# Ejercicios:

# ADS.1,ADS.2

# ADS.3, ADS.4

**Exámenes: Curso 2009-2010**

**Examen: 3 de Junio 2010**

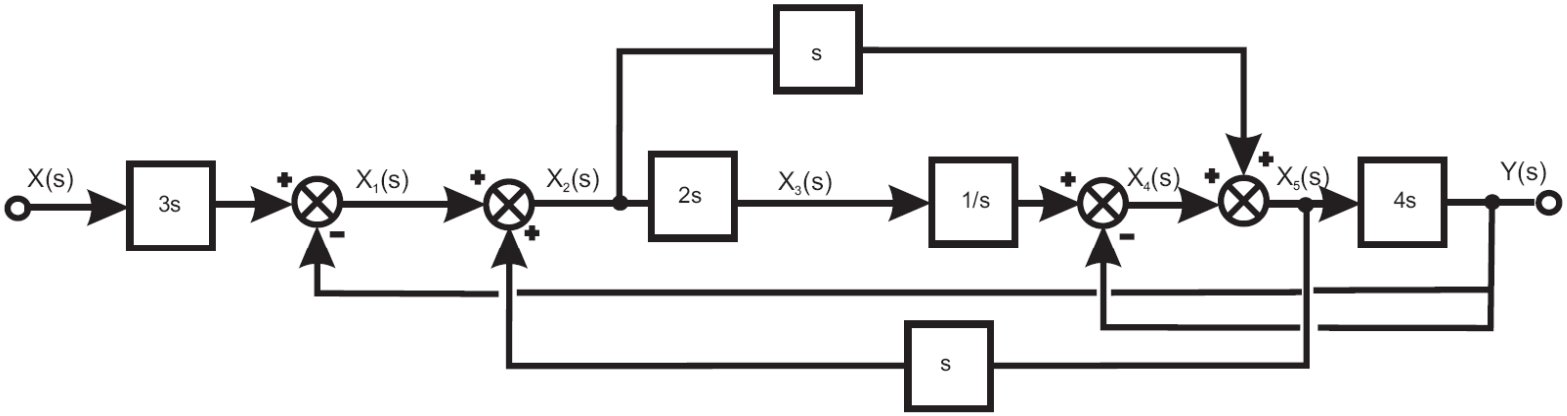
## ADS.1_TLC

Dado el sistema da la figura. Determinar:

a) La función de transferencia, $M(s) = Y(s) / X(s)$

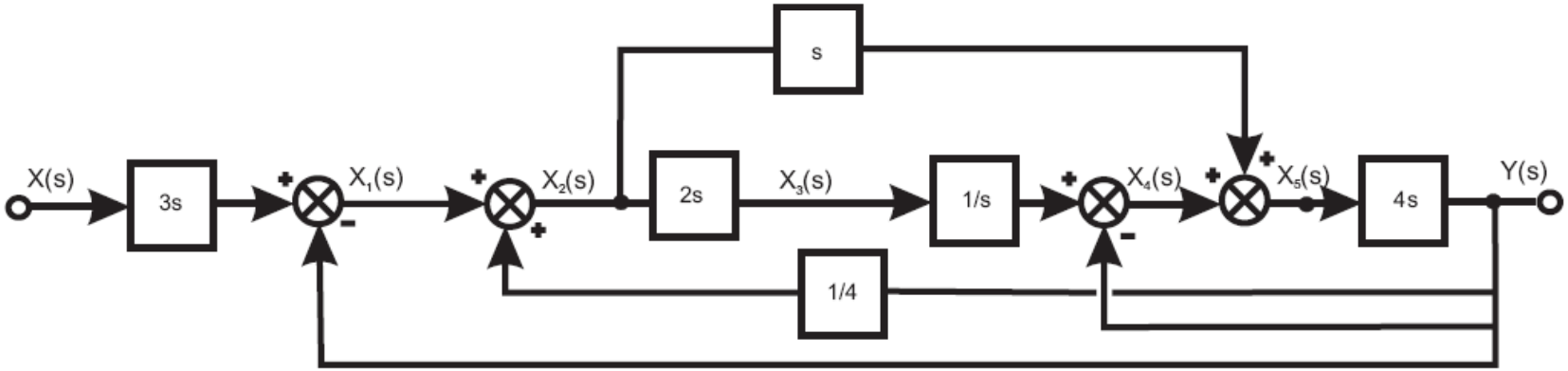
b) Respuesta $y(t)$ para una entrada $x(t) = t^2 /12$

d) Representar gráficamente la respuesta



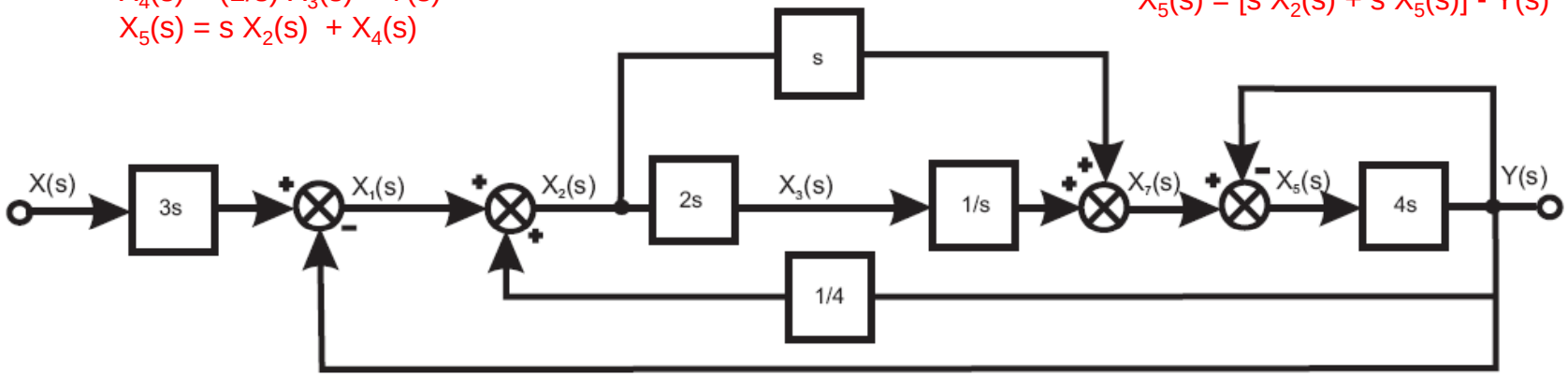
ADS.1_TLC

$Y(s) = 4s\, X_5(s)$ ; $X_5(s) = (1/4s)\, Y(s)$

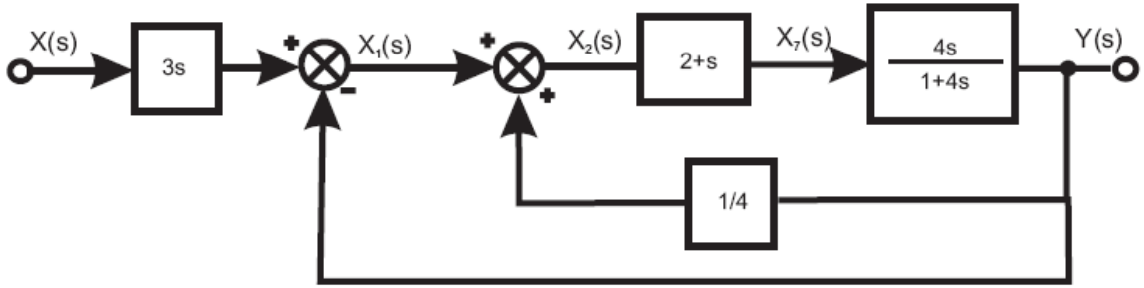


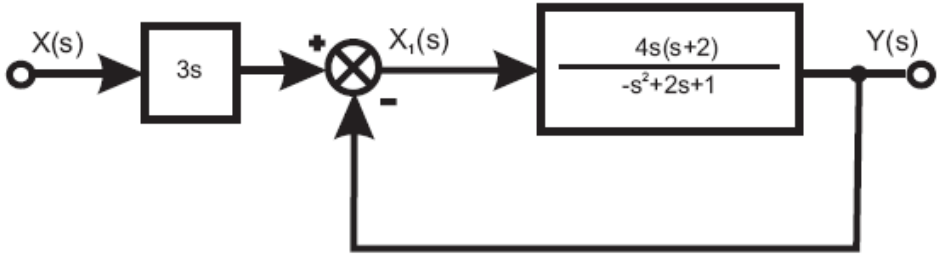

$X_4(s) = (1/s)\, X_3(s) - Y(s)$
$X_5(s) = s\, X_2(s) + X_4(s)$

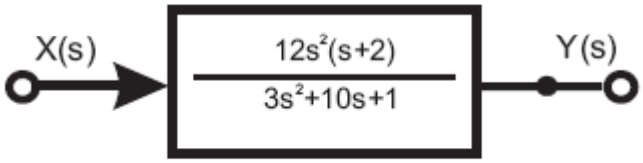
$X_5(s) = s\, X_2(s) + (1/s) X_3(s) - Y(s)$
$X_5(s) = [s\, X_2(s) + s\, X_5(s)] - Y(s)$



ADS.1_TLC


X(s)
3s
X1(s)
X2(s)
2+s
X7(s)
4s
1+4s
Y(s)
1/4


X(s)
3s
X1(s)
4s(s+2)
-s2+2s+1
Y(s)


X(s)
12s2(s+2)
3s2+10s+1
Y(s)

## ADS.1_TLC

```
% Respuesta del sistema

numr=[2 4];
denr=[3 10 1 0];
[r,p,k]=residue(numr,denr);
```

```
r =

   -0.0812
   -3.9188
    4.0000
```

```
p =

   -3.2301
   -0.1032
         0
```

La respuesta del sistema ante $x(t) = (t^2)/12$, viene dada como sigue.
$X(s) = 1/6s^3$ .

**$Y(s) = [2s+4] / [ 3s^3 + 10s^2 + s ]$**

**$Y(s) = [( -0,0812) / ( s+3,2301)] + [( -3,9188) / (( s+0,1032) ] + [ 4 / s ]$**

$y(t) = -0,0812\, e^{-3,2301t} - 3,9188\, e^{-0,1032t} + 4$

Antitransformadas:

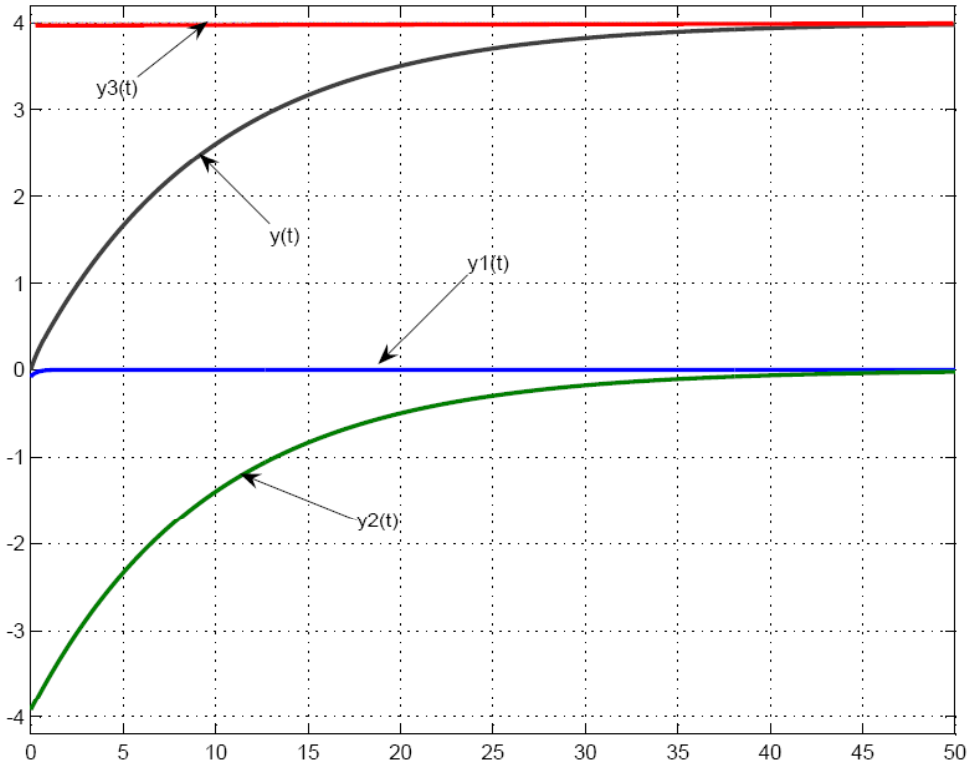
$£^{-1}[(1/s)] = 1;$

$£^{-1}[ 1 / (s+3,2301)] = e^{-3,2301t}$

$£^{-1}[ 1 / (s+0,1032)] = e^{-0,1032t}$

## ADS.1_TLC

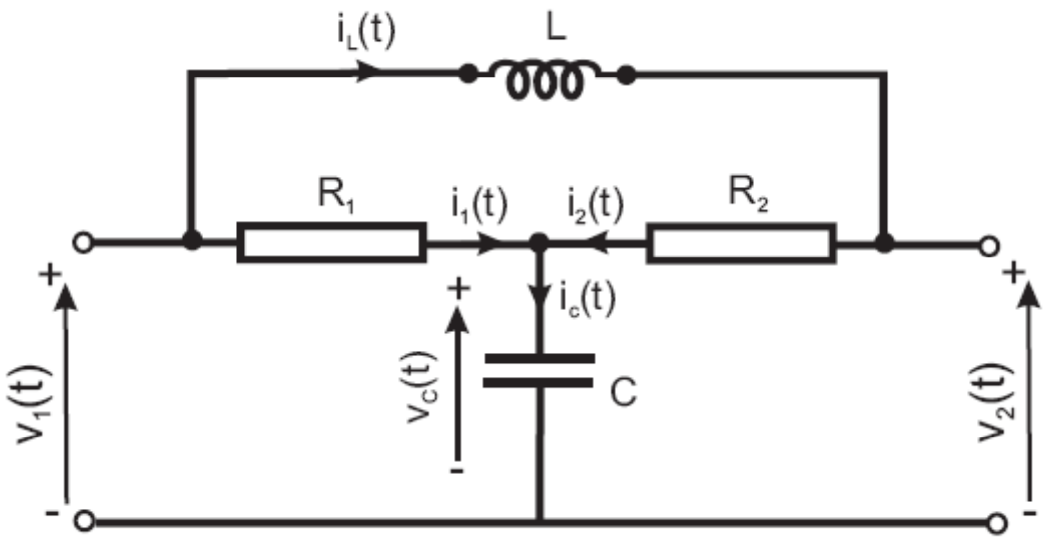
```
% respuesta analítica%
t=0:0.1:50;
y1=-0.0812.*(exp(-(3.2301.*t)));
y2=-3.9188.*(exp(-(0.1032.*t)));
y3=4;

y=y1+y2+y3;

% Representamos gráficamente x(t)

plot(t,y1,t,y2,t,y3,t,y);
```



ADS.2_TLC

En sistema de la figura se tomará como entradas $v_1(t)$ y $v_2(t)$. Como variables de estado $x_1(t) = i_L(t)$ y $x_2(t) = v_C(t)$

Como salida $y(t) = v_{R1}(t)$ ( caída de tensión en la resistencia $R_1$ )



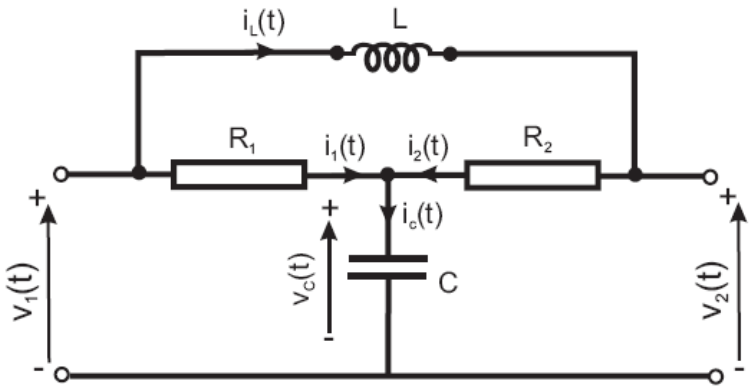
# Análisis Dinámico de Sistemas

## ADS.2_TLC

Tomando como variables de estado:

$x_1(t) = i_L(t)$; $x_2(t) = v_c(t)$;
como entradas y salida;

$v_1(t)$ y $v_2(t)$; $y(t) = v_{R1}(t)$




Ecuaciones de mallas y nudo:

$i_C(t) = i_1(t) + i_2(t)$;
$v_1(t) - v_L(t) - v_2(t) = 0$ ; $v_1(t) - v_2(t) = L\, di_L(t)/dt$

$L\, di_L(t)/dt = L\, dx_1(t)/dt$

$v_1(t) - v_C(t) = R_1\, i_1(t)$ ; $i_1(t) = (1/R_1)\,(v_1(t) - v_C(t))$
$v_2(t) - v_C(t) = R_2\, i_2(t)$ ; $i_2(t) = (1/R_2)\,(v_2(t) - v_C(t))$

$i_C(t) = (1/R_1)\,(v_1(t) - v_C(t)) + (1/R_2)\,(v_2(t) - v_C(t))$

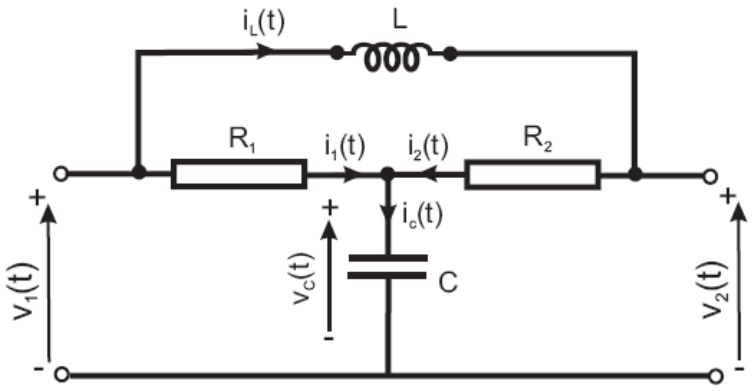
Ecuaciones de los componentes:

$v_c(t) = (1/C_1) \int i(t)\, dt$;
$v_L(t) = L_1\,(\, di_L(t) / dt\,)$;
$v_{R1}(t) = R_1\, i_1(t)$; $v_{R2}(t) = R_2\, i_2(t)$

$i_C(t) = C\,(\, dv_C(t) / dt\,)$

## ADS.2_TLC

Las ecuaciones de estado son:




$$dx_1(t)/dt = (1/L)\ (\ v_1(t) - v_2(t)\ )$$

$$dx_2(t)\ /\ dt = -\ \frac{R_1 + R_2}{CR_1R_2} + \frac{v_1(t)}{C\ R_1} + \frac{v_2(t)}{C\ R_2}$$

$$\begin{bmatrix} dx_1(t)/dt \\ dx_2(t)/dt \end{bmatrix} = \begin{bmatrix} 0 & 0 \\ 0 & -\dfrac{R_1+R_2}{CR_1R_2} \end{bmatrix} \begin{bmatrix} x_1(t) \\ x_2(t) \end{bmatrix} + \begin{bmatrix} 1/L & -1/L \\ \dfrac{1}{C\ R_1} & \dfrac{1}{C\ R_2} \end{bmatrix} \begin{bmatrix} v_1(t) \\ v_2(t) \end{bmatrix}$$

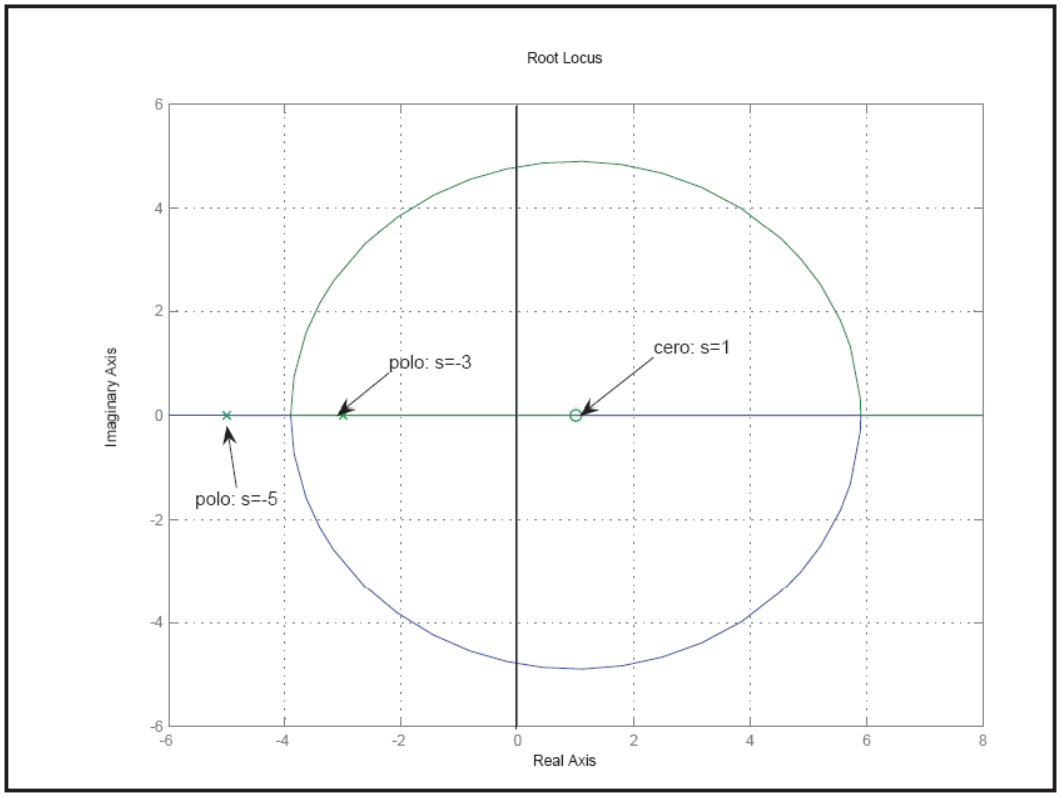
$$\begin{bmatrix} y(t) \end{bmatrix} = \begin{bmatrix} 0 & -1 \end{bmatrix} \begin{bmatrix} x_1(t) \\ x_2(t) \end{bmatrix} + \begin{bmatrix} 1 & 0 \end{bmatrix} \begin{bmatrix} v_1(t) \\ v_2(t) \end{bmatrix}$$

## ADS.3_TLC

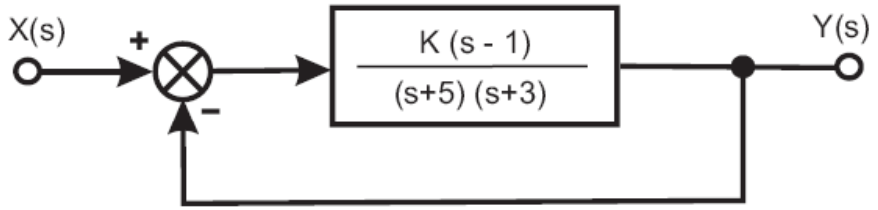
De un sistema con realimentación unitaria se conoce su lugar de las raíces directo e inverso. ( Ver figura ).

a) Determinar el valor K para que el sistema tenga una respuesta oscilatoria.

b) Hallar la respuesta que nos daría para una entrada impulso unitario.



ADS.3_TLC




$$M(s) = \frac{K\,(s-1)}{(s+5)\,(s+3) + K\,(s-1)}$$

$$M(s) = \frac{K\,(s-1)}{s^2 + (8+K)\,s + 15 - K}$$

| | | |
|---|---|---|
| $s^2$ | 1 | 15 - K |
| $s^1$ | 8 + K | 0 |
| $s^0$ | 15 - K | 0 |

$8 + K = 0;\ K = -8$

$s^2 + 15 - K = 0\ ;$

$s^2 + 15 + 8 = 0\ ;$

$s^2 + 23 = 0;\ \ s = (-23)^{1/2}$

$$M(s) = \frac{-8\,(s-1)}{s^2 + 23}$$

$$Y(s) = \frac{-8\,s}{s^2 + 23} + \frac{8}{s^2 + 23}$$

$y(t) = -8\,[\,\cos(4{,}8t) - 0{,}2\ \mathrm{sen}(4{,}8t)\,]$

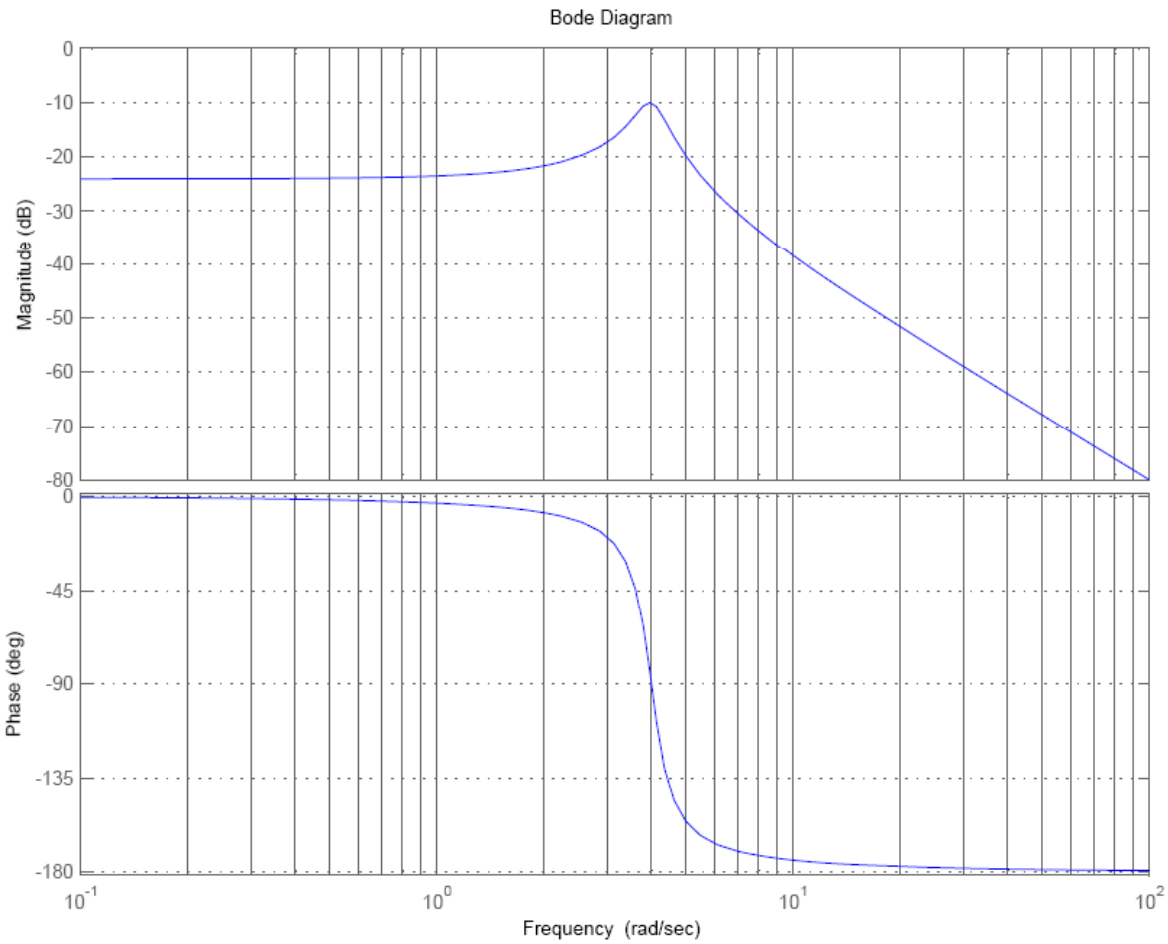
$y(t) = 8{,}17\ \ \mathrm{sen}(4{,}8t - 0{,}68)$

## ADS.4_TLC

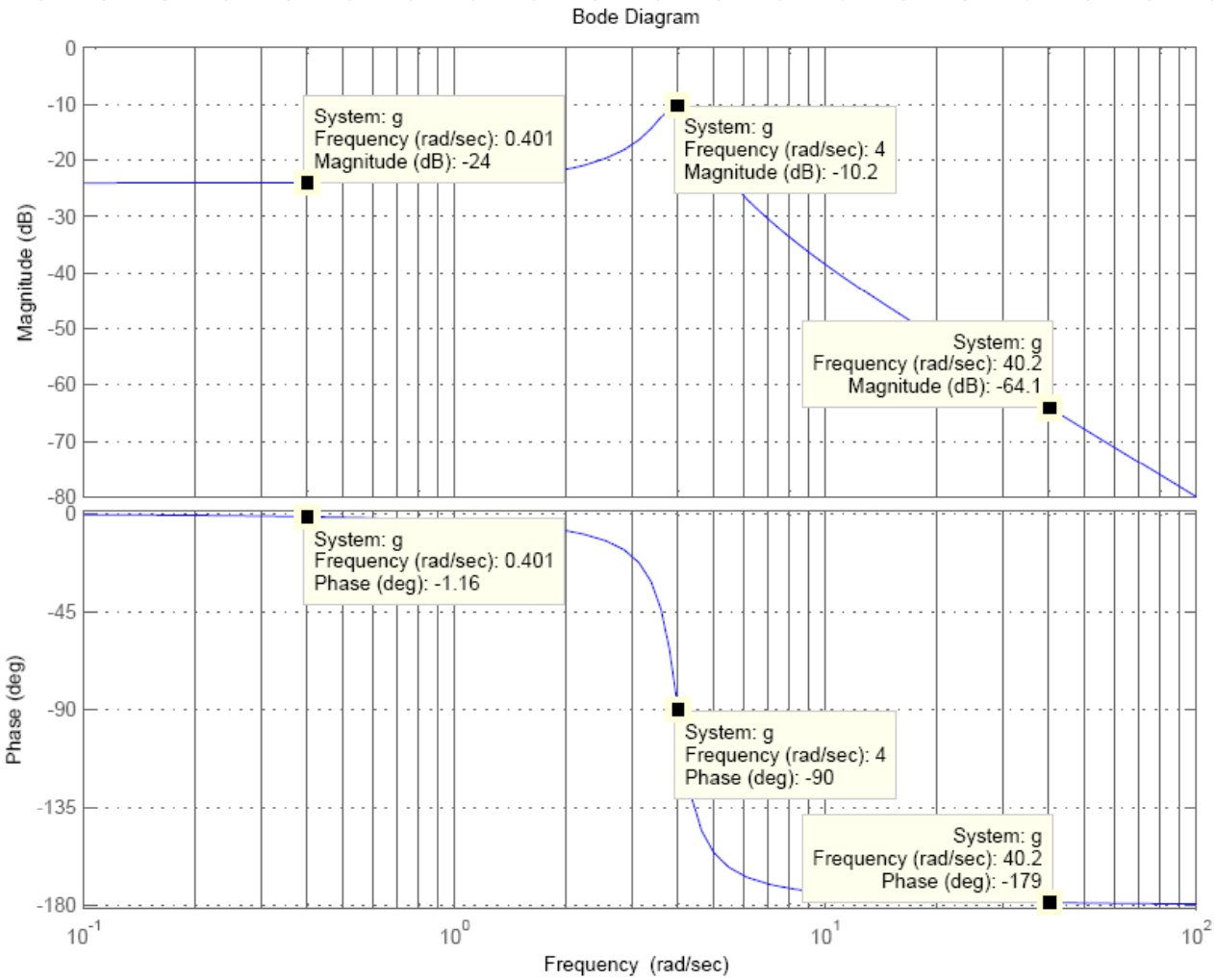
A partir del diagrama de Bode dado en la figura, calcular:

a) La respuesta permanente para las entradas:
$x_1(t) = 10 \text{ sen } (0{,}4t)$;
$x_2(t) = 10 \text{ sen } (4t)$;
$x_3(t) = 10 \text{ sen } (40t)$;

b) Representar gráficamente las respuestas respecto a su entrada.



ADS.4_TLC




**Exámenes: Curso 2009-2010**

**Examen: 3 de Junio 2010**

## ADS.4_TLC

```
>> n=[1];d=[1 0.8 16];

w=[0.4 4 40];
bode(n,d,w);
[ma,fa,w]=bode(n,d,w);
[Mg,Mf,wf,wg]=margin(ma,fa,w);
grid;

madb=20*log10(ma);
fc=pi/180;fard=fa*fc;

% Entrada  armmónica %
t=0:0.01:30;

arg1=0.4*t;
x1=10*sin(arg1);

arg2=4*t;
x2=10*sin(arg2);

arg3=40*t;
x3=10*sin(arg3);
```

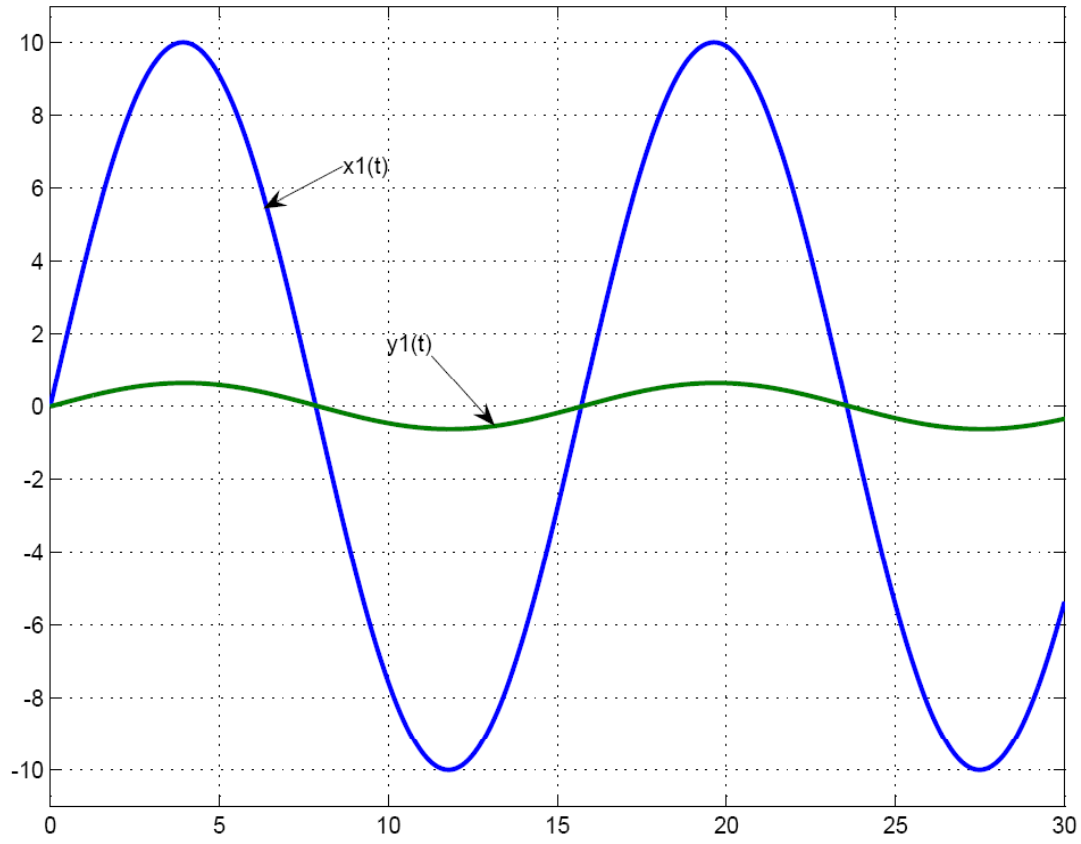
```
% Salida armónica estable %

w1=w(1);ma1=ma(1)*10;fa1r=fa(1)*fc;
y1=ma1*sin(arg1+fa1r);

w2=w(2);ma2=ma(2)*10;fa2r=fa(2)*fc;
y2=ma2*sin(arg2+fa2r);

w3=w(3);ma3=ma(3)*10;fa3r=fa(3)*fc;
y3=ma3*sin(arg3+fa3r);
```

```
ma =                    fa =

    0.0631                 -1.1573
    0.3125                -90.0000
    0.0006               -178.8427


madb =                  fard =

   -23.9969                -0.0202
   -10.1030                -1.5708
   -63.9969                -3.1214
```

## ADS.4_TLC

```
mal =

    0.6312
```

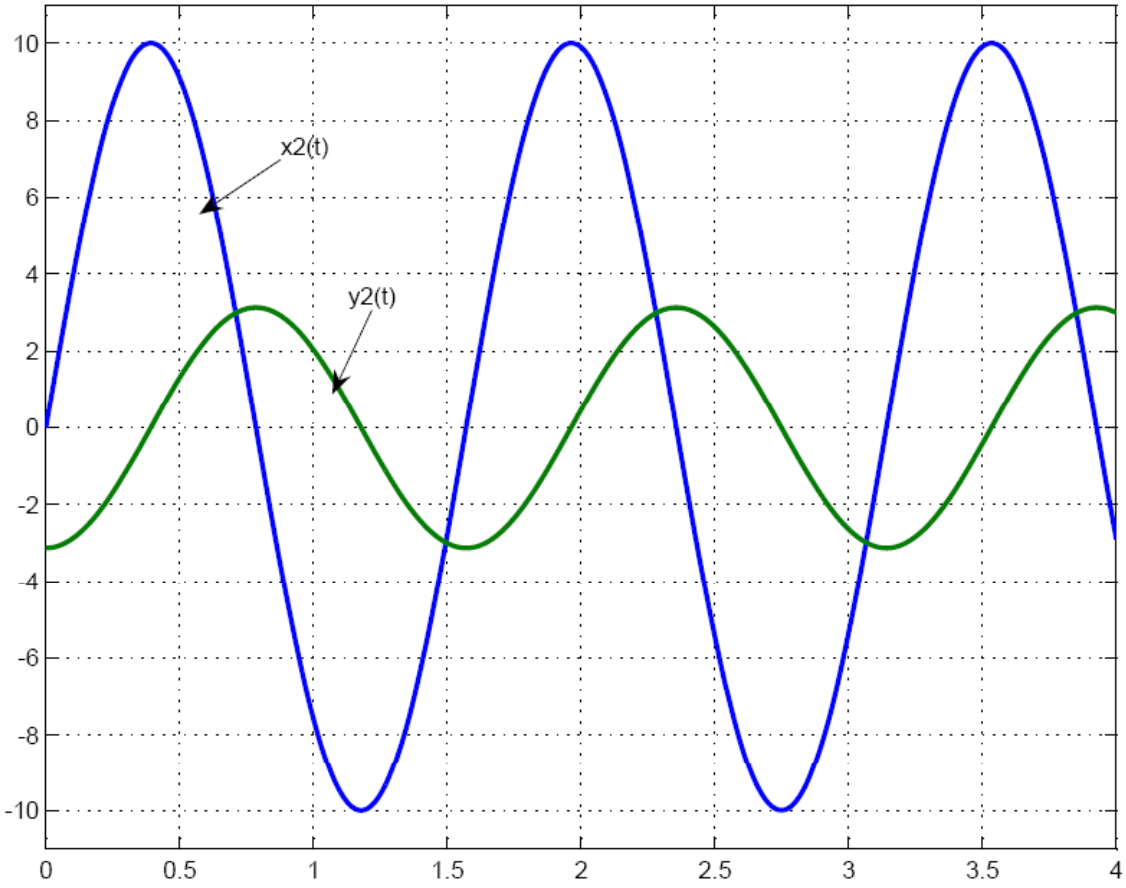
$y_1(t) = 0{,}63 \text{ sen } (0{,}4t-0{,}02)$



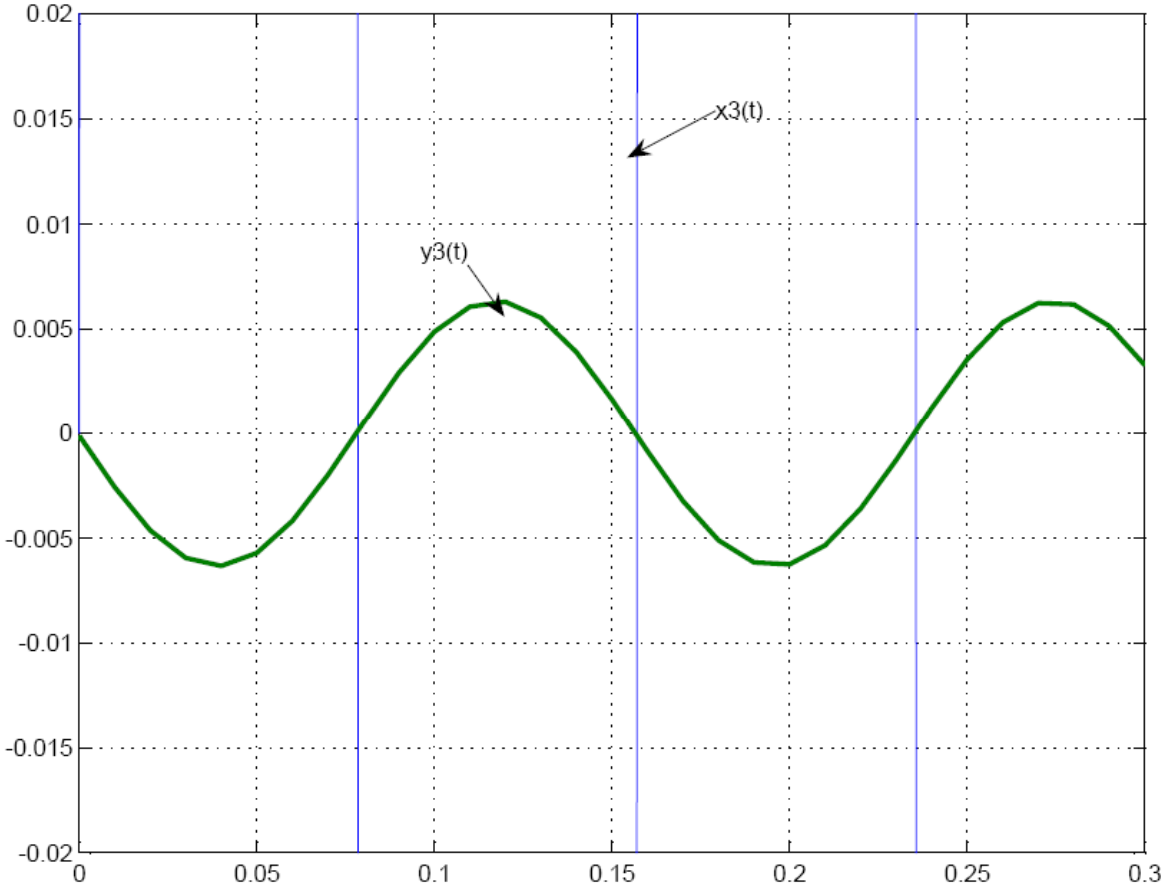
ADS.4_TLC

```
ma2 =

    3.1250
```

$y_2(t) = 3{,}12 \text{ sen } (4t-1{,}57)$



ADS.4_TLC

```
ma3 =

    0.0063
```

$y_3(t) = 0{,}0063 \text{ sen } (40t - 3{,}12)$