CA7

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بخش اول)

تمرین اول -

الف -

$$V_{in} = Ri(t) + L\frac{di(t)}{dt} + \frac{1}{C}\int_{-\infty}^{t} i(\tau)d\tau \xrightarrow{\frac{d}{dt}}$$

$$\frac{d}{dt}V_{in} = \frac{i(t)}{C} + R\frac{d}{dt}i(t) + L\frac{d^2}{dt^2}i(t)$$

ب -

$$\text{Laplace} \rightarrow SV_{in} = S^2LI(S) + SRI(S) + \frac{1}{C}I(S)$$

$$\Rightarrow I(S) = \frac{SV_{in}}{LS^2 + RS + \frac{1}{C}}$$

ج -

$$V_C(t) = \frac{1}{C}\int_{-\infty}^{t} i(\tau)d\tau \xrightarrow{L} V_C(S) = \frac{1}{CS}I(S)$$

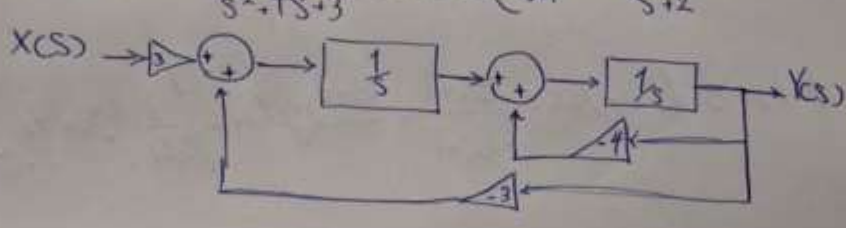
$$\Rightarrow I(S) = CSV_C(S)$$

$$\Rightarrow V_C(S) = \frac{1}{CS} \times \frac{SV_{in}(S)}{LS^2 + RS + \frac{1}{C}} = \frac{V_{in}(S)}{LCS^2 + RCS + 1}$$

$$\Rightarrow Y(S) = \frac{X(S)}{LCS^2 + RCS + 1}$$

د -

$$Y(S) = X(S) \times \frac{3}{S^2 + 4S + 3} = X(S)\left(\frac{3/2}{S+1} - \frac{3/2}{S+2}\right)$$



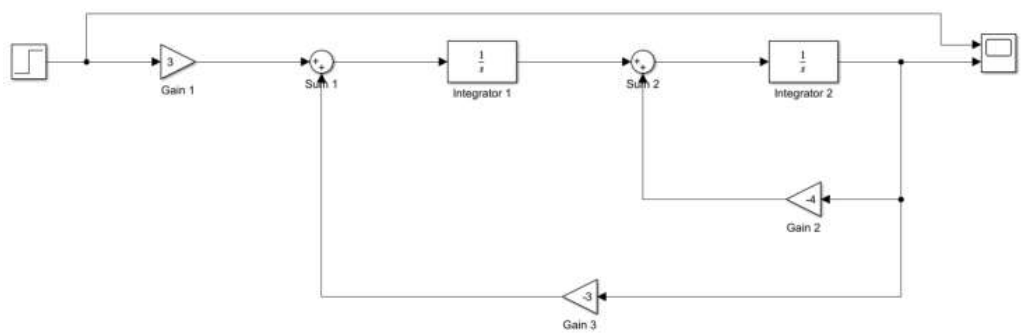
-۹

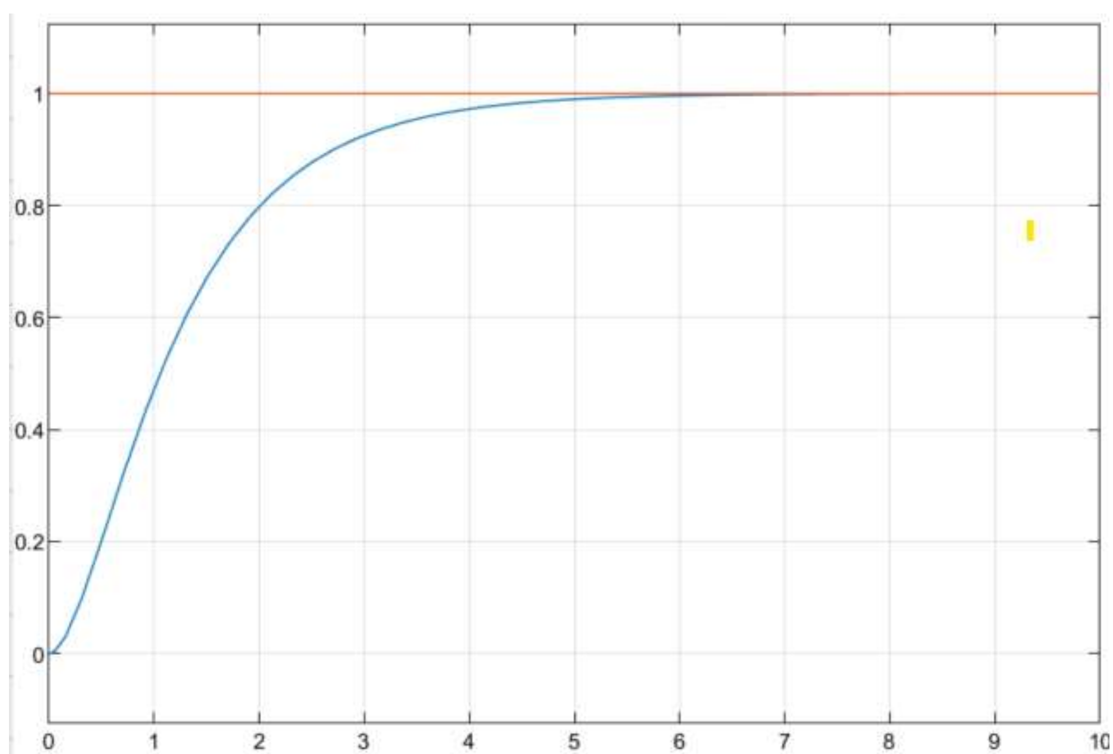
input: $u(t) \Rightarrow X(s) = \frac{1}{s} \Rightarrow Y(s) = \frac{3}{s^3+4s^2+3s}$

$\xrightarrow{\mathcal{L}^{-1}} y(t) = u(t) - \frac{3}{2}e^{-t} + \frac{1}{2}e^{-3t}$

محاسبات با Simulation انجام شده همخوانی داشت

۵)





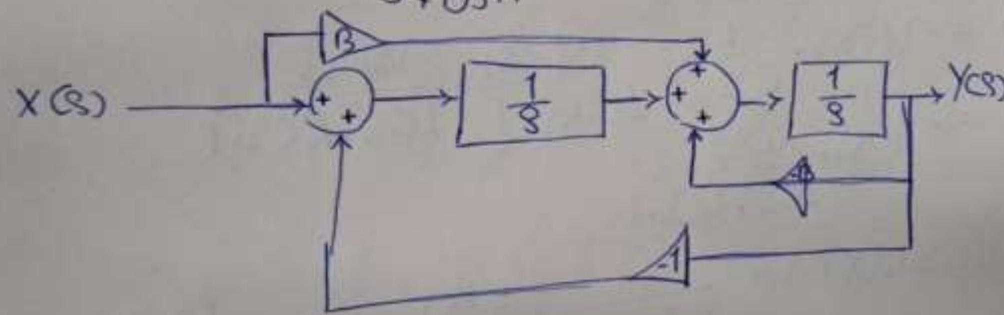
تمرین دوم)

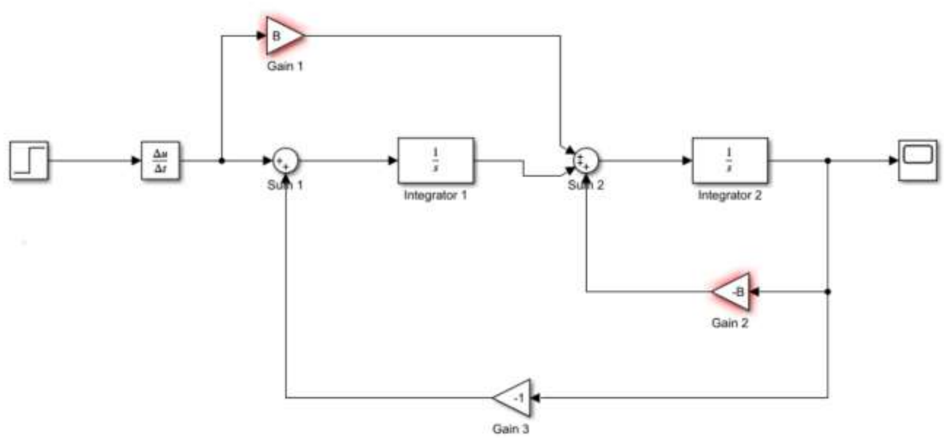
تمرین دوم -

الف - $\frac{d^2}{dt^2}y(t) + B\frac{d}{dt}y(t) + y(t) = B\frac{d}{dt}x(t) + x(t)$

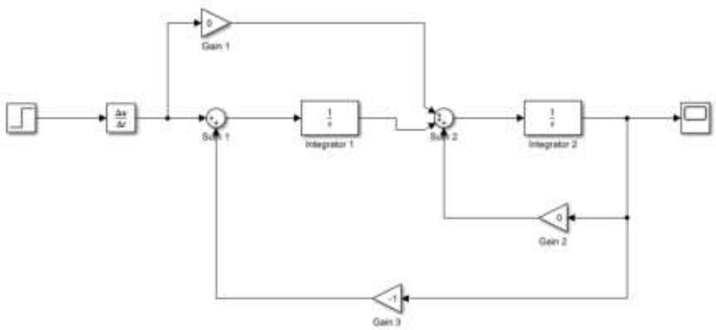
ب - $s^2 Y(s) + BsY(s) + Y(s) = BsX(s) + X(s)$

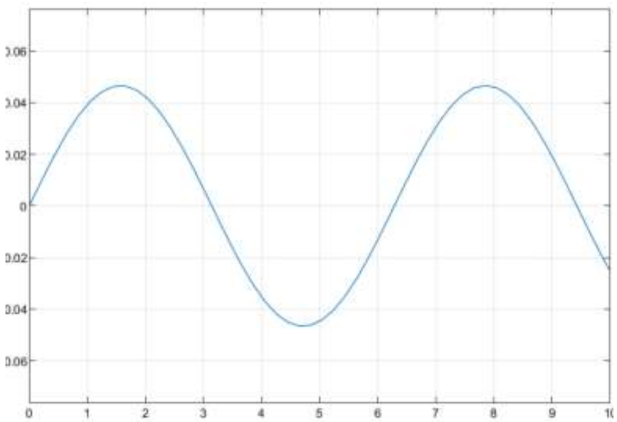
$$\Rightarrow Y(s) = X(s)\left(\frac{Bs+1}{s^2+Bs+1}\right)$$





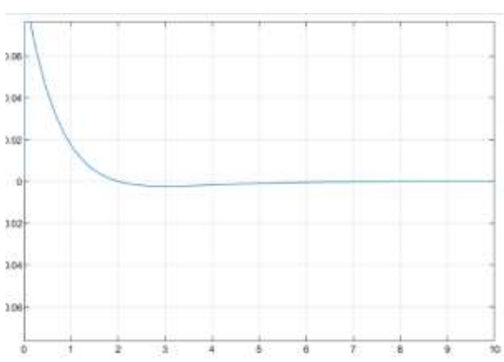
ج - $x(t) = \delta(t) \Rightarrow Y(s) = \frac{Bs+1}{s^2+Bs+1} \xrightarrow{B=0} y(t) = L^{-1}\left\{\frac{1}{s^2+1}\right\} = \sin(t)$

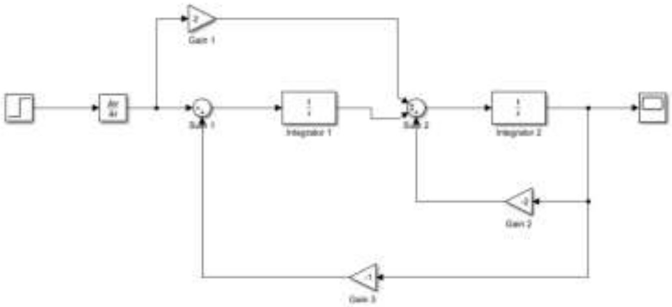




$S^2+BS+1=0 \qquad \Delta = B^2-4 \Rightarrow |B| \geq 2$ -)

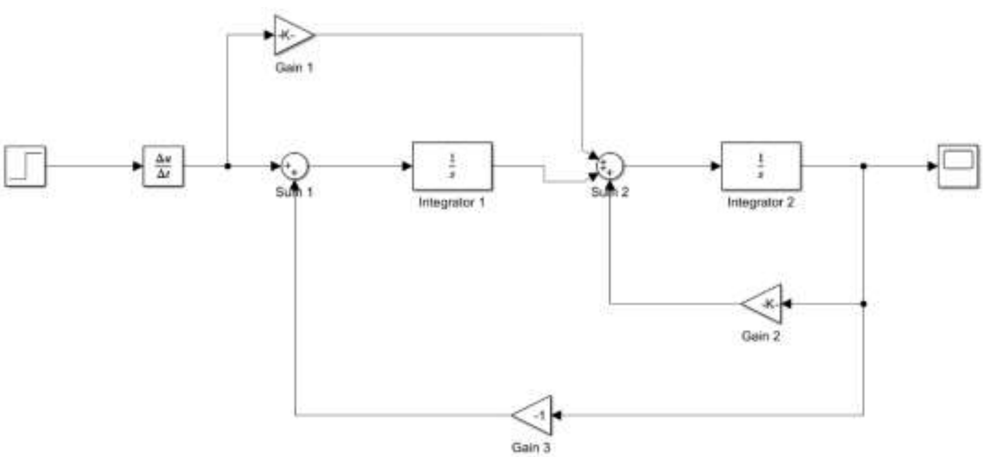
$$\left.\begin{aligned} B&=2 \\ x(t)&=\delta(t) \end{aligned}\right\} \Rightarrow y(t) = L^{-1}\left\{\frac{2S+1}{S^2+2S+1}\right\} = 2e^{-t} - e^{-t}t$$

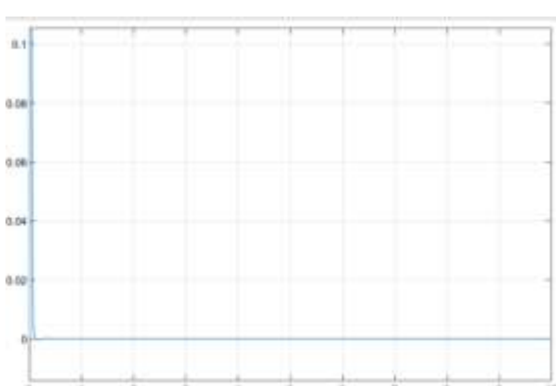




$$B = 100$$
$$x(t) = \delta(t)$$

$$\Big\} y(t) = L^{-1}\left\{ \frac{100S+1}{S^2+100S+1} \right\} = 100e^{-50t}\cosh(7\sqrt{51}t) - 9$$
$$- \frac{4999}{7\sqrt{51}} e^{-50t} C\, 7\sqrt{51}t)$$





ه)

باید تا جای ممکن قطب ها نزدیک به هم باشند.اگر قطب حقیقی نداشته باشیم به حالت پایداری نمی رسیم. $B = +2,-2$ بهترین حالت برای سیستم هستند.

تمرین سوم)

تمرین سوم.

$$\frac{d^2}{dt^2}y(t)+3\frac{d}{dt}y(t)+2y(t)=5u(t)$$

الف. پاسخ حالت ورودی: $s^2Y(s)+3sY(s)+2Y(s)=\frac{5}{s}$

$$\Rightarrow Y(s)=\frac{5}{s(s^2+3s+2)} \xrightarrow{L^{-1}} y(t)=\left(\frac{5}{2}e^{-2t}-5e^{-t}+5/2\right)u(t)$$

پاسخ ناشی از شرایط اولیه: $s^2Y(s)-sy(0)-y'(0)+3sY(s)-3y(0)+2Y(s)=0$

$$\Rightarrow Y(s)=\frac{s+2}{(s+2)(s+1)} \xrightarrow{L^{-1}} y(t)=\left(-2e^{-2t}+3e^{-t}\right)u(t)$$

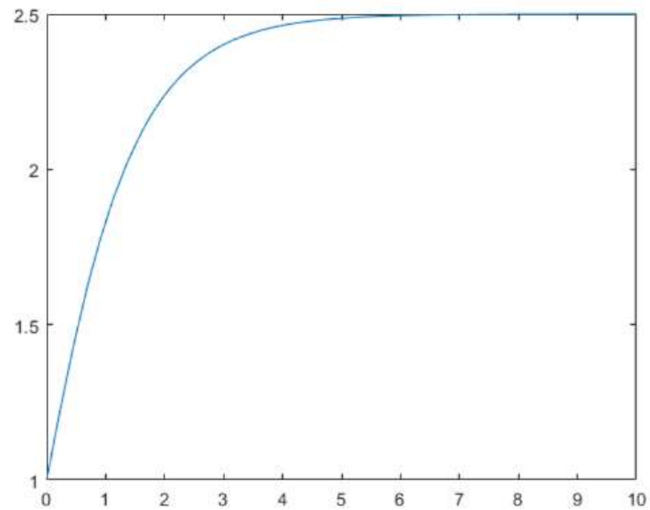
p3.m

```
clc;
clear all;
syms y(t)
dy = diff(y);
equation = diff(y,t,2) + 3*diff(y,t,1) + 2*y == 5*heaviside(t);
cond1 = y(0) == 1;
cond2 = dy(0) == 1;
conditions = [cond1 cond2];
ySol(t) = dsolve(equation,conditions);
ySol = simplify(ySol);
fprintf("The answer of the differential equation:\n%s\nis\ny(t) = %s\n", equation, ySol);
fplot(ySol, [0, 10]);
```

Command Window

New to MATLAB? See resources for Getting Started.

```
The answer of the differential equation:
2*y(1) + 3*subs(diff(y(t), t), t, 1) + subs(diff(y(t), t, t), t, 1) == 5
is
y(t) = (exp(-2)*(10*exp(2) - 8*exp(1) + 2))/4
```


2.5
2
1.5
1
0
1
2
3
4
5
6
7
8
9
10