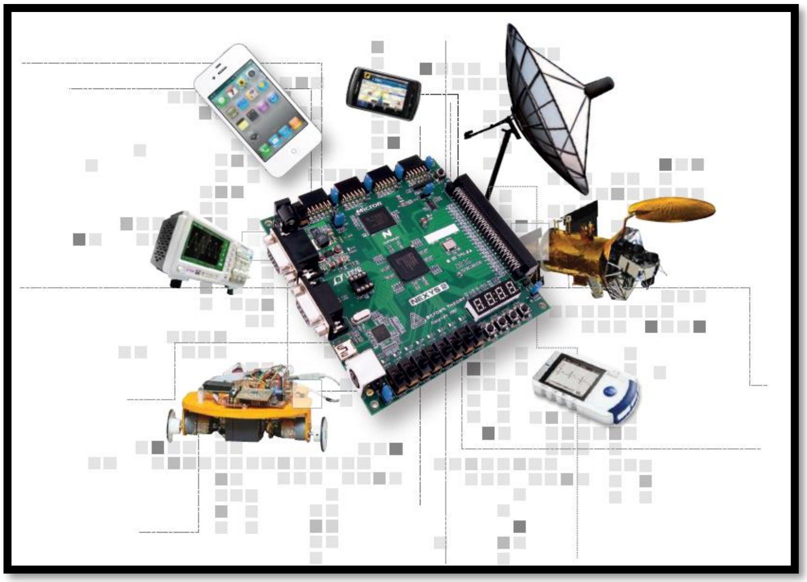
22-2-2024

Tarea 3

Sistemas embebidos



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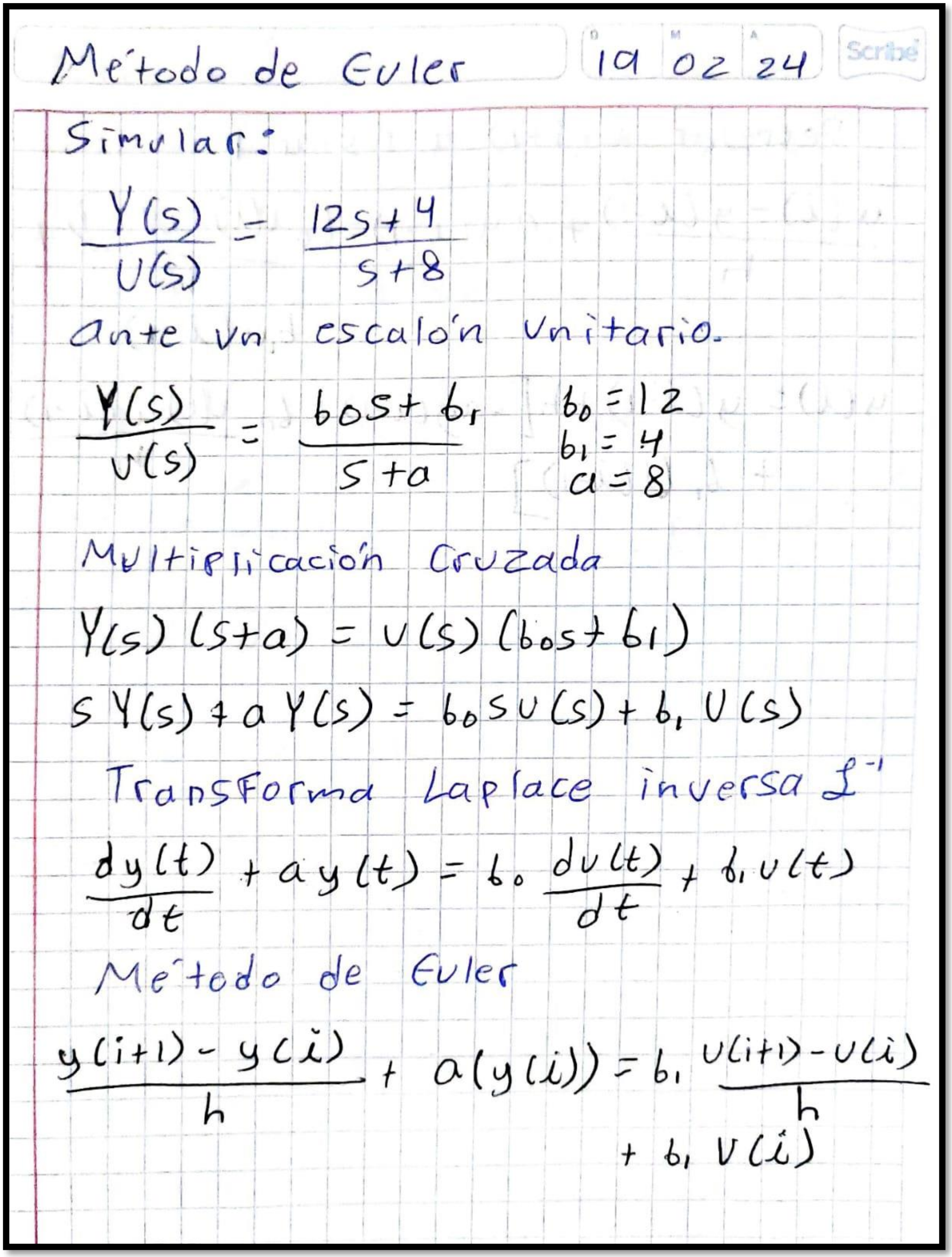
Procedimiento



Método de Euler

19 02 24

Simular:

$$\frac{Y(s)}{U(s)} = \frac{12s+4}{s+8}$$

ante un escalón unitario.

$$\frac{Y(s)}{U(s)} = \frac{b_0 s + b_1}{s+a}$$

$b_0 = 12$

$b_1 = 4$

$a = 8$

Multiplicación Cruzada

$$Y(s)(s+a) = U(s)(b_0 s + b_1)$$

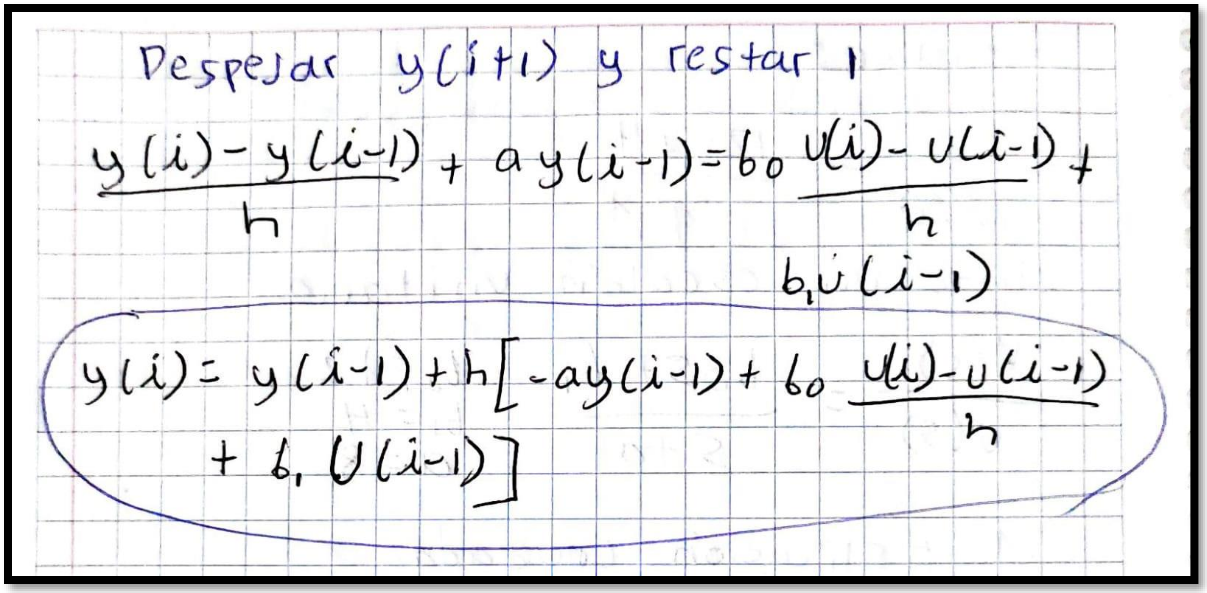
$$sY(s) + aY(s) = b_0 sU(s) + b_1 U(s)$$

Transforma Laplace inversa $\mathcal{L}^{-1}$

$$\frac{dy(t)}{dt} + ay(t) = b_0 \frac{du(t)}{dt} + b_1 u(t)$$

Método de Euler

$$\frac{y(i+1) - y(i)}{h} + a(y(i)) = b_1 \frac{u(i+1) - u(i)}{h} + b_1 u(i)$$

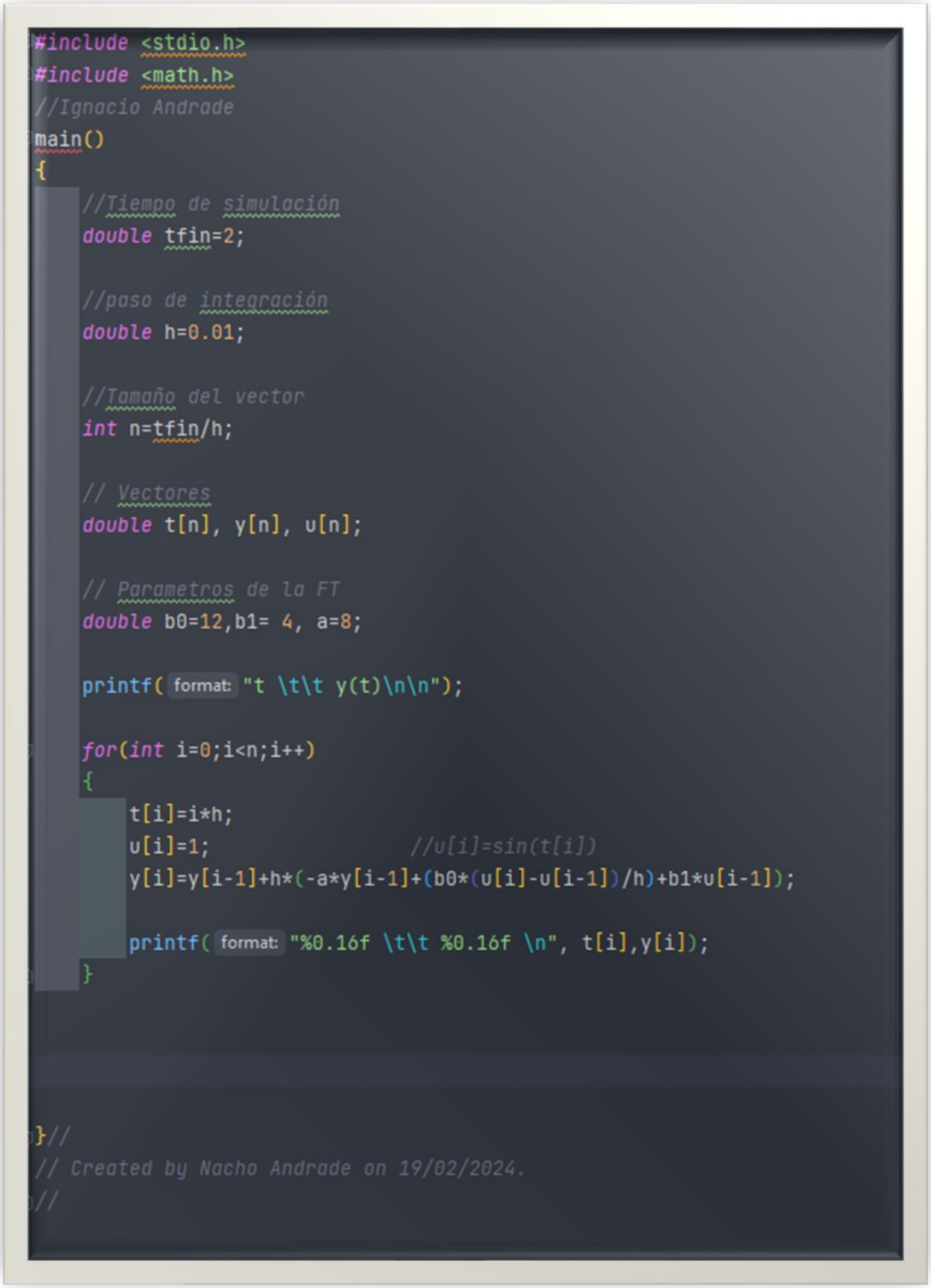


Despejar y(i+1) y restar 1

$$\frac{y(i)-y(i-1)}{h} + a\,y(i-1) = b_0\,\frac{u(i)-u(i-1)}{h} + b_1 u(i-1)$$

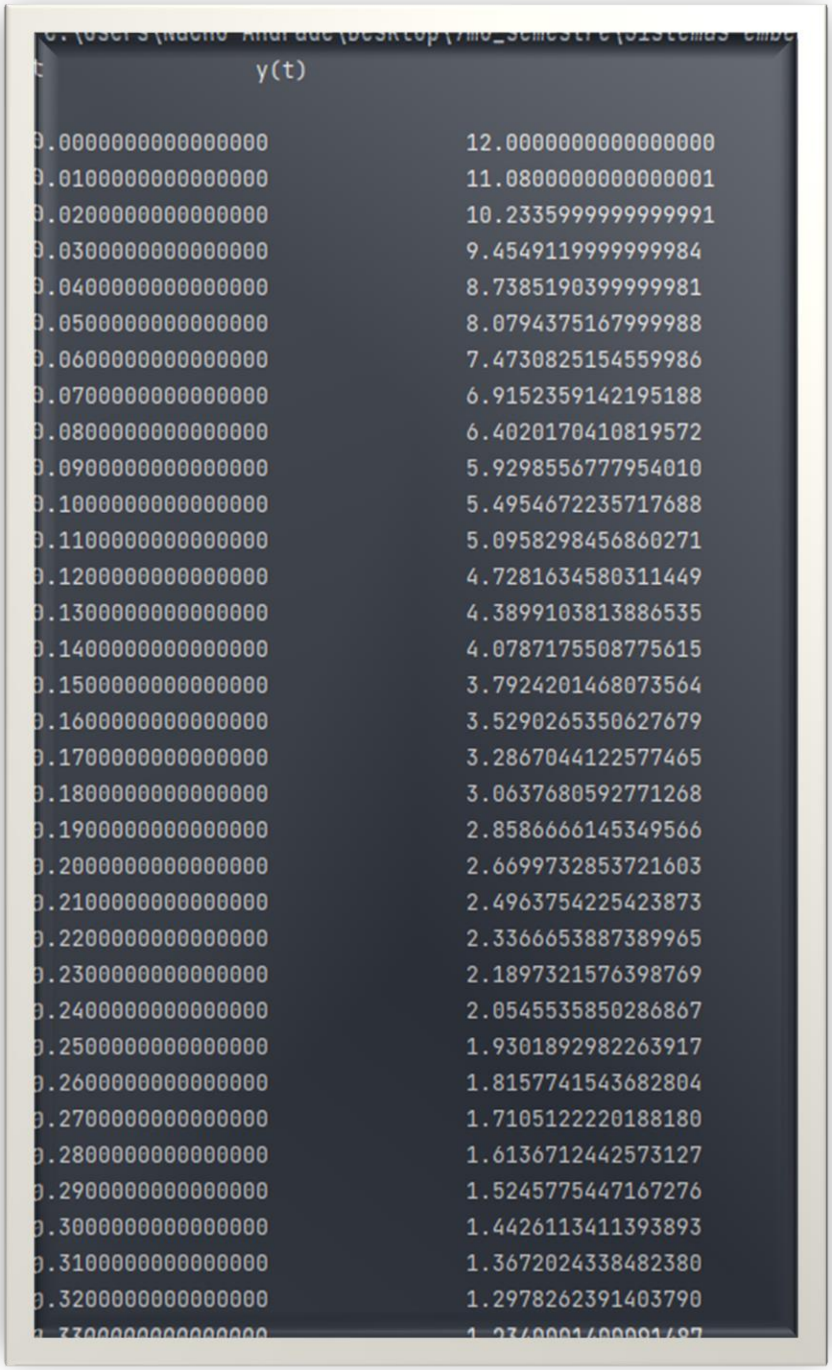
$$\boxed{\begin{aligned} y(i) = y(i-1) + h\Big[-a\,y(i-1) + b_0\,\frac{u(i)-u(i-1)}{h} \\ + b_1\,U(i-1)\Big] \end{aligned}}$$

Código en C



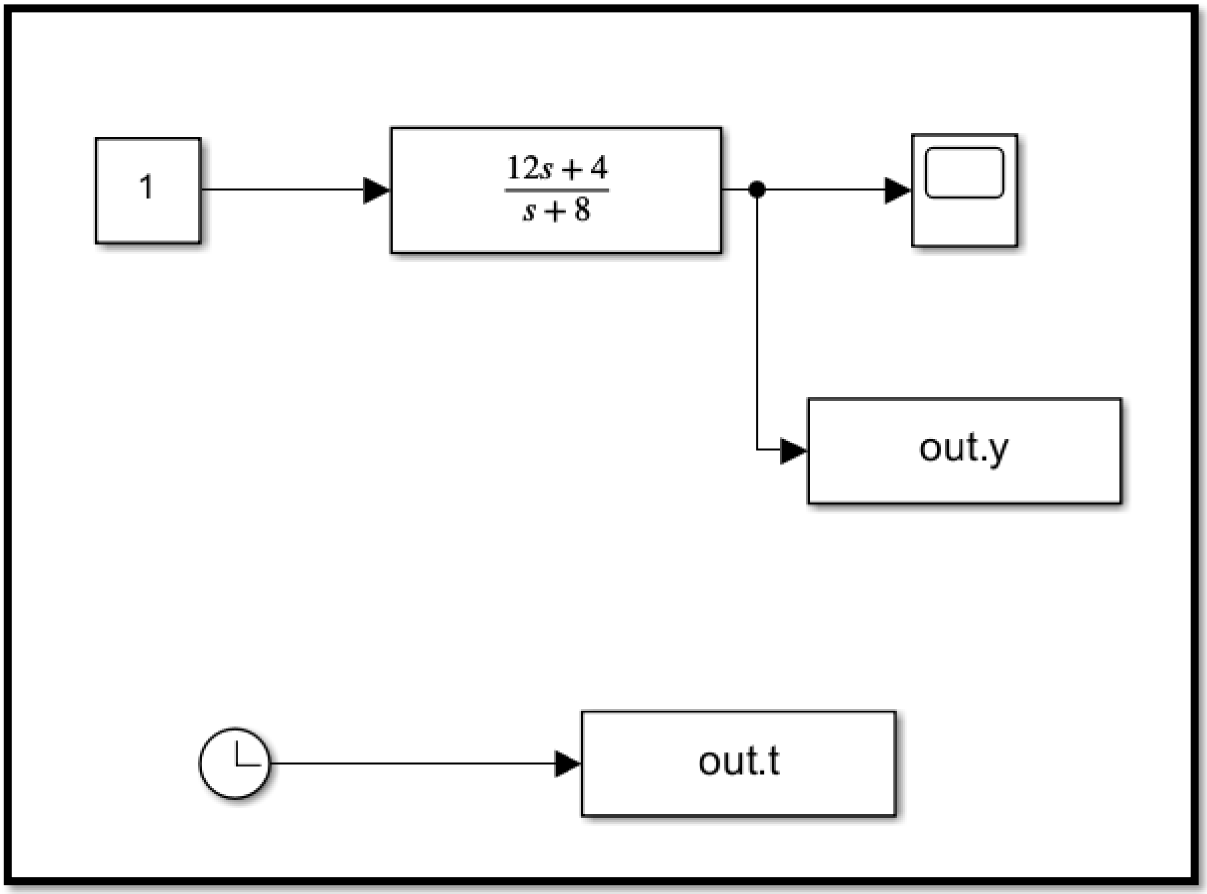
```
#include <stdio.h>
#include <math.h>
//Ignacio Andrade
main()
{
    //Tiempo de simulación
    double tfin=2;

    //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 b0=12,b1= 4, a=8;

    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]=y[i-1]+h*(-a*y[i-1]+(b0*(u[i]-u[i-1])/h)+b1*u[i-1]);

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



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

Resultados en C

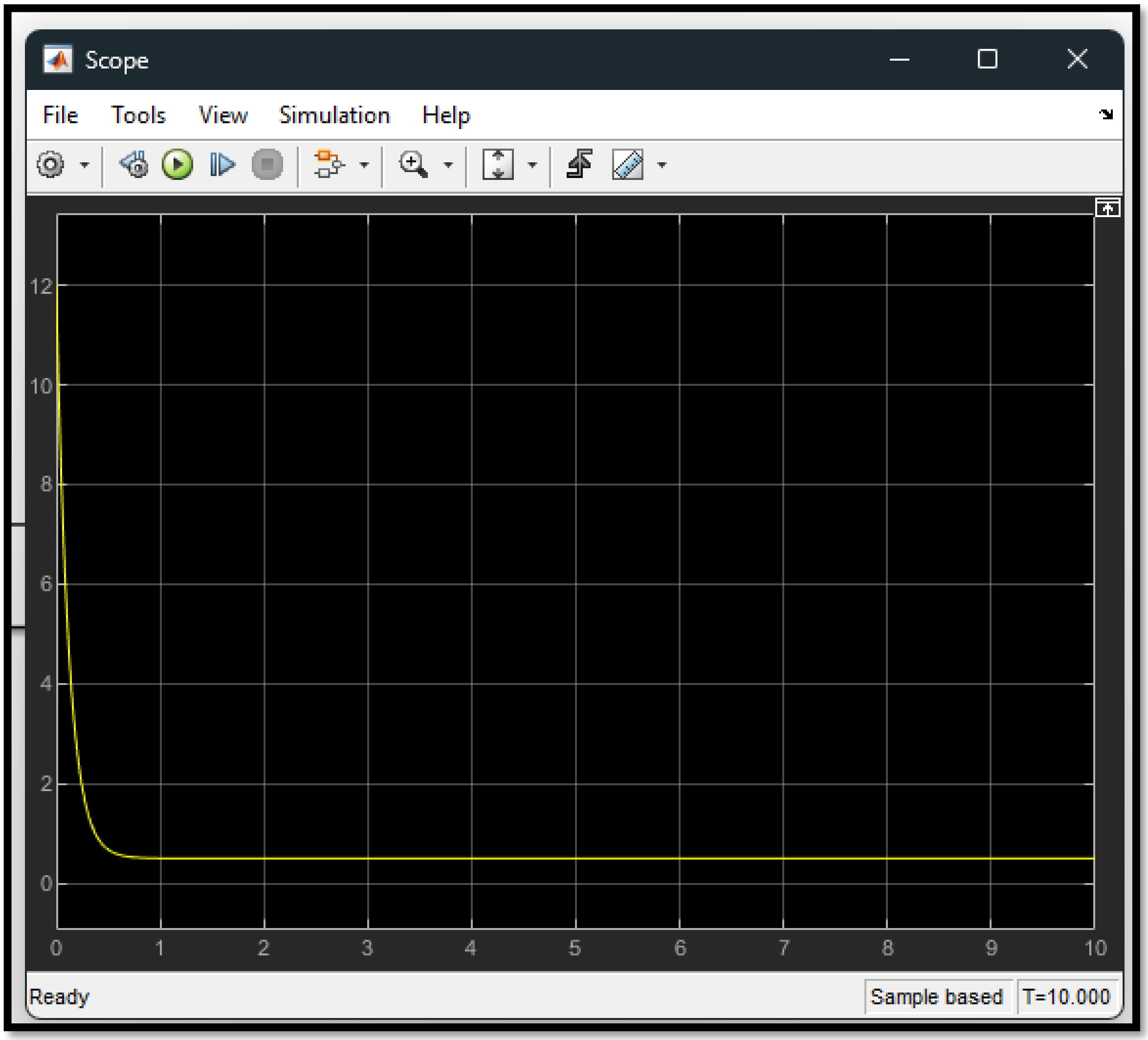


```
C:\Users\Nacho Andrade\Desktop\7mo_Semestre\Sistemas embe
t                 y(t)

0.0000000000000000              12.0000000000000000
0.0100000000000000              11.0800000000000001
0.0200000000000000              10.2335999999999991
0.0300000000000000              9.4549119999999984
0.0400000000000000              8.7385190399999981
0.0500000000000000              8.0794375167999988
0.0600000000000000              7.4730825154559986
0.0700000000000000              6.9152359142195188
0.0800000000000000              6.4020170410819572
0.0900000000000000              5.9298556777954010
0.1000000000000000              5.4954672235717688
0.1100000000000000              5.0958298456860271
0.1200000000000000              4.7281634580311449
0.1300000000000000              4.3899103813886535
0.1400000000000000              4.0787175508775615
0.1500000000000000              3.7924201468073564
0.1600000000000000              3.5290265350627679
0.1700000000000000              3.2867044122577465
0.1800000000000000              3.0637680592771268
0.1900000000000000              2.8586666145349566
0.2000000000000000              2.6699732853721603
0.2100000000000000              2.4963754225423873
0.2200000000000000              2.3366653887389965
0.2300000000000000              2.1897321576398769
0.2400000000000000              2.0545535850286867
0.2500000000000000              1.9301892982263917
0.2600000000000000              1.8157741543682804
0.2700000000000000              1.7105122220188180
0.2800000000000000              1.6136712442573127
0.2900000000000000              1.5245775447167276
0.3000000000000000              1.4426113411393893
0.3100000000000000              1.3672024338482380
0.3200000000000000              1.2978262391403790
0.3300000000000000              1.2340001400091487
```

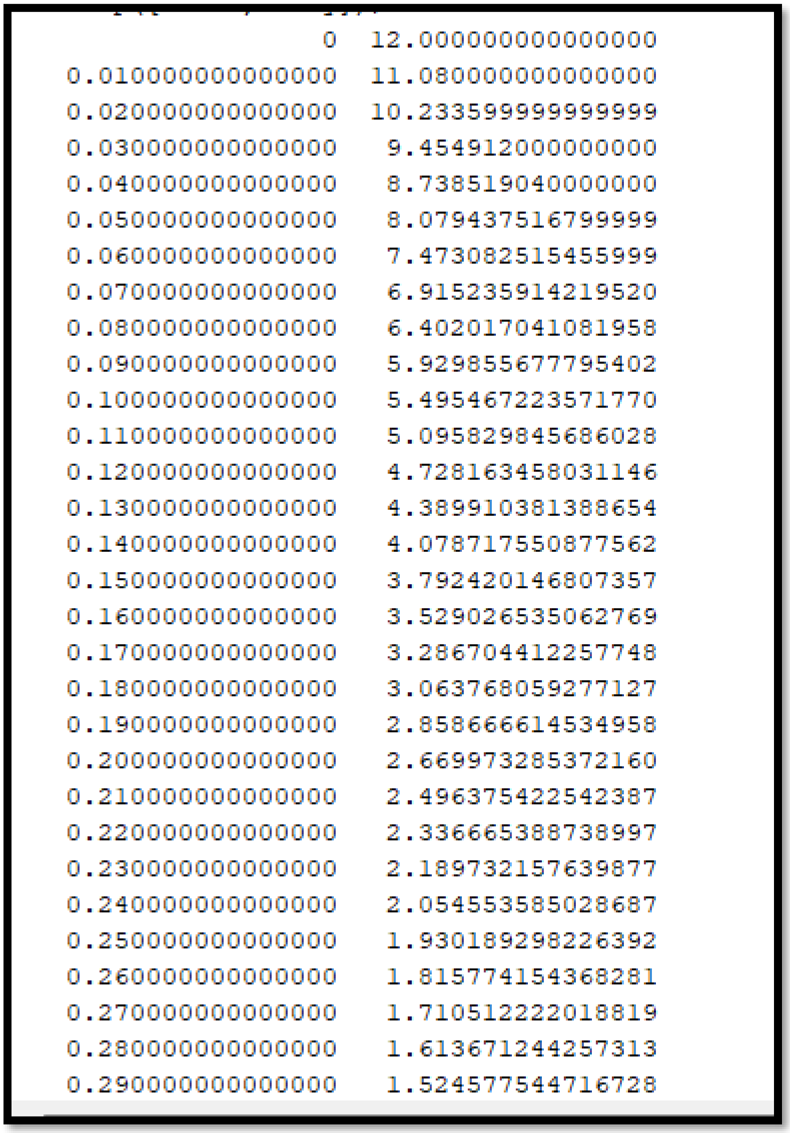
Diagrama a bloques Simulink



Gráfica en Simulink



Resultados en Matlab



```
                 0  12.000000000000000
 0.010000000000000  11.080000000000000
 0.020000000000000  10.233599999999999
 0.030000000000000   9.454912000000000
 0.040000000000000   8.738519040000000
 0.050000000000000   8.079437516799999
 0.060000000000000   7.473082515455999
 0.070000000000000   6.915235914219520
 0.080000000000000   6.402017041081958
 0.090000000000000   5.929855677795402
 0.100000000000000   5.495467223571770
 0.110000000000000   5.095829845686028
 0.120000000000000   4.728163458031146
 0.130000000000000   4.389910381388654
 0.140000000000000   4.078717550877562
 0.150000000000000   3.792420146807357
 0.160000000000000   3.529026535062769
 0.170000000000000   3.286704412257748
 0.180000000000000   3.063768059277127
 0.190000000000000   2.858666614534958
 0.200000000000000   2.669973285372160
 0.210000000000000   2.496375422542387
 0.220000000000000   2.336665388738997
 0.230000000000000   2.189732157639877
 0.240000000000000   2.054553585028687
 0.250000000000000   1.930189298226392
 0.260000000000000   1.815774154368281
 0.270000000000000   1.710512222018819
 0.280000000000000   1.613671244257313
 0.290000000000000   1.524577544716728
```