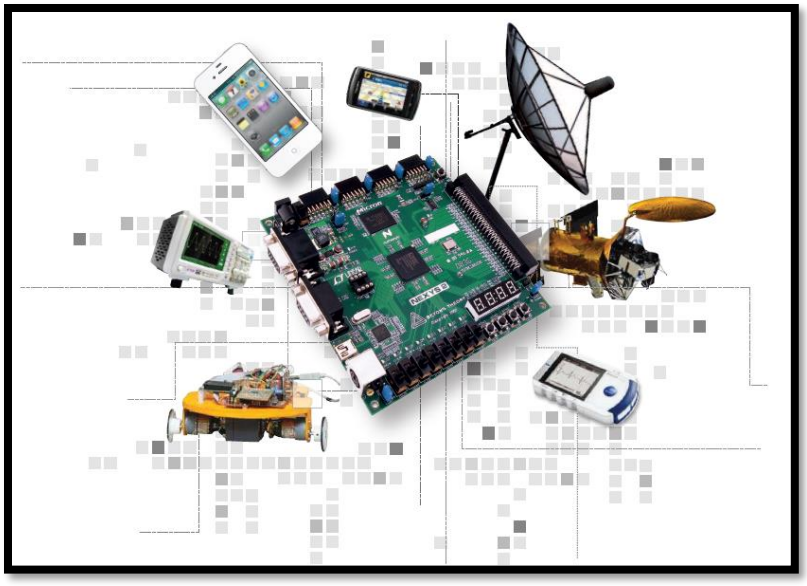
22-2-2024

Tarea 4

Sistemas embebidos



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Procedimiento

Método de Euler 19 02 24

$$\frac{Y(s)}{U(s)} = \frac{8.5}{s^2+2s+17}$$

$b = 8.5$
$a_1 = 2$
$a_2 = 17$

Multiplicación Cruzada

$$Y(s)(s^2+2s+17) = b\,U(s)$$

$$s^2(y(s)) + a_1 s\,Y(s) + a_2 = b\,U(s)$$

Transformada inversa de Laplace $\mathcal{L}^{-1}$

$$\frac{d^2y(t)}{dt^2} + a_1\frac{dy(t)}{dt} + a_2 y(t) = b\,U(t)$$

Método de Euler

$$\frac{y(k+2) - 2y(k+1) + y(k)}{h^2} + a_1\frac{y(i+1)-y(i)}{h}$$

$$+a_2 y(i) = b\,U(i)$$

multiplicar todo por h^2

$$y(i+2) - 2y(i+1) + y(i) + a_1 h\left[y(i+1)-y(i)\right] +$$

$$a_2 h^2 y(i) = b h^2 U(i)$$

$$y(i+2) = 2y(i+1) - y(i) - a_1 h\left[y(i+1) - y(i)\right] -$$

$$a_2 h^2 y(i) + b h^2 v(i)$$

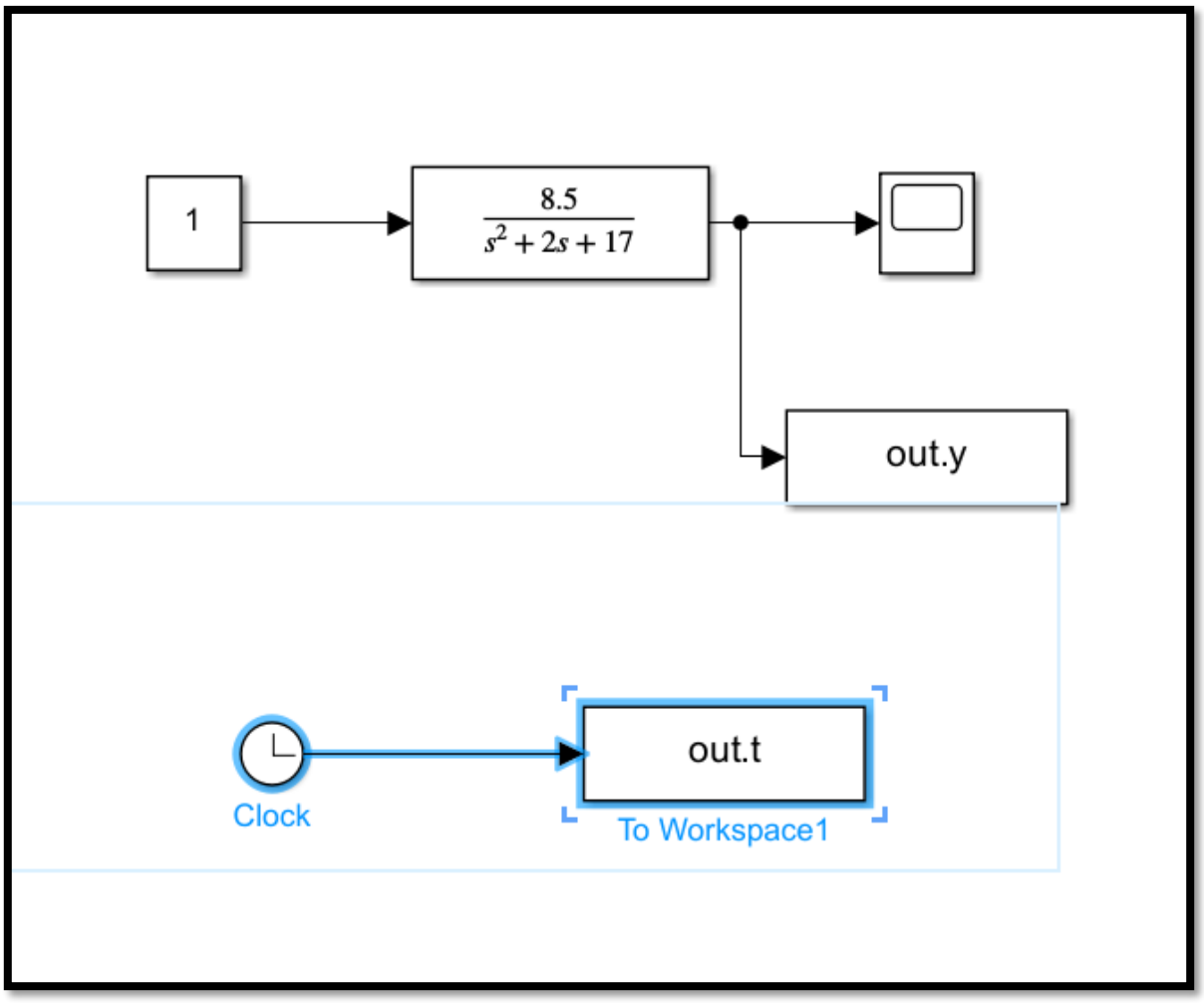
Código en C

```c
#include <math.h>
//Ignacio Andrade
main()
{
    //Tiempo de simulación
    double tfin=10;

    //paso de integración
    double h=0.01;

    //Tamaño del vector
    int n=tfin/h;

    // Vectores
    double t[n], y[n], u[n];

    // Parametros de la FT
    double b=8.5,a1= 2, a2=17;

    printf( format: "t \t\t y(t)\n\n");

    for(int i=0;i<n;i++)
    {
        t[i]=i*h;
        u[i]=1;                  //u[i]=sin(t[i])
        y[i+2]=2*y[i+1]-y[i]-a1*h*(y[i+1]-y[i])-a2*pow( x: h, y: 2)*y[i]+b*pow( x: h, y: 2)*u[i];

        printf( format: "%0.16f \t\t %0.16f \n", t[i],y[i]);
    }




}//
// Created by Nacho Andrade on 19/02/2024.
//
```

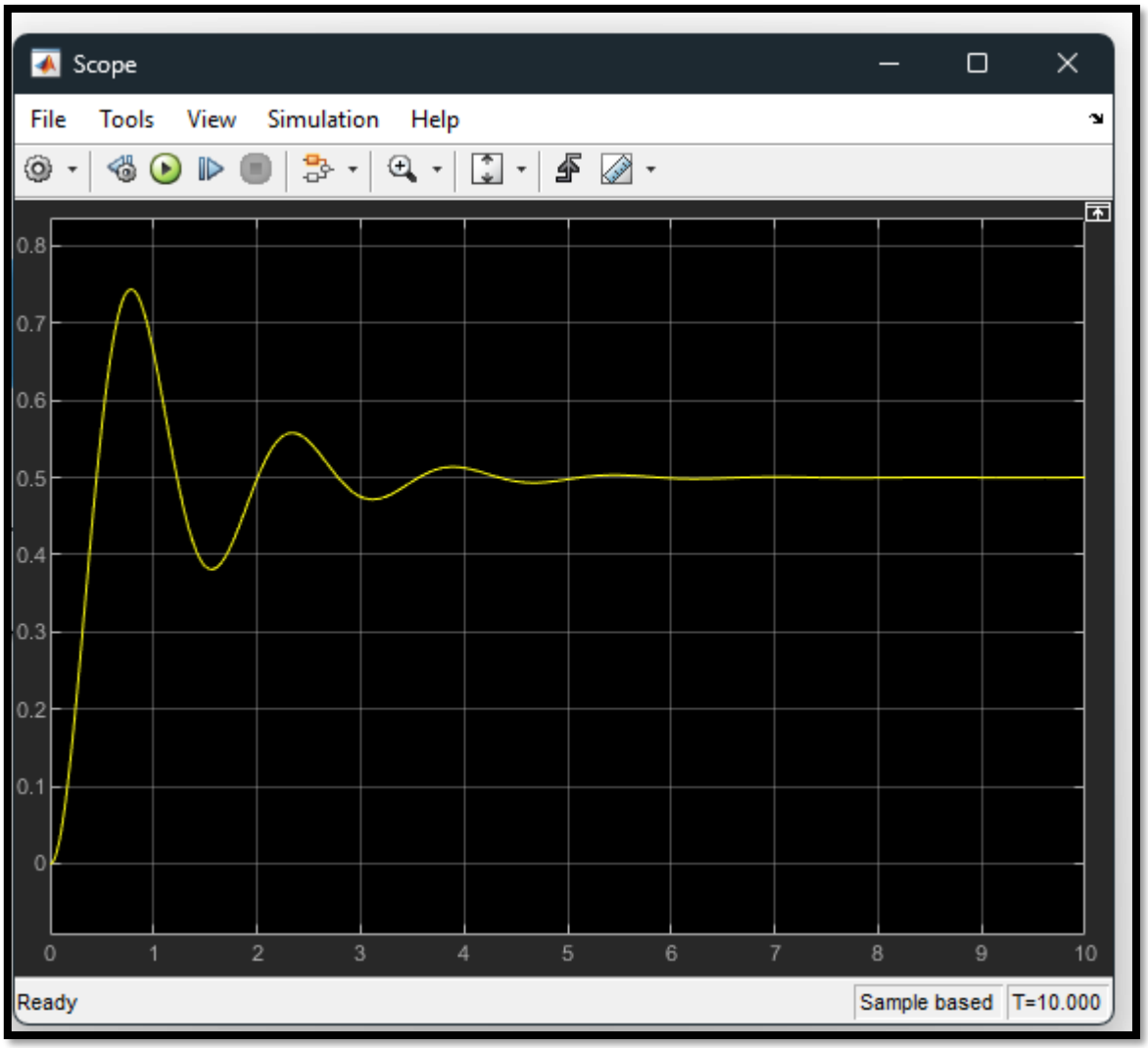
Resultados en C

	y(t)
0.0000000000000000	0.0000000000000000
0.0100000000000000	0.0000000000000000
0.0200000000000000	0.0008500000000000
0.0300000000000000	0.0025330000000000
0.0400000000000000	0.0050308950000000
0.0500000000000000	0.0083245260000000
0.0600000000000000	0.0123937318585000
0.0700000000000000	0.0172174019056300
0.0800000000000000	0.0227735292076580
0.0900000000000000	0.0290392643804058
0.1000000000000000	0.0359909698500456
0.1100000000000000	0.0436042744608460
0.1200000000000000	0.0518541283306853
0.1300000000000000	0.0607148578565443
0.1400000000000000	0.0701602207737241
0.1500000000000000	0.0801634611742041
0.1600000000000000	0.0906973643913591
0.1700000000000000	0.1017343116601750
0.1800000000000000	0.1132463344641492
0.1900000000000000	0.1252051684822216
0.2000000000000000	0.1375823070513435
0.2100000000000000	0.1503490540626631
0.2200000000000000	0.1634765762117691
0.2300000000000000	0.1769359545259864
0.2400000000000000	0.1906982350943594
0.2500000000000000	0.2047344789286707
0.2600000000000000	0.2190158108866353
0.2700000000000000	0.2335134675912619
0.2800000000000000	0.2481988442832886
0.2900000000000000	0.2630435405465697
0.3000000000000000	0.2780194048493036
0.3100000000000000	0.2930985778470537
0.3200000000000000	0.3082535343966050
0.3300000000000000	0.3234571242328252
0.3400000000000000	0.3386826112638469
0.3500000000000000	0.3539037114430524
0.3600000000000000	0.3690946291795252

Diagrama a bloques Simulink



Gráfica en Simulink



Resultados en Matlab

```
>> disp([out.t,out.y]);
                   0                   0
   0.010000000000000                   0
   0.020000000000000   0.000850000000000
   0.030000000000000   0.002533000000000
   0.040000000000000   0.005030895000000
   0.050000000000000   0.008324526000000
   0.060000000000000   0.012393731858500
   0.070000000000000   0.017217401905630
   0.080000000000000   0.022773529207658
   0.090000000000000   0.029039264380406
   0.100000000000000   0.035990969850046
   0.110000000000000   0.043604274460846
   0.120000000000000   0.051854128330685
   0.130000000000000   0.060714857856544
   0.140000000000000   0.070160220773724
   0.150000000000000   0.080163461174204
   0.160000000000000   0.090697364391359
   0.170000000000000   0.101734311660175
   0.180000000000000   0.113246334464149
   0.190000000000000   0.125205168482221
   0.200000000000000   0.137582307051343
   0.210000000000000   0.150349054062663
   0.220000000000000   0.163476576211769
   0.230000000000000   0.176935954525986
   0.240000000000000   0.190698235094359
   0.250000000000000   0.204734478928671
   0.260000000000000   0.219015810886635
   0.270000000000000   0.233513467591262
   0.280000000000000   0.248198844283289
   0.290000000000000   0.263043540546570
   0.300000000000000   0.278019404849304
   0.310000000000000   0.293098577847054
   0.320000000000000   0.308253534396606
   0.330000000000000   0.323457124232826
   0.340000000000000   0.338682611263848
   0.350000000000000   0.353903711443053
```