Corso di Laurea in Ingegneria Elettronica, Informatica e delle Telecomunicazioni
a.a. 2001/2002

Elettrotecnica A

29/11/2001

Esercizio 1 [3 punti]

Determinare l'andamento nel tempo della corrente ai capi della capacità (i_c) in Figura 1.

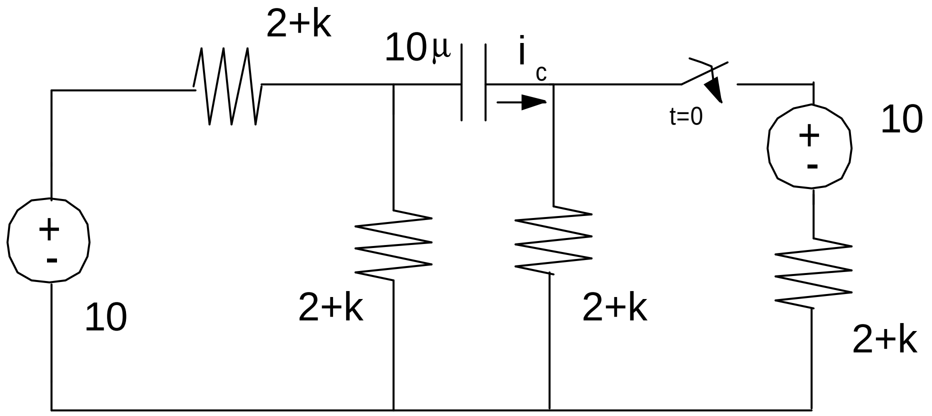


Figura 1

K	Ic(t)
0	$-2.5\ e^{-50000\ t}$
1	$-1.66667\ e^{-33333\ t}$
2	$-1.25\ e^{-25000\ t}$
3	$-1\ e^{-20000\ t}$
4	$-0.83333\ e^{-16666\ t}$
5	$-0.714286\ e^{-14285\ t}$
6	$-0.625\ e^{-12500\ t}$
7	$-0.55556\ e^{-11111\ t}$
8	$-0.5\ e^{-10000\ t}$
9	$-0.454545\ e^{-9090\ t}$

Esercizio 2 [4 punti]

Con riferimento al circuito in figura 2, determinare i valori di L ed R corrispondenti all'andamento di corrente sull'induttanza (i_L) riportato graficamente in figura 3.

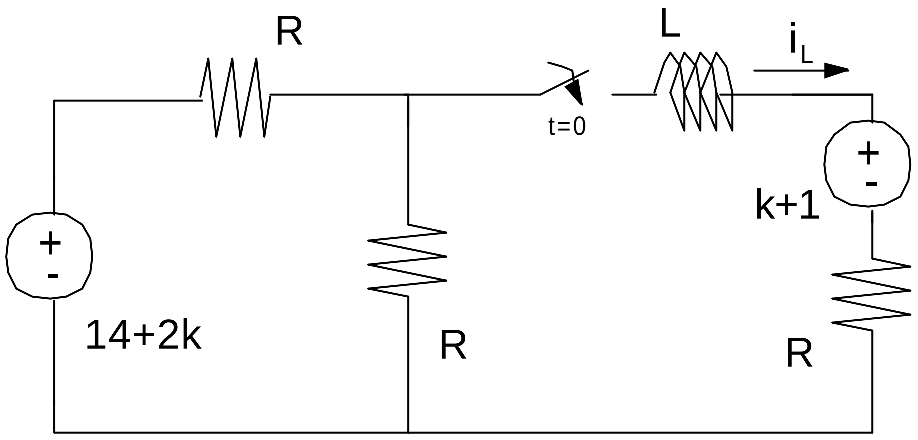


Figura 2

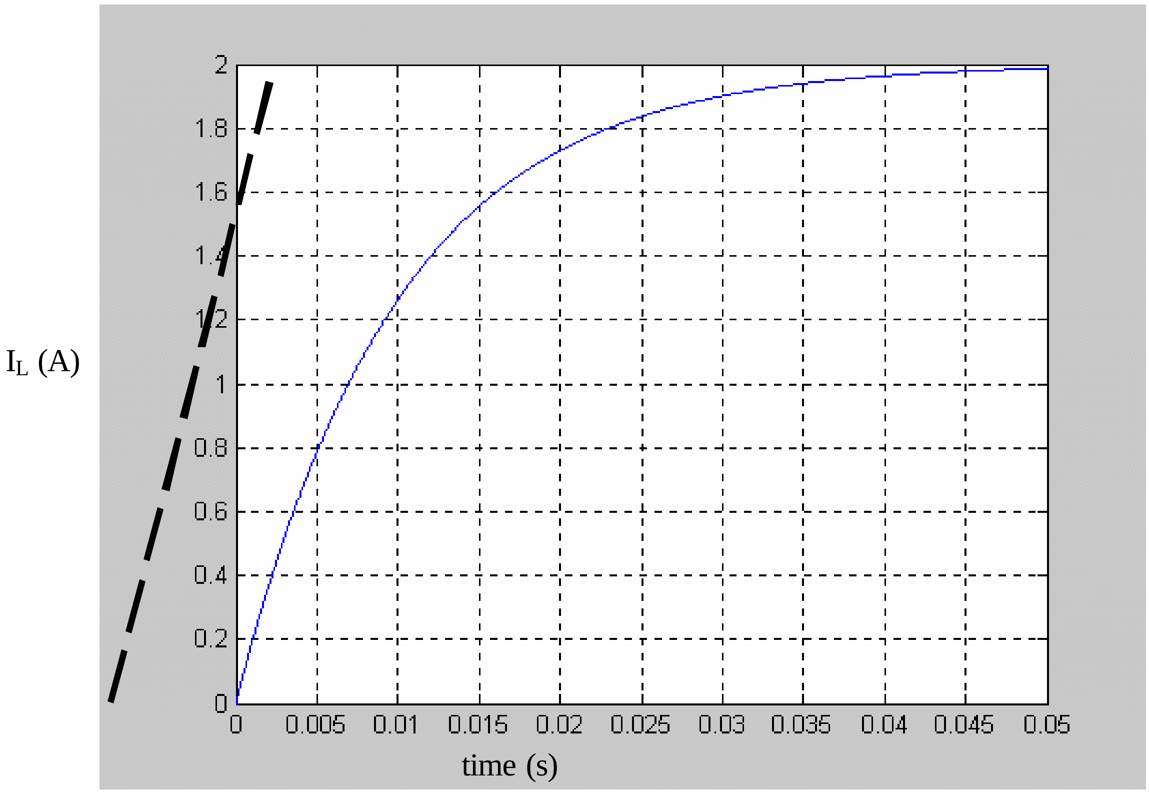


Figura 3

∀k

R = 2 W
L = 30 mH

Esercizio 3 [3 punti]

Con riferimento alla figura 4 determinare i valori delle condizioni iniziali e finali della tensione e della corrente sull’induttore, della tensione e della corrente sul condensatore.

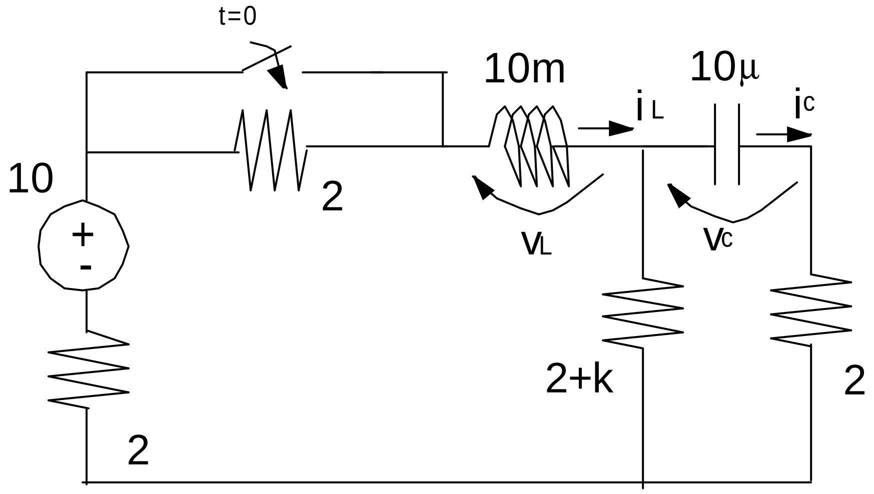


Figura 4

1.250000, 1.250000, 1.666667
1.111111, 1.111111, 1.428571

K=0	**0-**	**0+**	**8**
i_L	1.66667	1.66667	2.5
v_C	-2.5	-2.5	5
i_C	0	0	0
v_L	0	-3.333	0
K=1	**0-**	**0+**	**8**
i_L	1.428571	1.428571	2.0
v_C	-1.666667	-1.666667	6.000000
i_C	0.000000	0.000000	0.000000
v_L	0.000000	-2.857143	0.000000
K=2	**0-**	**0+**	**8**
i_L	1.25	1.25	1.6667
v_C	-1.250000	-1.250000	6.666667
i_C	0.000000	0.000000	0.000000
v_L	0.000000	-2.500000	0.000000
K=3	**0-**	**0+**	**8**
i_L	1.11111	1.11111	1.428571
v_C	-1.000000	-1.000000	7.142857
i_C	0.000000	0.000000	0.000000
v_L	0.000000	-2.222222	0.000000
K=4	**0-**	**0+**	**8**
i_L	1.0	1.0	1.25
v_C	-0.833333	-0.833333	7.500000
i_C	0.000000	0.000000	0.000000
v_L	0.000000	-2.000000	0.000000
K=5	**0-**	**0+**	**8**
i_L	0.909091	0.909091	1.111111
v_C	-0.714286	-0.714286	7.777778
i_C	0.000000	0.000000	0.000000
v_L	0.000000	-1.818182	0.000000

K=6	**0-**	**0+**	**8**
i_L	0.833333	0.833333	1.0
v_C	-0.625000	-0.625000	8.000000
i_C	0.000000	0.000000	0.000000
v_L	0.000000	-1.666667	0.000000
K=7	**0-**	**0+**	**8**
i_L	0.769231	0.769231	0.909091
v_C	-0.555556	-0.555556	8.181818
i_C	0.000000	0.000000	0.000000
v_L	0.000000	-1.538462	0.000000
K=8	**0-**	**0+**	**8**
i_L	0.714286	0.714286	0.833333
v_C	-0.500000	-0.500000	8.333333
i_C	0.000000	0.000000	0.000000
v_L	0.000000	-1.428571	0.000000
K=9	**0-**	**0+**	**8**
i_L	0.666667	0.666667	0.769231
v_C	-0.454545	-0.454545	8.461538
i_C	0.000000	0.000000	0.000000
v_L	0.000000	-1.333333	0.000000

Esercizio 4 [4 punti]

Con riferimento alla figura 5, calcolare la corrente $i_c(t)$ che attraversa la capacità C, e la relativa potenza reattiva, essendo i(t) = 10 cos (100 t), C = 10 mF, L = 20 mH, R = (1+k) O.

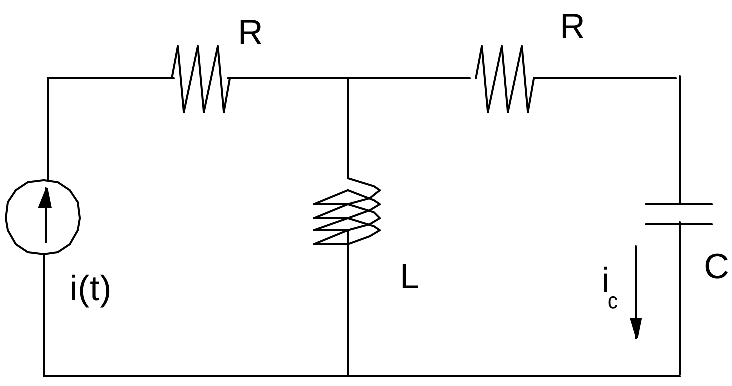


Figura 5

k	$\|I_c\|$	**f** $_I$	Q_c	$I_c(t)$ =
0	14.142136	0.785398	-100.000000	$\|I_c\|$ cos(100t+ f $_I$)
1	8.944272	1.107149	-40.000000	$\|I_c\|$ cos(100t+ f $_I$)
2	6.324555	1.249046	-20.000000	$\|I_c\|$ cos(100t+ f $_I$)
3	4.850713	1.325818	-11.764706	$\|I_c\|$ cos(100t+ f $_I$)
4	3.922323	1.373401	-7.692308	$\|I_c\|$ cos(100t+ f $_I$)
5	3.287980	1.405648	-5.405405	$\|I_c\|$ cos(100t+ f $_I$)

6	2.828427	1.428899	-4.000000	$\|I_c\| \cos(100t+ f_I)$
7	2.480695	1.446441	-3.076923	$\|I_c\| \cos(100t+ f_I)$
8	2.208631	1.460139	-2.439024	$\|I_c\| \cos(100t+ f_I)$
9	1.990074	1.471128	-1.980198	$\|I_c\| \cos(100t+ f_I)$

Esercizio 5 [4 punti]

Per trasmettere un segnale a 10 MHz si utilizza un doppino telefonico con sezione del singolo conduttore pari a 0.2 mm^2 e raggio della guaina r = 1.07 mm. I cavi sono lunghi L = (10+k) m. Si calcoli approssimativamente l'attenuazione di tensione V_u/V_i, trascurando la resistenza trasversale del doppino.

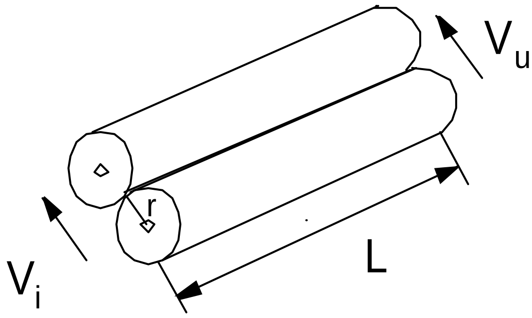


Figura 6

k	C(k+1)	L(k+1)	res(k+1)	XL(k+1)	Xc(k+1)	Vu/Vi
0	0.000000000129	0.000008574444	1.700000	538.748212	123.075862	0.296089
1	0.000000000142	0.000009431889	1.870000	592.623033	111.887148	0.232741
2	0.000000000155	0.000010289333	2.040000	646.497854	102.563219	0.188558
3	0.000000000168	0.000011146777	2.210000	700.372675	94.673740	0.156305
4	0.000000000181	0.000012004222	2.380000	754.247496	87.911330	0.131932
5	0.000000000194	0.000012861666	2.550000	808.122317	82.050575	0.113006
6	0.000000000207	0.000013719111	2.720000	861.997138	76.922414	0.097981
7	0.000000000220	0.000014576555	2.890000	915.871960	72.397566	0.085833
8	0.000000000233	0.000015433999	3.060000	969.746781	68.375479	0.075857
9	0.000000000246	0.000016291444	3.230000	1023.621602	64.776770	0.067557

$$\left|\frac{V_u}{V_i}\right| = \frac{X_c}{X_c - X_L}$$

Esercizio 6 [4 punti]

Con riferimento al circuito di figura 7 calcolare il guadagno di corrente I_u/I_i, dove R = 10 O, C $= \frac{1}{k+1}$ mF , L = 1 mH. Si tracci quindi il relativo diagramma di Bode.

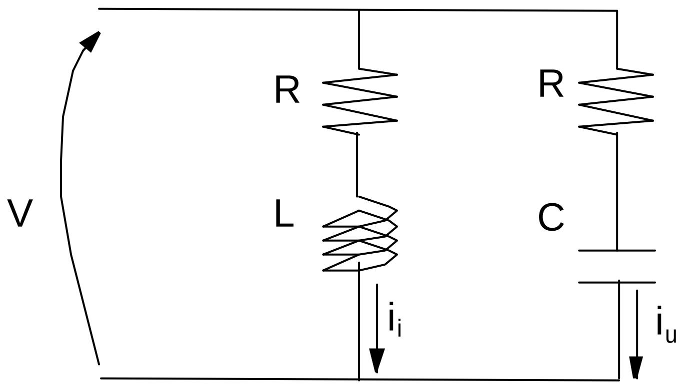
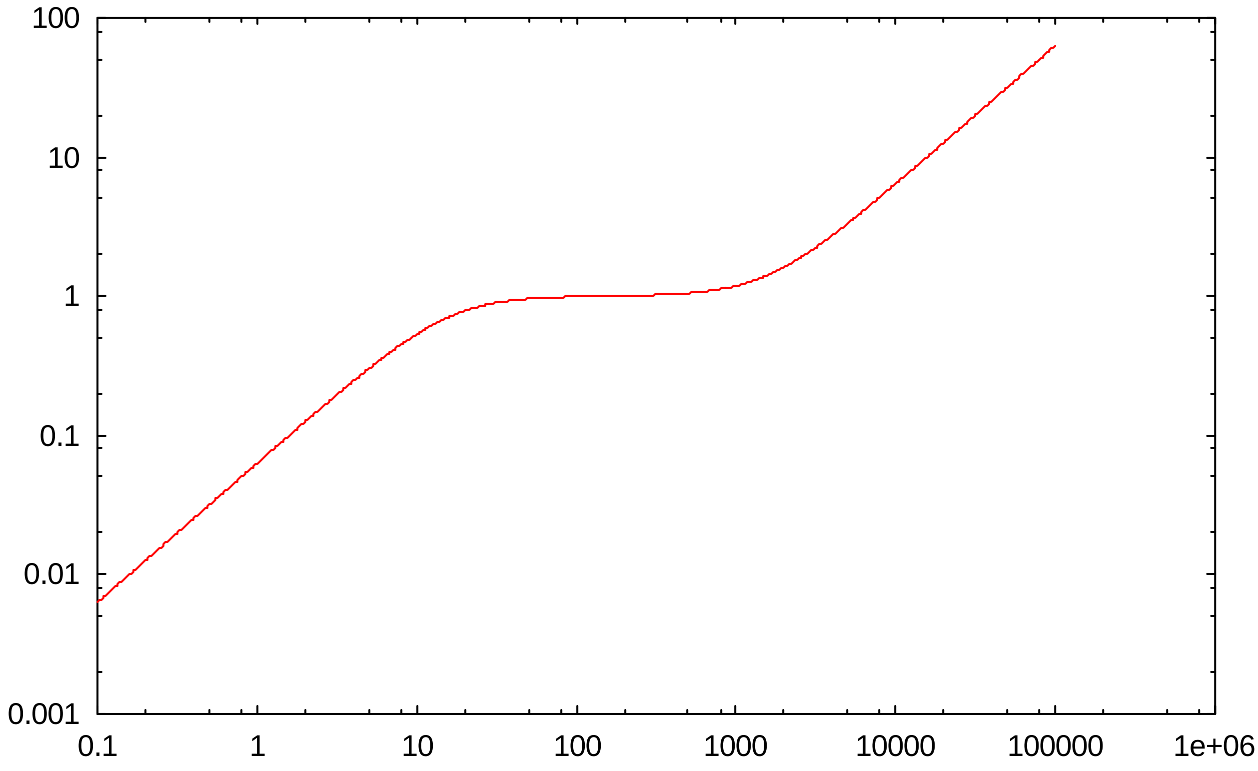


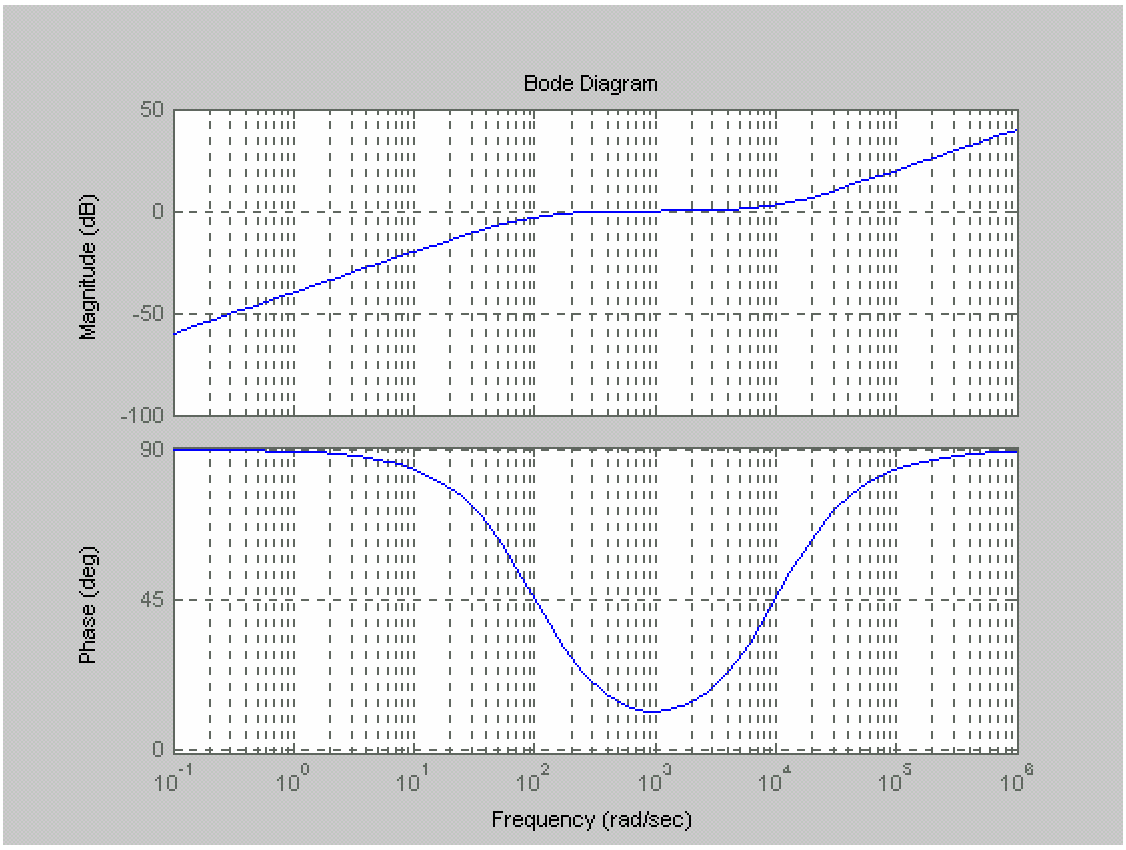
Figura 7

$$H(w) = G\frac{jw(1+\frac{jw}{z})}{1+\frac{jw}{p}}$$

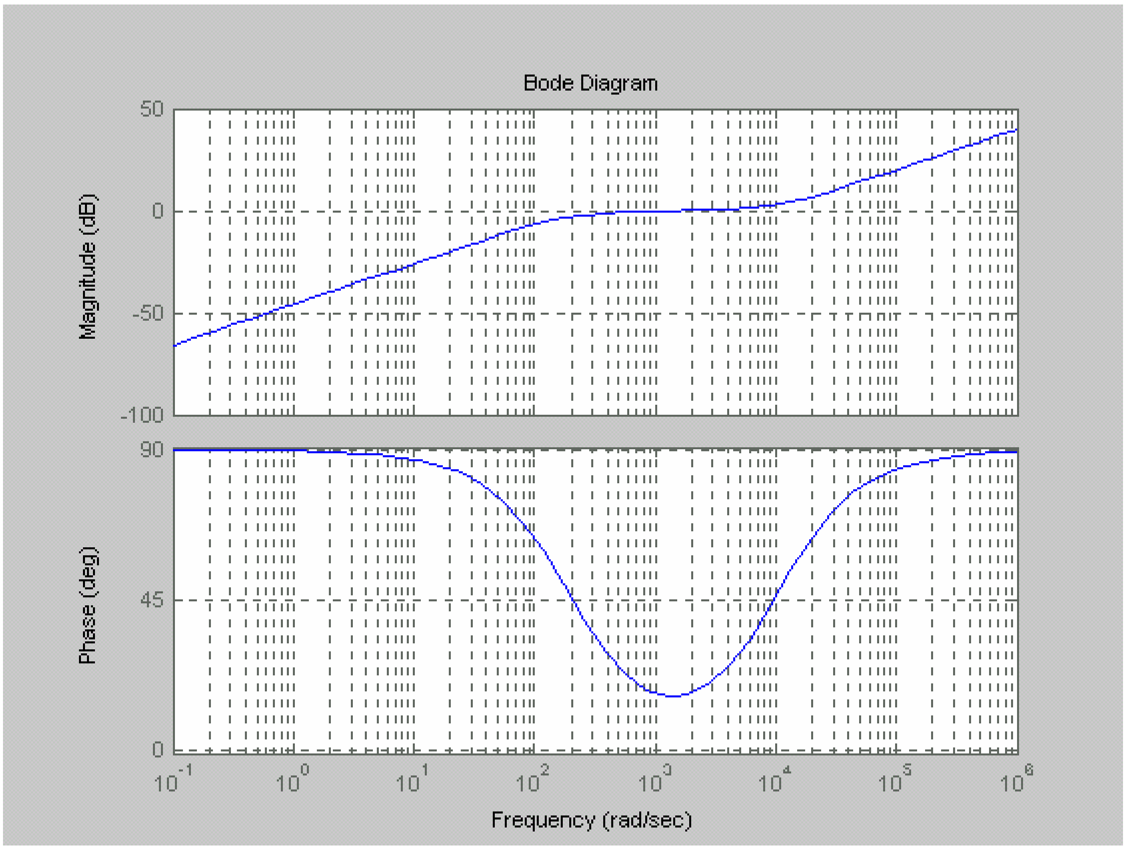
G = RC
Z = R/L
P = 1/(RC)

K = 0

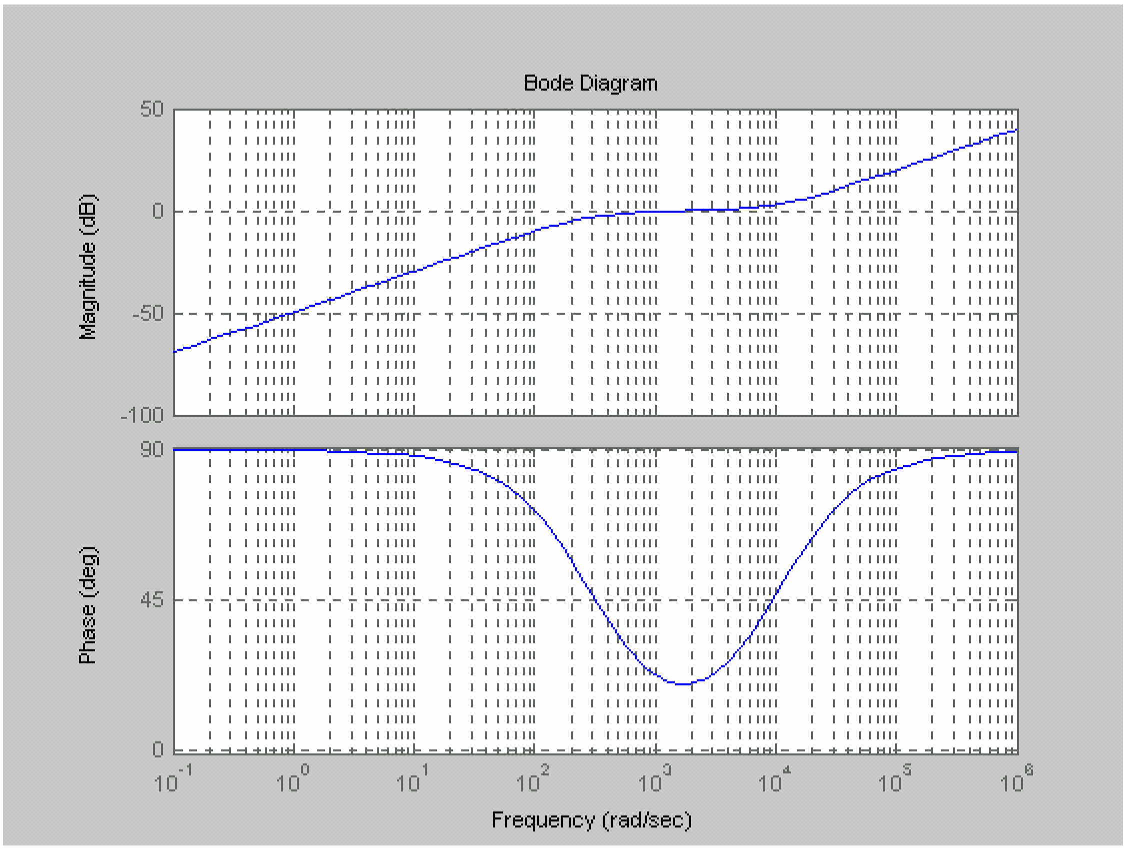



Bode Diagram
Magnitude (dB)
50
0
-50
-100
Phase (deg)
90
45
0
10^{-1}
10^{0}
10^{1}
10^{2}
10^{3}
10^{4}
10^{5}
10^{6}
Frequency (rad/sec)

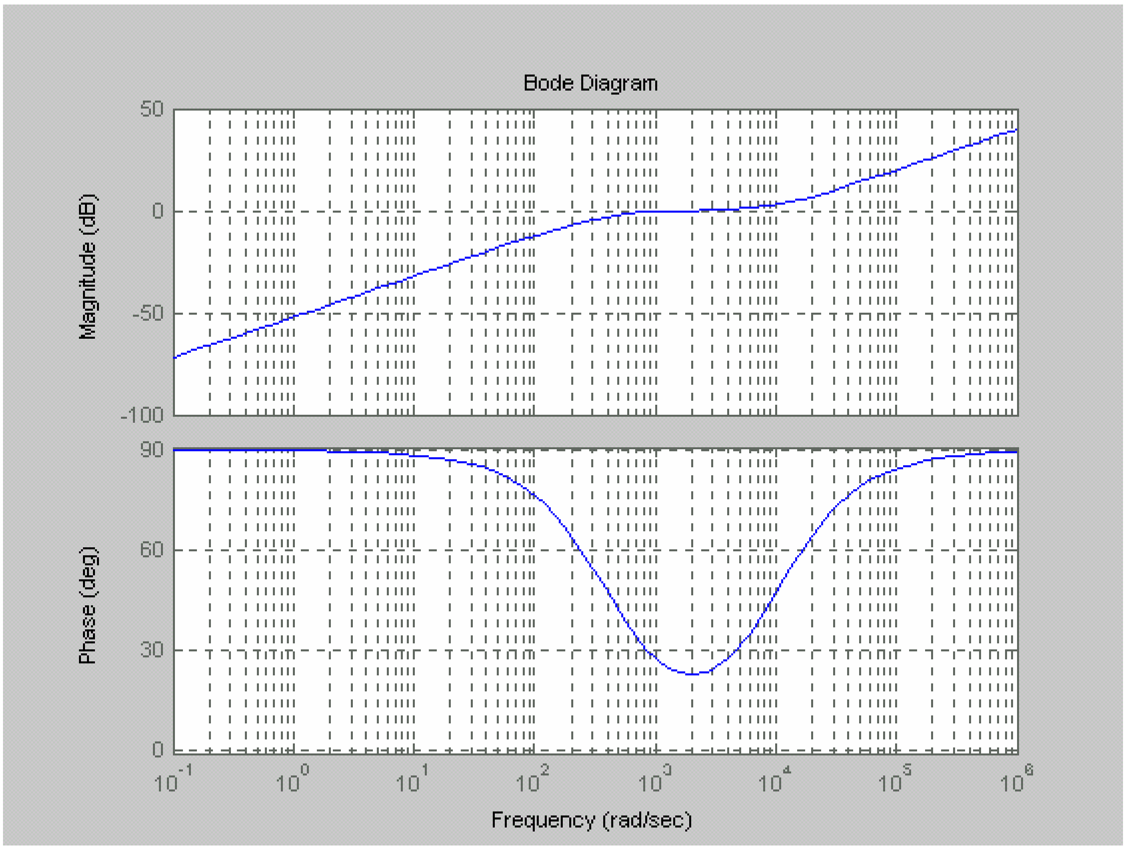
k=0


Bode Diagram
Magnitude (dB)
50
0
-50
-100
Phase (deg)
90
45
0
10^{-1}
10^{0}
10^{1}
10^{2}
10^{3}
10^{4}
10^{5}
10^{6}
Frequency (rad/sec)

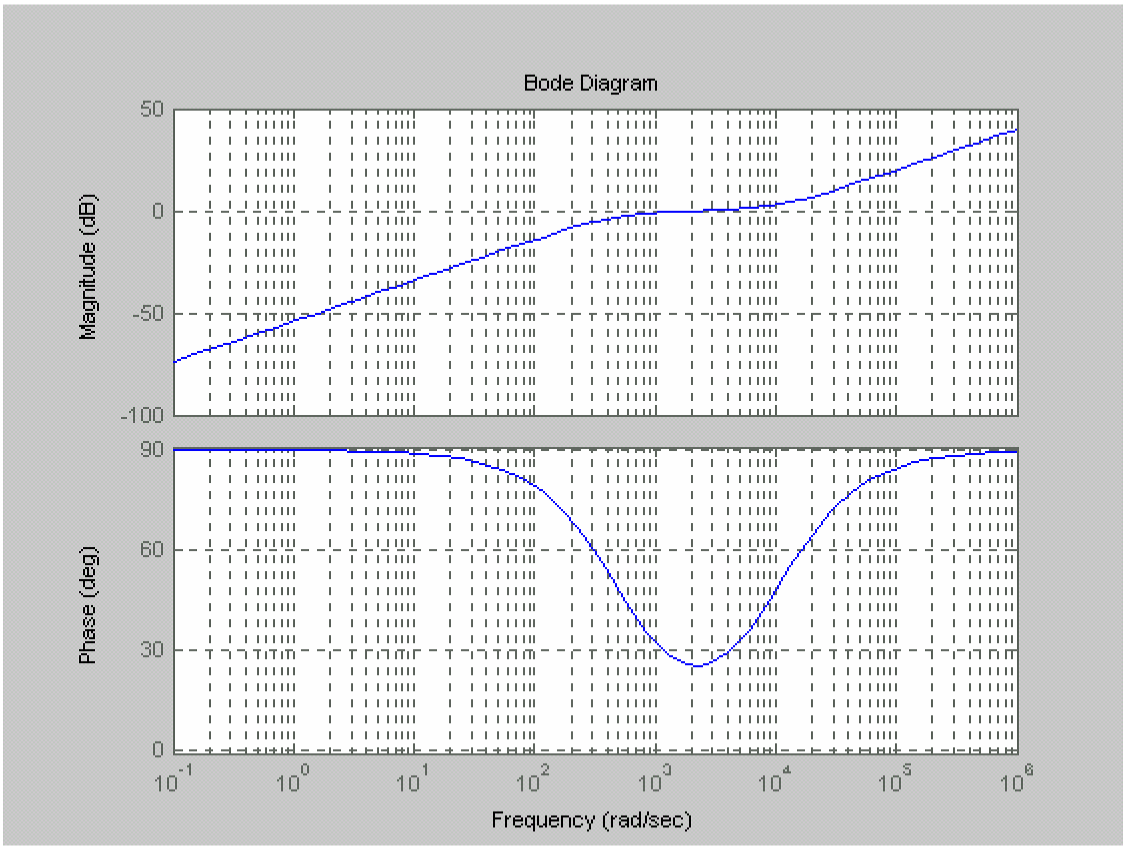
k=1


Bode Diagram
Magnitude (dB)
Phase (deg)
50
0
-50
-100
90
45
0
10^{-1} 10^{0} 10^{1} 10^{2} 10^{3} 10^{4} 10^{5} 10^{6}
Frequency (rad/sec)

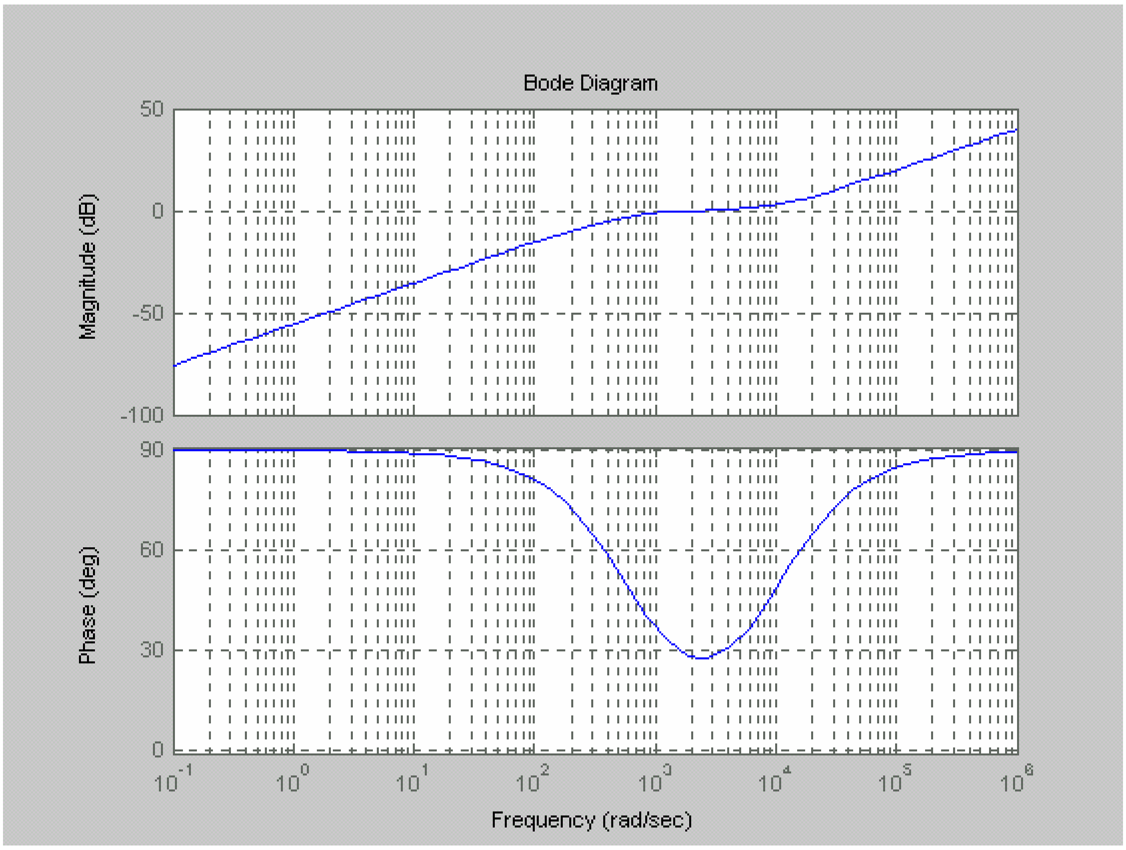
k=2


Bode Diagram
Magnitude (dB)
Phase (deg)
50
0
-50
-100
90
60
30
0
10^{-1} 10^{0} 10^{1} 10^{2} 10^{3} 10^{4} 10^{5} 10^{6}
Frequency (rad/sec)

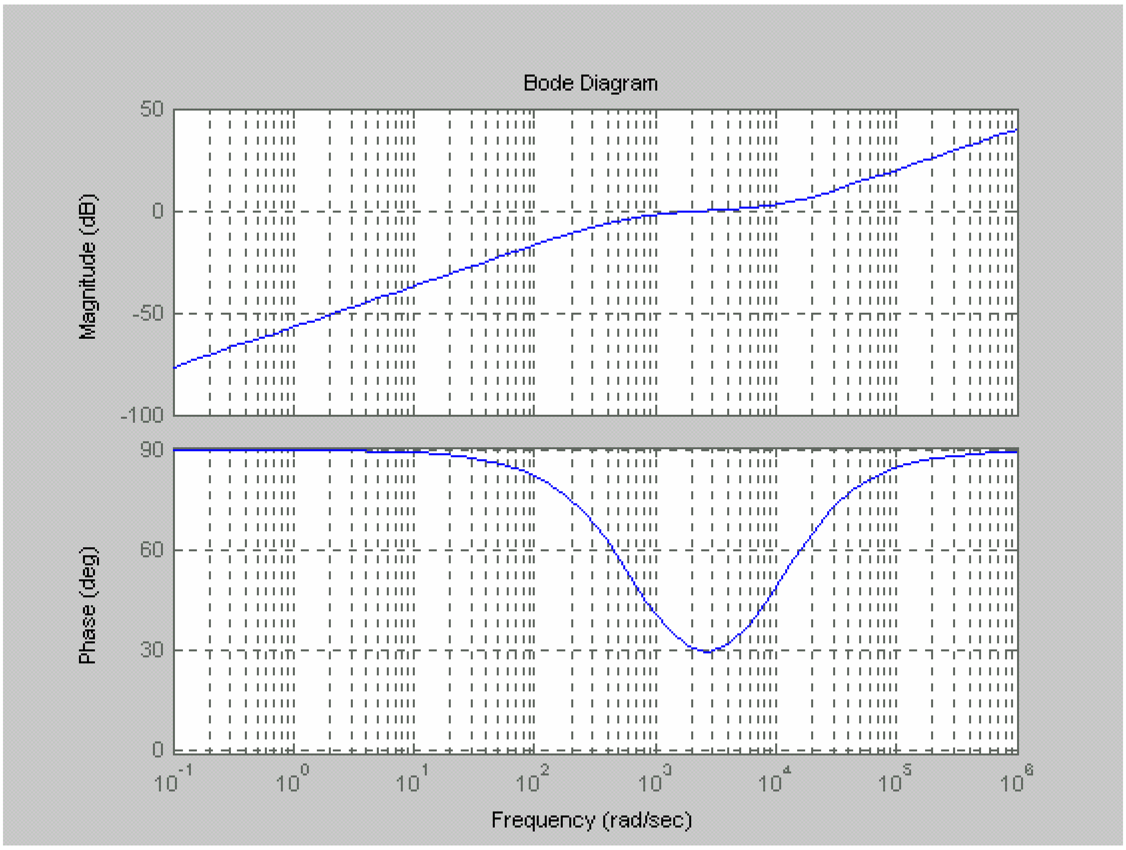
k=3


Bode Diagram
Magnitude (dB)
Phase (deg)
Frequency (rad/sec)

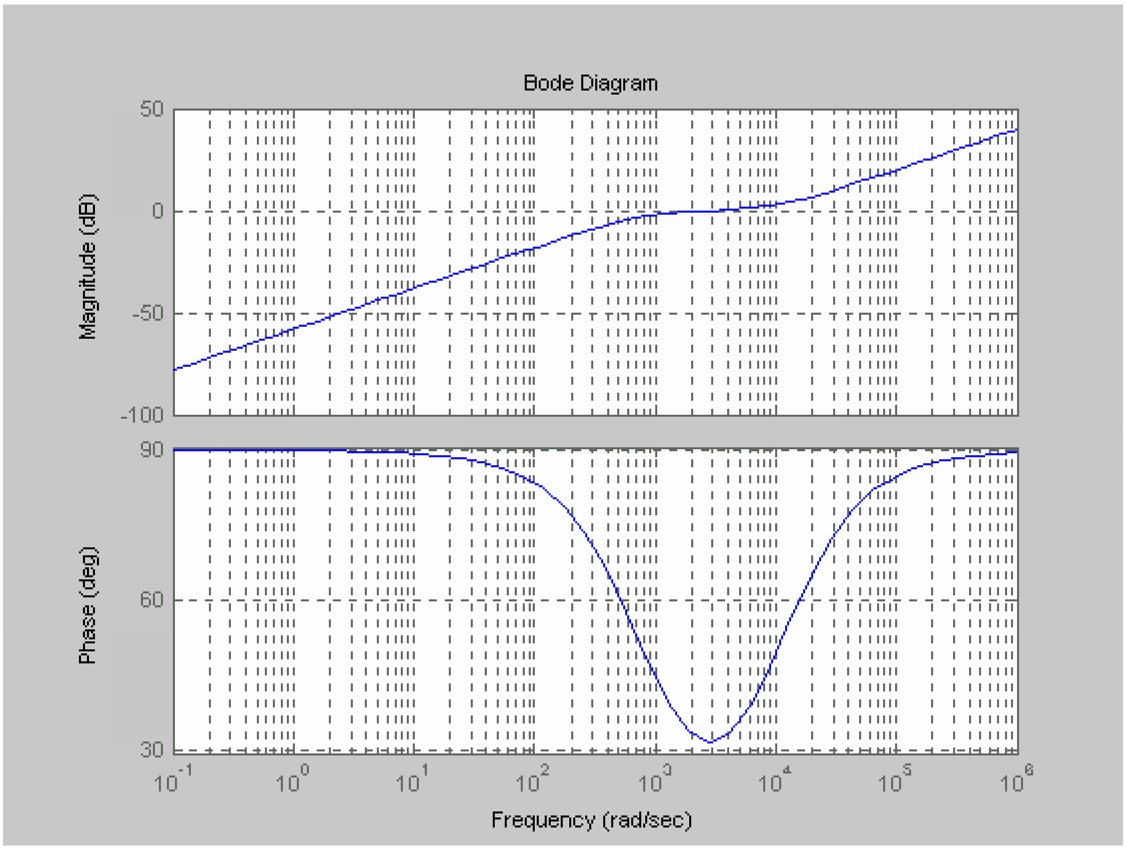
k=4


Bode Diagram
Magnitude (dB)
Phase (deg)
Frequency (rad/sec)

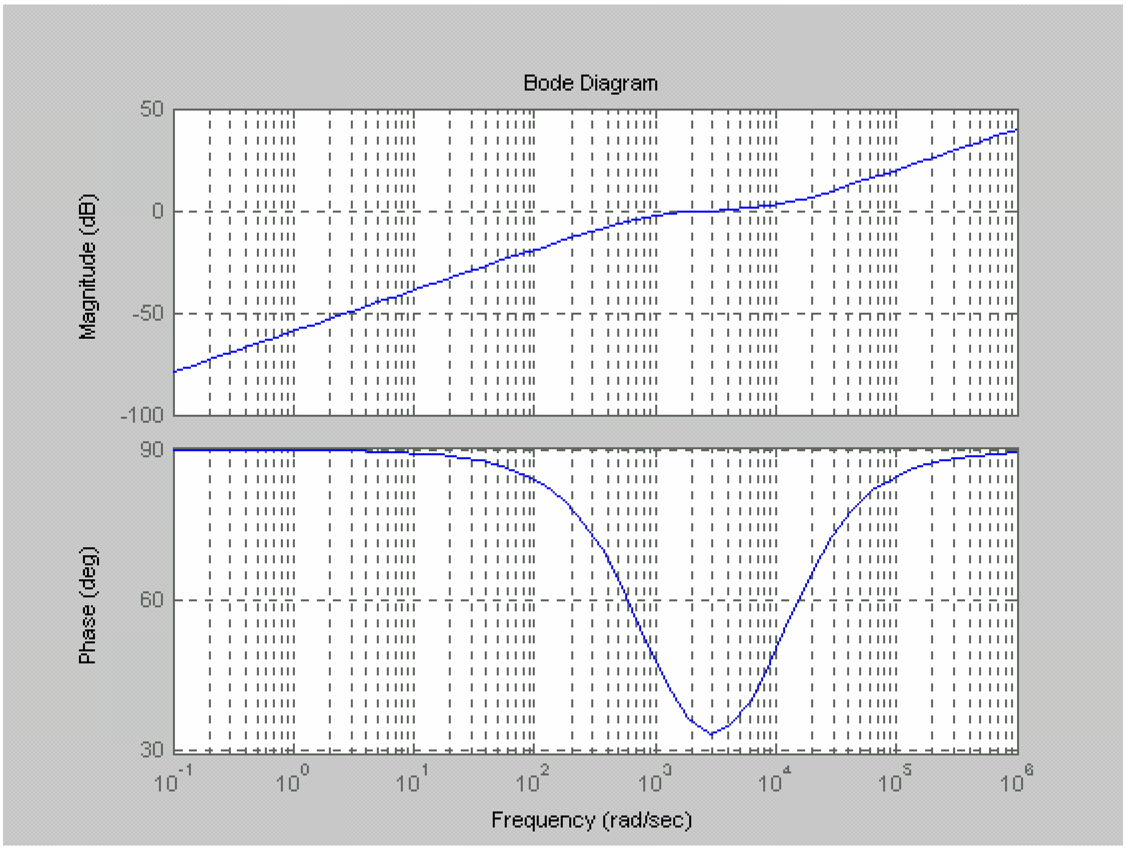
k=5


Bode Diagram
50
0
-50
-100
Magnitude (dB)
90
60
30
0
Phase (deg)
10^{-1}
10^{0}
10^{1}
10^{2}
10^{3}
10^{4}
10^{5}
10^{6}
Frequency (rad/sec)

k=6

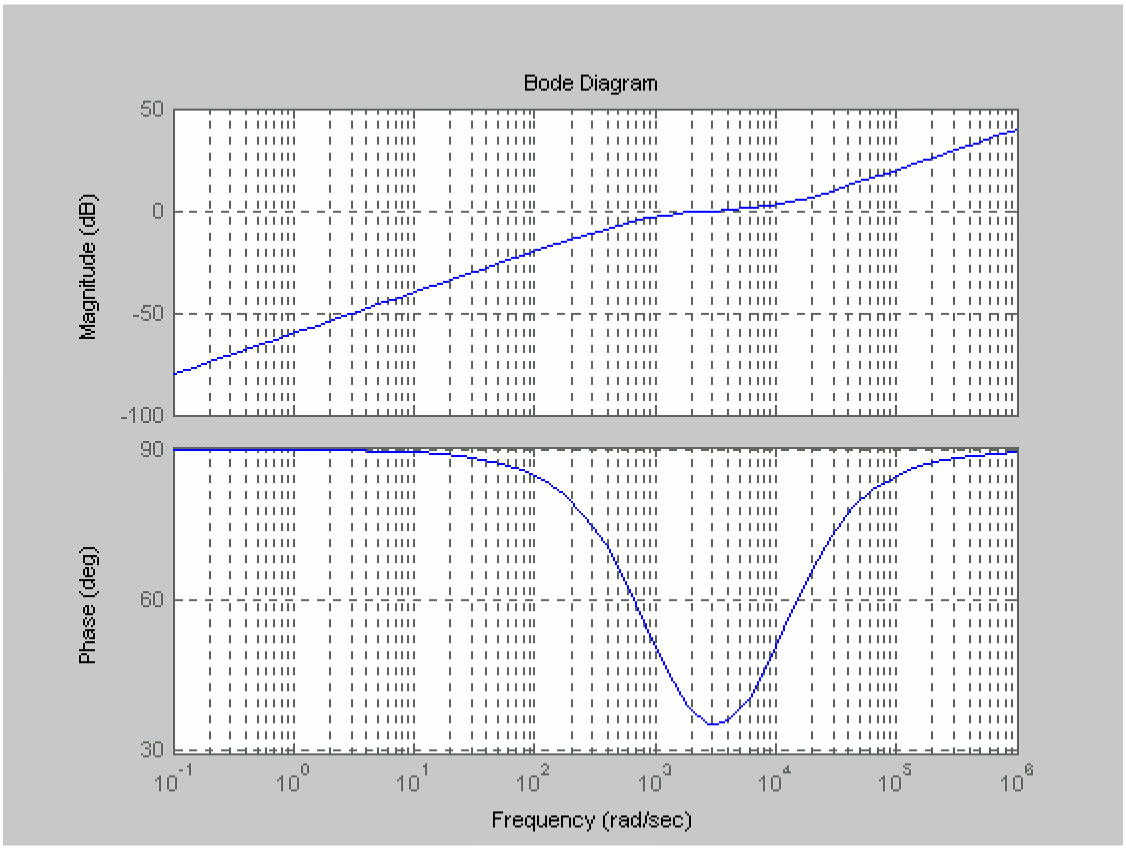

Bode Diagram
50
0
-50
-100
Magnitude (dB)
90
60
30
Phase (deg)
10^{-1}
10^{0}
10^{1}
10^{2}
10^{3}
10^{4}
10^{5}
10^{6}
Frequency (rad/sec)

k=7



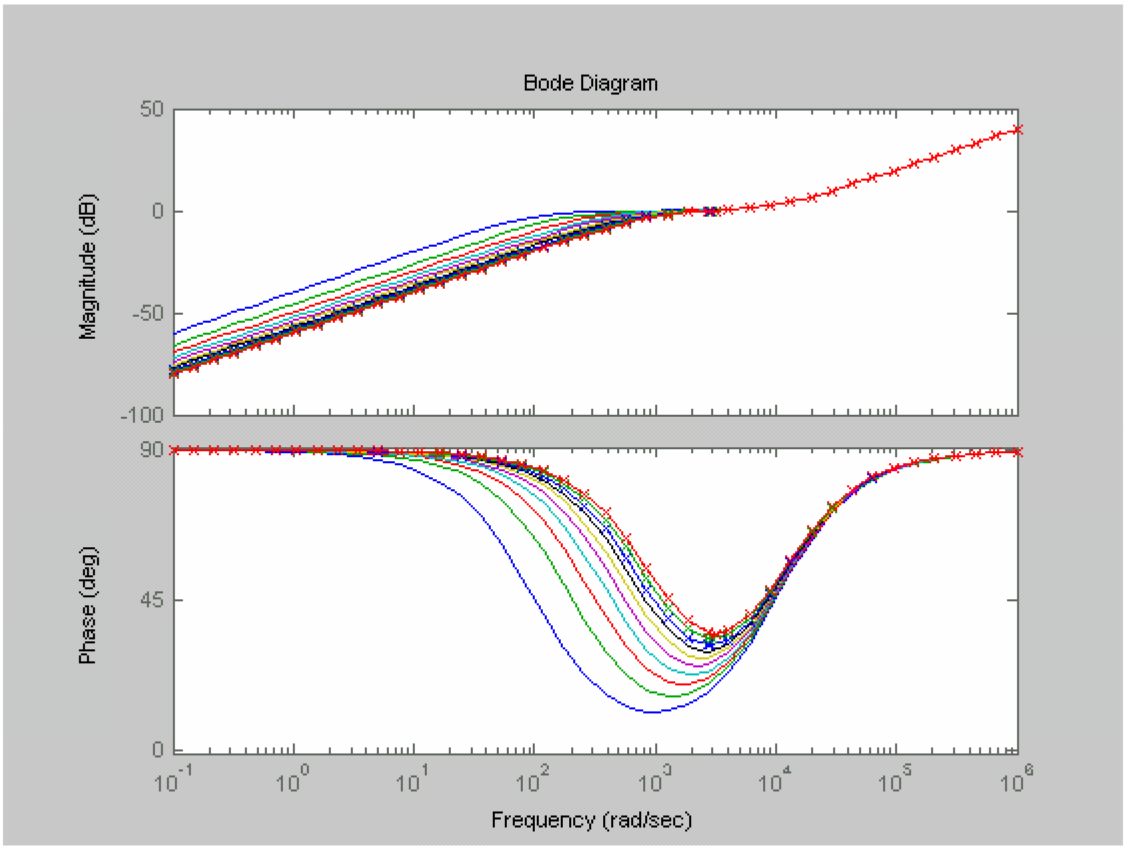
Bode Diagram
Magnitude (dB)
Phase (deg)
Frequency (rad/sec)

k=8



Bode Diagram
Magnitude (dB)
Phase (deg)
Frequency (rad/sec)

k=9


Bode Diagram
Magnitude (dB)
50
0
-50
-100
Phase (deg)
90
45
0
10^{-1}
10^{0}
10^{1}
10^{2}
10^{3}
10^{4}
10^{5}
10^{6}
Frequency (rad/sec)