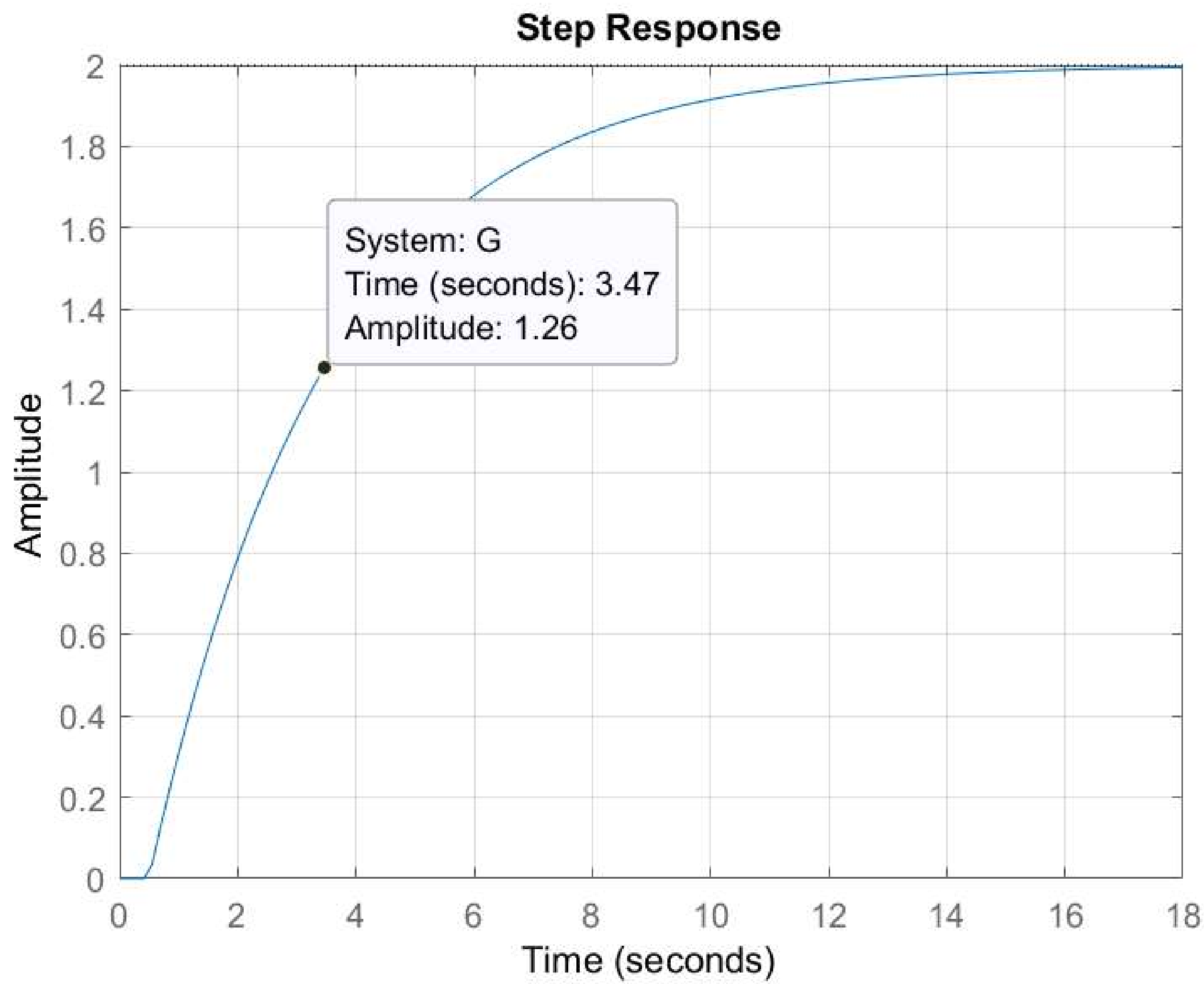
$$T = 1.5(t_2 - t_1)$$

$$L = (t_2 - T)$$

$$a = \frac{KL}{T}$$

```
>> y1 = 0.28*Kob

y1 =

   0.5600

>> y2=0.63*Kob

y2 =

   1.2600
```




Step Response
System: G
Time (seconds): 3.47
Amplitude: 1.26
Amplitude
Time (seconds)
0
0.2
0.4
0.6
0.8
1
1.2
1.4
1.6
1.8
2
0
2
4
6
8
10
12
14
16
18

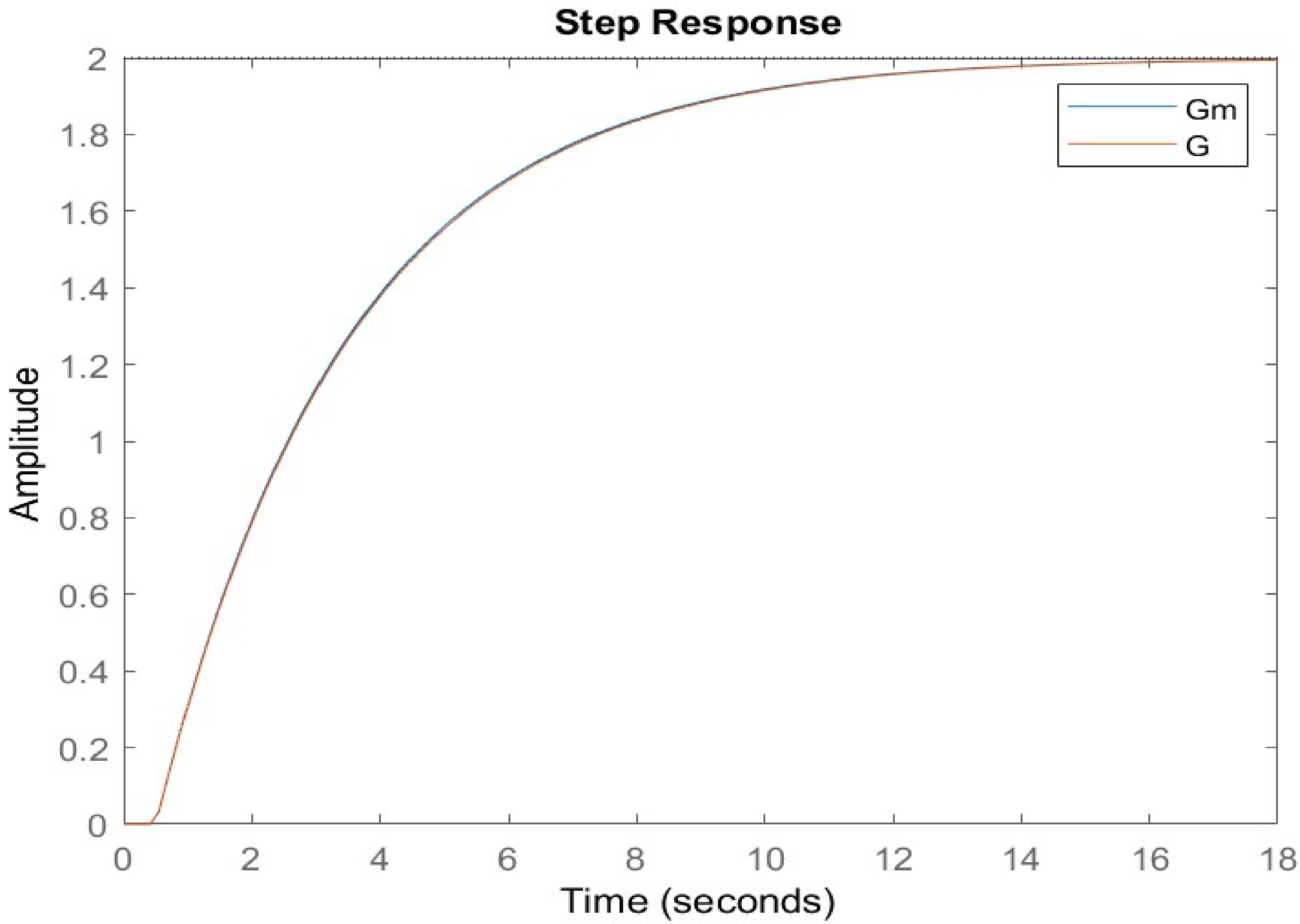
$$T = 1.5(t_2 - t_1)$$

$$L = (t_2 - T)$$

$$a = \frac{KL}{T}$$

- T=1.5*(3.47-1.49)=2.97
- L=(3.47-2.97)=0.5
- a=2*0.5/2.97=0.3367

$$G_m = \frac{2}{2.97s + 1} e^{-0.5s}$$


Step Response
Amplitude
Time (seconds)
Gm
G
0
0.2
0.4
0.6
0.8
1
1.2
1.4
1.6
1.8
2
0
2
4
6
8
10
12
14
16
18

Za domaći

2) Za sistem prvog reda sa prenosnom funkcijom $G(s) = \dfrac{1}{s+5}$ za koju pretpostavljamo da je ne poznajemo unaprijed,

a) na osnovu odziva na jediničnu pobudnu funkciju aproskimirati dati sistem sa sistemom prvog reda i čistim transportnim kašnjenjem

$$G(s) = \frac{k_{ob}}{T_{ob}s + 1} e^{-\tau_{ob}s}$$

b) koristeći blok MUX, uporediti odzive na jediničnu pobudnu funkciju stvarnog i aproskimirajućeg sistema.

3) Za sistem drugog reda sa prenosnom funkcijom $G(s)=\frac{1}{s^2+7s+10}$ za koju pretpostavljamo da je ne poznajemo unaprijed,

a) na osnovu odziva na jediničnu pobudnu funkciju aproskimirati dati sistem sa sistemom prvog reda i čistim transportnim kašnjenjem

$$G(s)=\frac{k_{ob}}{T_{ob}s+1}e^{-\tau_{ob}s}$$

b) unijeti prenosnu funkciju stvarnog sistema i aproskimirajućeg sistema u komandni prozor MATLAB-a, pa koristeći program **Itieview** uporediti za ova dva sistema slijedeće elemente:

i) odzive na jediničnu step funkciju
ii) odzive na impulsnu funkciju
iii) amplitudno-faznu karakteristiku (Potreban komentar)
iv) polove sistema (Potreban komentar)

Pokušajte i ovaj pristup i provjerite ponašanje modela i stvarne transfer funkcije

three- or four-parameter models presented above is suitable either. A three-parameter model that describes the oscillations is given by the transfer function

$$G(s) = \frac{K\omega^2}{s^2 + 2\zeta\omega s + \omega^2} \tag{2.16}$$

This model has three parameters: the static gain K, the natural frequency ω, and the relative damping ζ. These parameters can be determined approximately from the step response as indicated in Figure 2.14. The period of the oscillation T_p and the decay ratio d are first determined. Parameters ω and ζ are related to T_p and d as follows.

$$d = e^{-2\zeta\pi/\sqrt{1-\zeta^2}} \qquad T_p = \frac{2\pi}{\omega\sqrt{1-\zeta^2}}$$

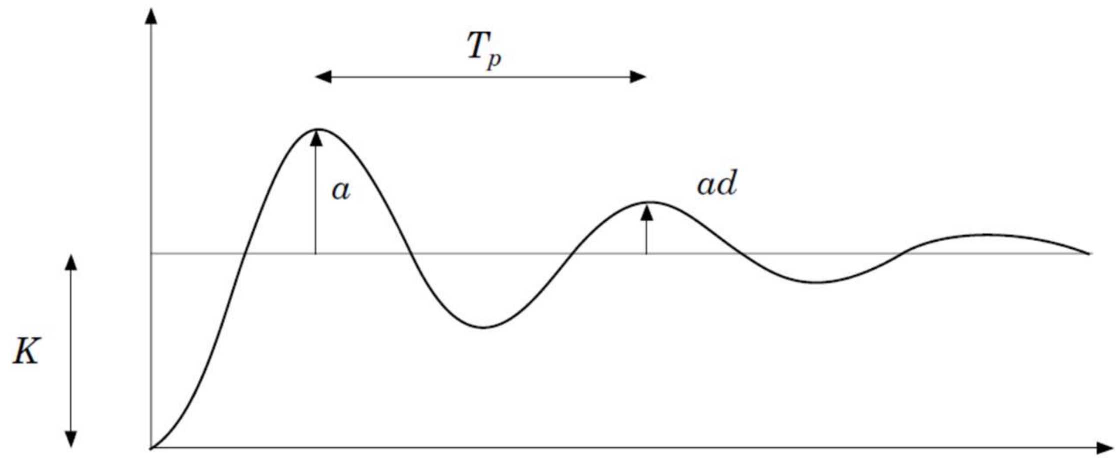


Figure 2.14 Graphical determination of mathematical models for systems with an oscillatory step response.

or

$$\zeta = \frac{1}{\sqrt{1 + (2\pi/\log d)^2}} \qquad \omega = \frac{2\pi}{T_p\sqrt{1-\zeta^2}} \tag{2.17}$$

A time delay can also be added to the model (2.16) and determined in the same way as for the previous models, e.g., by drawing the tangent of maximum slope or determining the time between the onset of the step and the time the step response has reached a few percent of its final value.