

به نام خدا



پروژه فاز یک تئوری مدار الکتریکی

دکتر فاطمی زاده

زهرا مجتهدین

۹۹۱۰۲۱۶۷

*در سؤالاتی که استفاده از MATLAB ذکر شده است، از آن برنامه استفاده نموده ام.

سوال (1)

$$KVL: -V_i + Ls i + \frac{1}{Cs} i + R i = 0 \rightarrow \left(Ls + \frac{1}{Cs} + R \right) i = V_i \quad \text{الف}$$

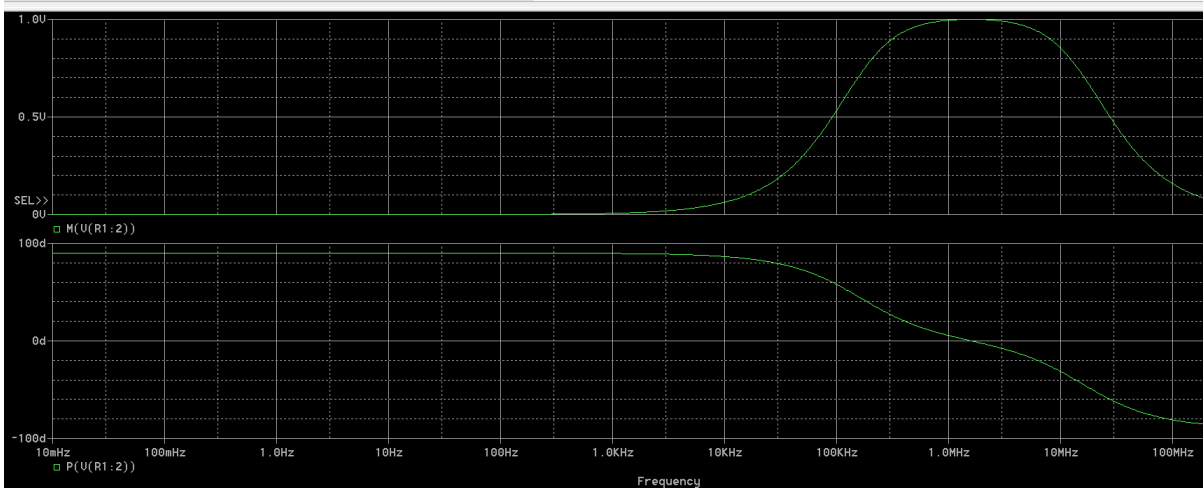
$$H(s) = \frac{V_o}{V_i} \Rightarrow \frac{R}{Ls + R + \frac{1}{Cs}} = \frac{RCS}{LCS + RCS + 1}$$

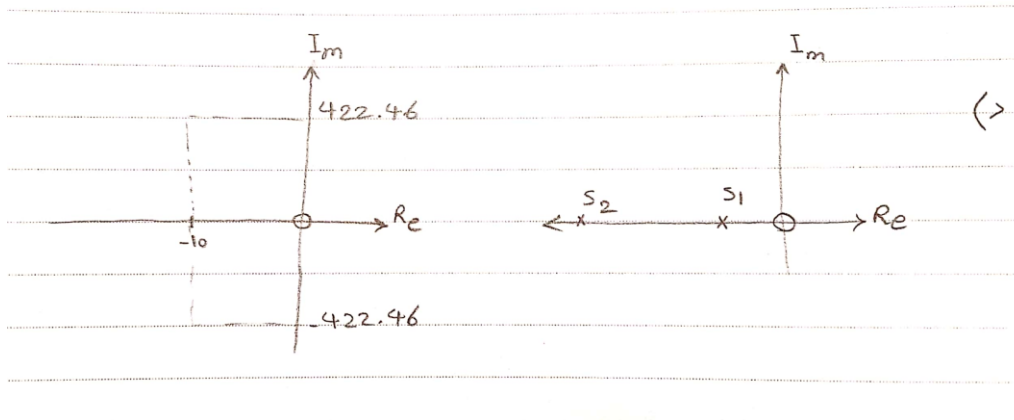
...

$$H(s) = \frac{1.12 \times 10^{-2} s}{5.6 \times 10^{-6} s^2 + 1.12 \times 10^{-2} s + 1} \Rightarrow \text{قطب} = s = 0 \quad \begin{cases} s_1 = -86.9 \\ s_2 = -1906.3 \end{cases} \quad \text{ب}$$

...

$$H(s) = \frac{1.12 \times 10^{-4} s}{5.6 \times 10^{-6} s^2 + 1.12 \times 10^{-4} s + 1} \Rightarrow \text{قطب} = s = 0 \quad \begin{cases} s_1 = -10 + j422.46 \\ s_2 = -10 - j422.46 \end{cases} \quad R = 100 \Omega \quad \text{ج}$$





سوال 2) کد در فایل زیپ ضمیمه شده است.

②

$$KVL: -\frac{10}{s}V + 5i_a + 4s(i_a - i_b) = 0 \rightarrow (5 + 4s)i_a - 4si_b = \frac{10}{s}$$

$$KVL: -\frac{20}{s}V + 15i_b + 4s(i_b - i_a) = 0 \rightarrow (15 + 4s)i_b - 4si_a = \frac{20}{s}$$

$$\begin{vmatrix} 5+4s & -4s \\ -4s & 15+4s \end{vmatrix} \begin{vmatrix} i_a \\ i_b \end{vmatrix} = \begin{vmatrix} 10/s \\ 20/s \end{vmatrix} \rightarrow i_a = \frac{24s+30}{s(16s+15)}; \quad i_b = \frac{24s+20}{(16s+15)s}$$

$$i_a = \frac{2}{s} \left(\frac{8}{16s+15} \right) = 2u(t) - \frac{1}{2}e^{-\frac{15}{16}t} \quad i_b = \frac{4}{3s} + \frac{8}{3(16s+15)} = \frac{4}{3}u(t) + \frac{1}{6}e^{-\frac{15}{16}t}$$

```

Editor - C:\Users\Asus\Documents\Untitled2.m
Untitled2.m x +
1 - syms a
2 - syms b
3 - syms s
4
5 - e1 = (5 + 4*s)*a - 4*s*b == 10/s
6
7 - e2 = (15 + 4*s)*b - 4*s*a == 20/s
8
9 - [A,B] = equationsToMatrix([e1, e2], [a,b])
10 - l = linsolve(A,B)
11 - ilaplace(l(1))
12 - ilaplace(l(2))

```

Command Window

```

1 =

(6*(4*s + 5))/(s*(16*s + 15))
(4*(6*s + 5))/(s*(16*s + 15))

ans =

2 - exp(-(15*t)/16)/2

ans =

exp(-(15*t)/16)/6 + 4/3

```

منبع برای حل این سوال: <https://youtu.be/Rec0qybE2Eo>

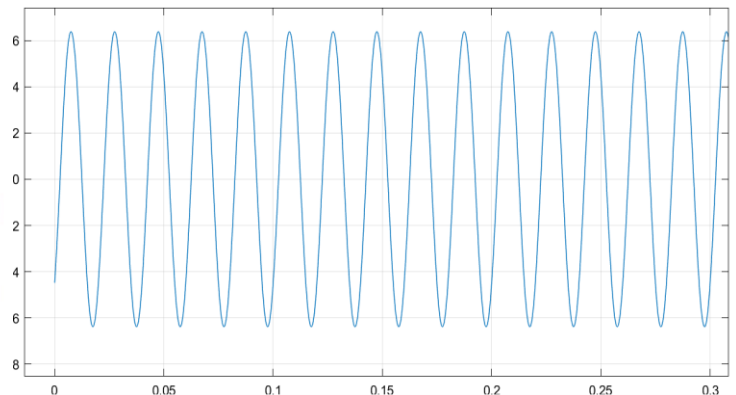
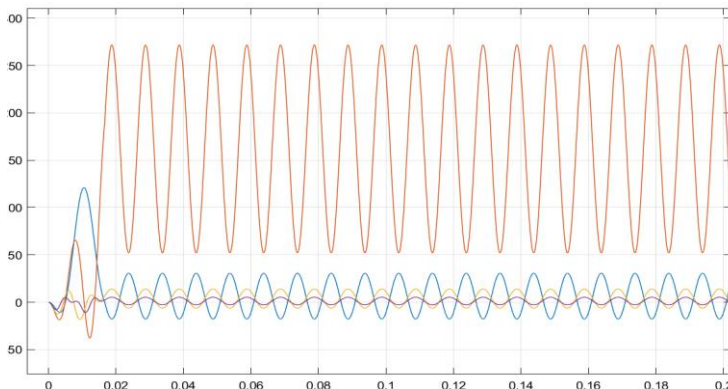
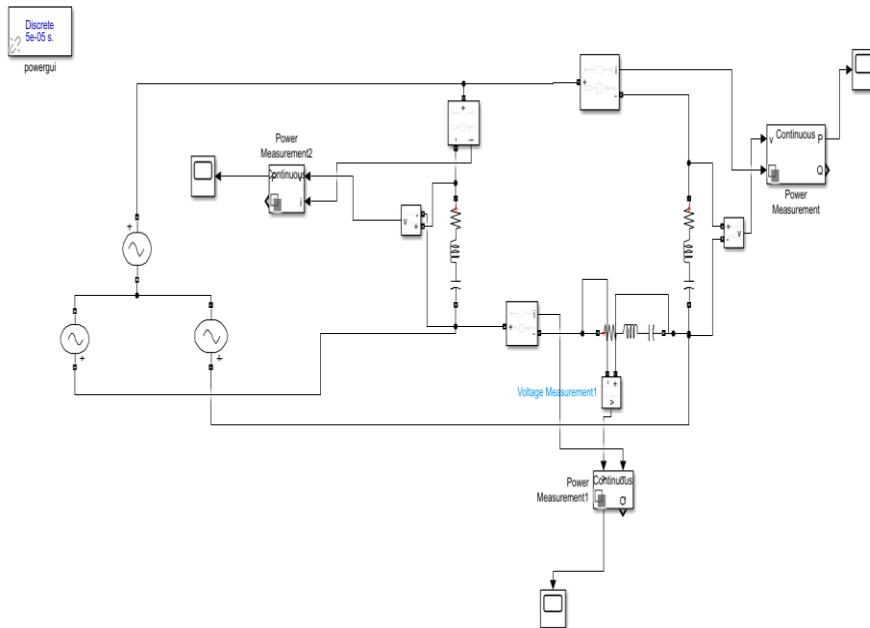
سوال (3)

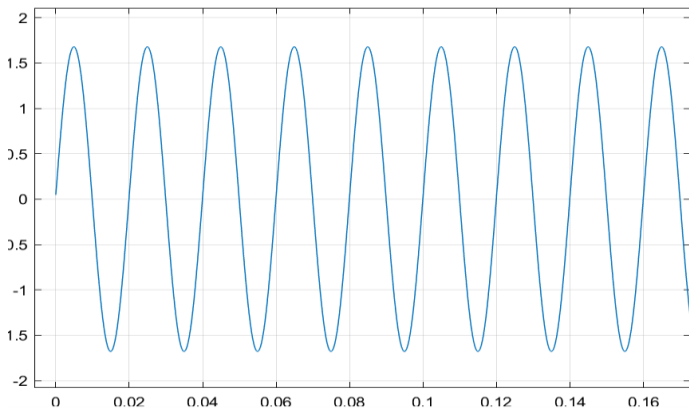
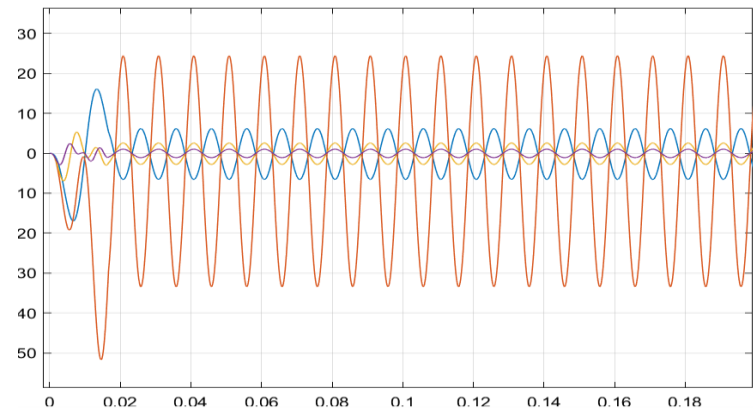
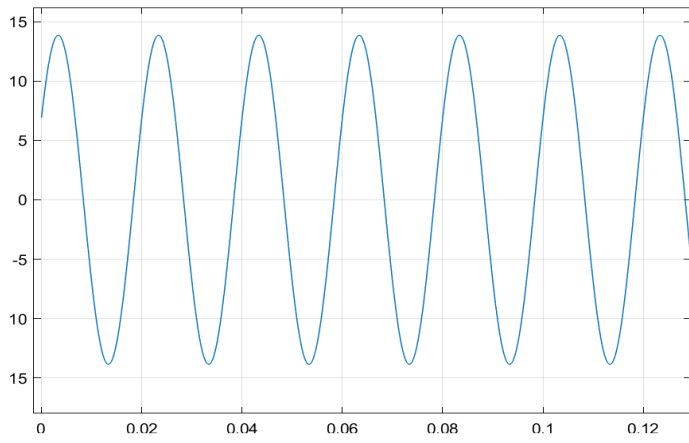
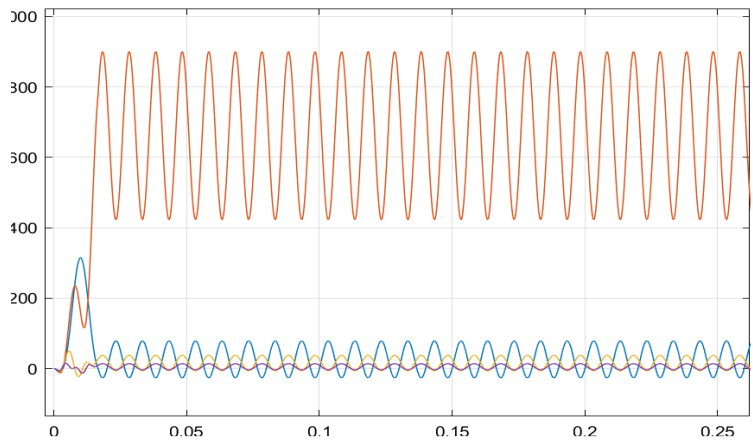
$$Z_1 = 10 \angle 30^\circ \Rightarrow (10 \times \frac{\sqrt{3}}{2}) + (10 \times \frac{1}{2}) \Rightarrow 5\sqrt{3} + j5 ; L = 5 \text{ mH} \Rightarrow \begin{cases} L = 10^{-1} \text{ H} \\ R = 8.7 \Omega \end{cases}$$

$$Z_2 = 15 \angle -60^\circ \Rightarrow (15 \times \frac{1}{2}) + (15 \times \frac{\sqrt{3}}{2} \times (-j)) \Rightarrow 7.5 - j7.5\sqrt{3} ; \frac{1}{C\omega} = 7.5\sqrt{3}$$

$$C = \frac{1}{100 \times 7.5\sqrt{3}} = 2.4516 \times 10^{-4} \text{ F} \quad R = 15/2 \Omega$$

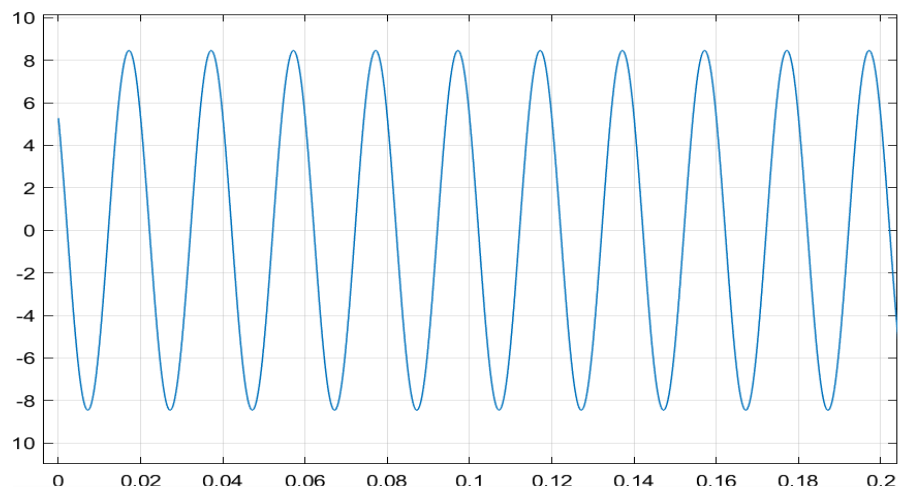
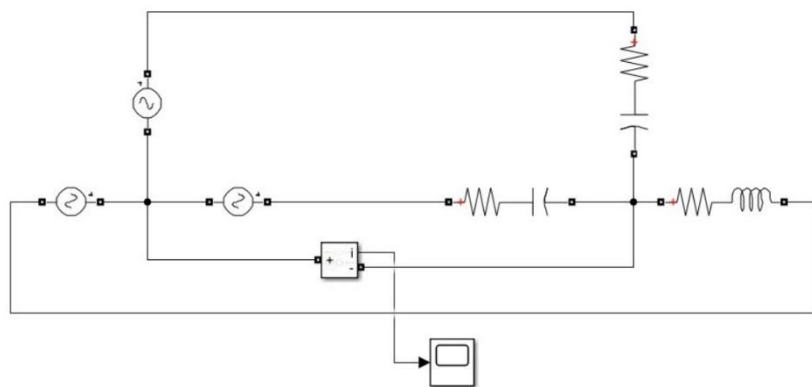
$$Z_3 = 20 \angle 80^\circ \Rightarrow 3.5 + j19.7 \Rightarrow L = 19.7 \text{ mH} \Rightarrow \begin{cases} L = 0.3942 \text{ H} \\ R = 3.444 \Omega \end{cases}$$





نمودارهای بالا به ترتیب نشان دهنده جریان و توان لودهای اول تا سوم را نشان می دهند.

(ب)



سوال (4)

$$V_- = V_+ \Rightarrow \frac{\frac{1}{Cs} V_1}{\frac{1}{Cs} + 1000} = \frac{V_1}{1 + 1000 Cs} \Rightarrow \frac{V_1}{1 + 10^{-4} s}$$

$$KVL : \dots 2000 I_1 \Rightarrow \frac{V_1}{1 + 10^{-4} s} \rightarrow V_1 = (-10^{-1} s - 2 \times 10^{-3}) I_1$$

$$KCL : \frac{V_- - V_o}{1000} + \frac{V_-}{2000} = 0 \rightarrow \frac{V_-}{1000} + \frac{V_-}{2000} = \frac{V_o}{1000} \rightarrow V_o = 6 V_-$$

$$V_2 - 2000 I_2 \Rightarrow V_o = -12000 I_1 \rightarrow V_2 = 2000 I_2 - 12000 I_1$$

$$\frac{V_{out}}{V_s} = \frac{2}{1 + 1050 Cs} \rightarrow \frac{2}{1 + 1.05 \times 10^{-4} s}$$

$$V_+ = \frac{\frac{1}{Cs} V_s}{\frac{1}{Cs} + 1050} = \frac{V_s}{1 + 1050 Cs}$$

$$\frac{V_s}{1 + 1050 Cs} + \frac{V_s}{1 + 1050 Cs} - \frac{V_o}{1000} = 0 \Rightarrow$$

$$V_o = \frac{6 V_s}{1 + 1050 Cs} ; \frac{V_{out} - V_o}{2000} + \frac{V_{out}}{1000} = 0 \rightarrow$$

$$\frac{V_{out}}{2000} + \frac{V_{out} - V_o}{1000} = \frac{V_o}{2000} \rightarrow \frac{3 V_{out}}{2000} = \frac{V_o}{2000} \rightarrow 3 V_{out} = V_o$$

Editor - C:\Users\Asus\Documents\Project-Phase 1\Q4\Untitled4.m

```

1 face = [2]
2
3 denominator = [1.050*10^(-4) 1]
4
5 find = tf(face,denominator)
6 bode(find),grid
7

```

Command Window

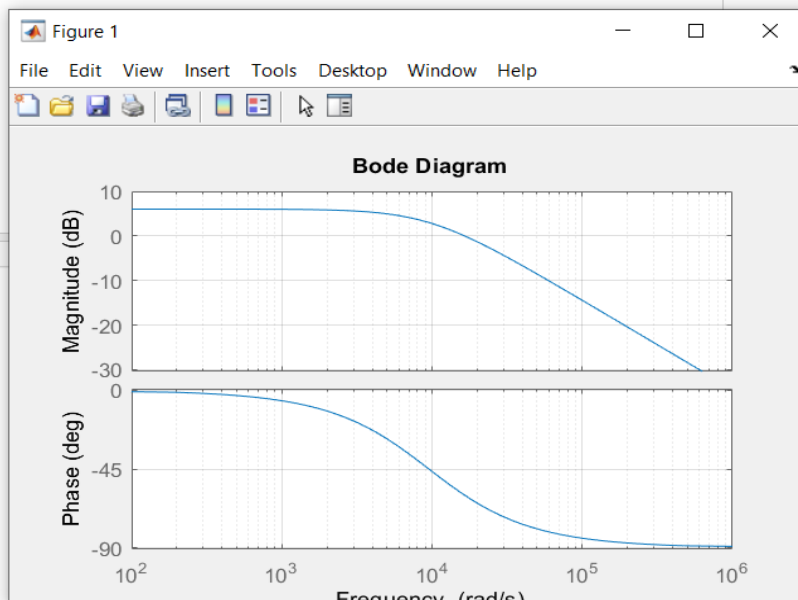
```

2
denominator =
    0.0001    1.0000
find =
    2
-----
0.000105 s + 1

```

Continuous-time transfer function.

fx >>



منبع برای حل این سوال: <https://youtu.be/-HMhKVZ0EtQ>