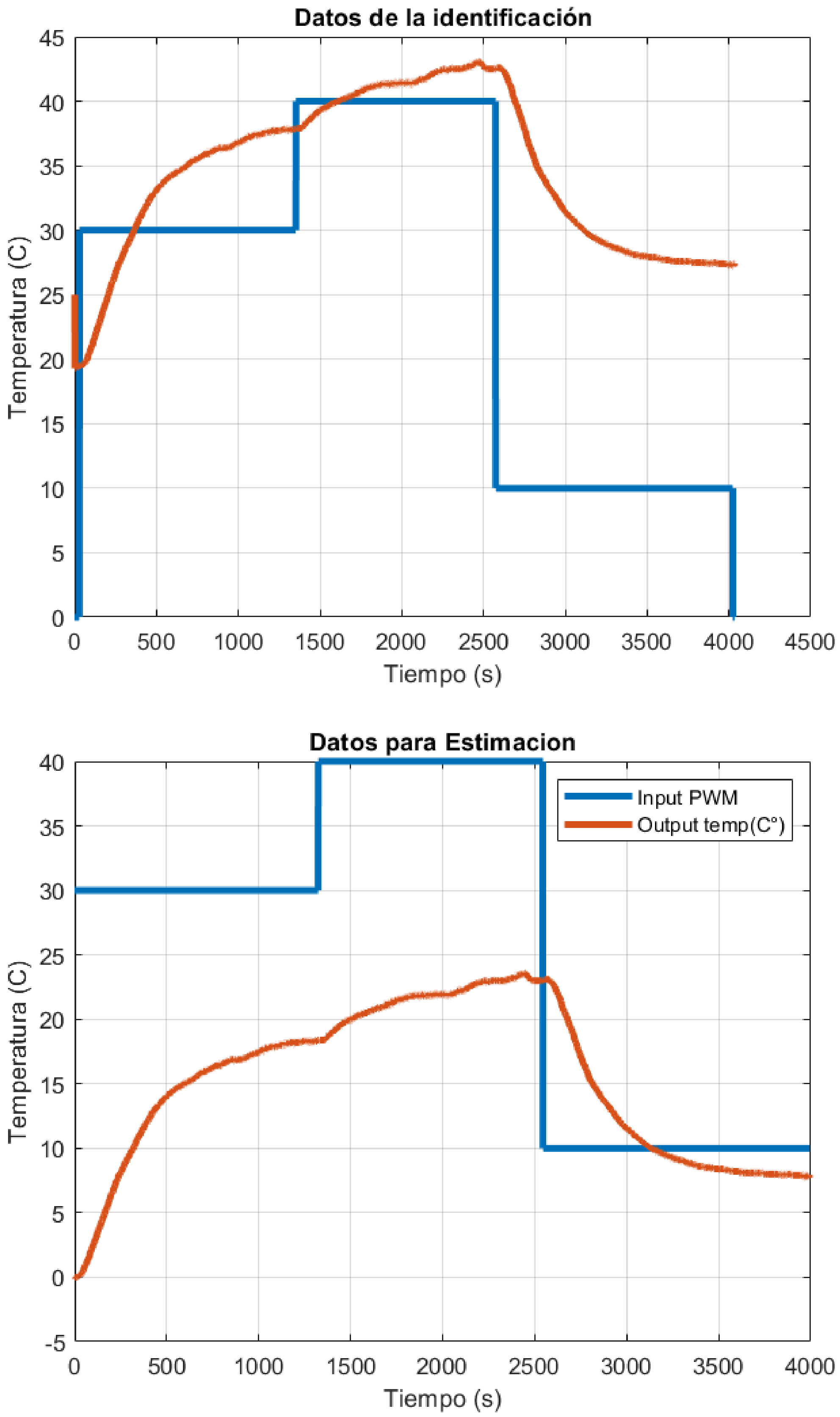
ETAPA DE ESTIMACION CON VARIOS MODELOS

```
load('systemIdentification_pr6.mat')
plot(ts,us,ts,ys,'linewidth',3),grid
title('Datos de la identificación')
xlabel('Tiempo (s)')
ylabel('Temperatura (C)')
b1=30;
b2=40;
b3=10;

i=1;
while(us(i)<b1)
    i=i+1;
end
x1_start=i;
while(us(i)==b1)
    i=i+1;
end
x1_end=i-1;
%................
while(us(i)<b2)
    i=i+1;
end
x2_start=i;
while(us(i)==b2)
    i=i+1;
end
x2_end=i-1;
%................
while(us(i)<b3)
    i=i+1;
end
x3_start=i;
while(us(i)==b3)
    i=i+1;
end
x3_end=i-1;

ur=us(x1_start:x3_end)';
yr=ys(x1_start:x3_end)';
tr=ts(x1_start:x3_end)';

ut=ur-us(1);
yt=yr-yr(2);
tt=tr-tr(1);

figure(2)
plot(tt,ut,tt,yt,'linewidth',3),grid
title('Datos para Estimacion')
xlabel('Tiempo (s)')
ylabel('Temperatura (C)')
legend('Input PWM','Output temp(C°)')
```

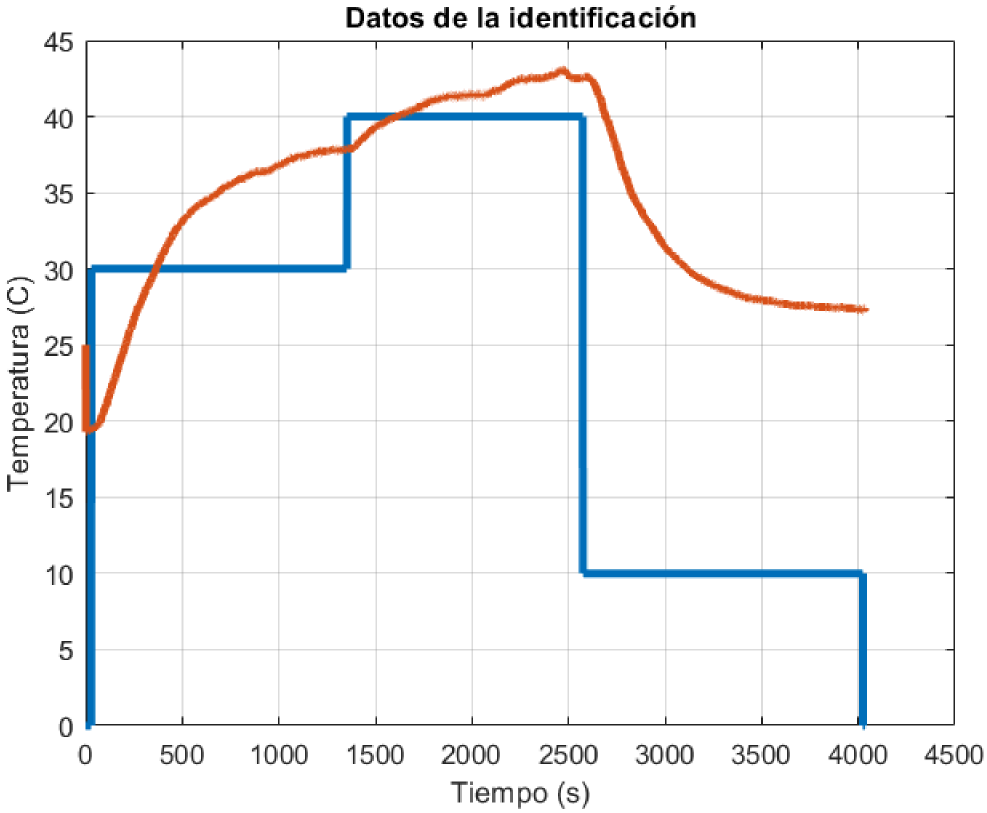
```
saveas(gcf,'grafico1_entreno.png')
```



```
data_estimacion = iddata(yt,ut,1);
```

MODELO 01:

```
Gest = tfest(data_estimacion,2,0,NaN)
```



```
Gest =

  From input "u1" to output "y1":
                         0.0001776
  exp(-28*s) * -------------------------
               s^2 + 0.1105 s + 0.000294

Continuous-time identified transfer function.

Parameterization:
   Number of poles: 2   Number of zeros: 0
   Number of free coefficients: 3
   Use "tfdata", "getpvec", "getcov" for parameters and their uncertainties.

Status:
Estimated using TFEST on time domain data "data_estimacion".
Fit to estimation data: 88.03%
FPE: 0.5275, MSE: 0.5262
```

```
%opt = compareOptions;
%opt.InitialCondition = 'z';
%compare(data,Gest,opt);
%set(findall(gca,'Type','Line'),'LineWidth',4);
```

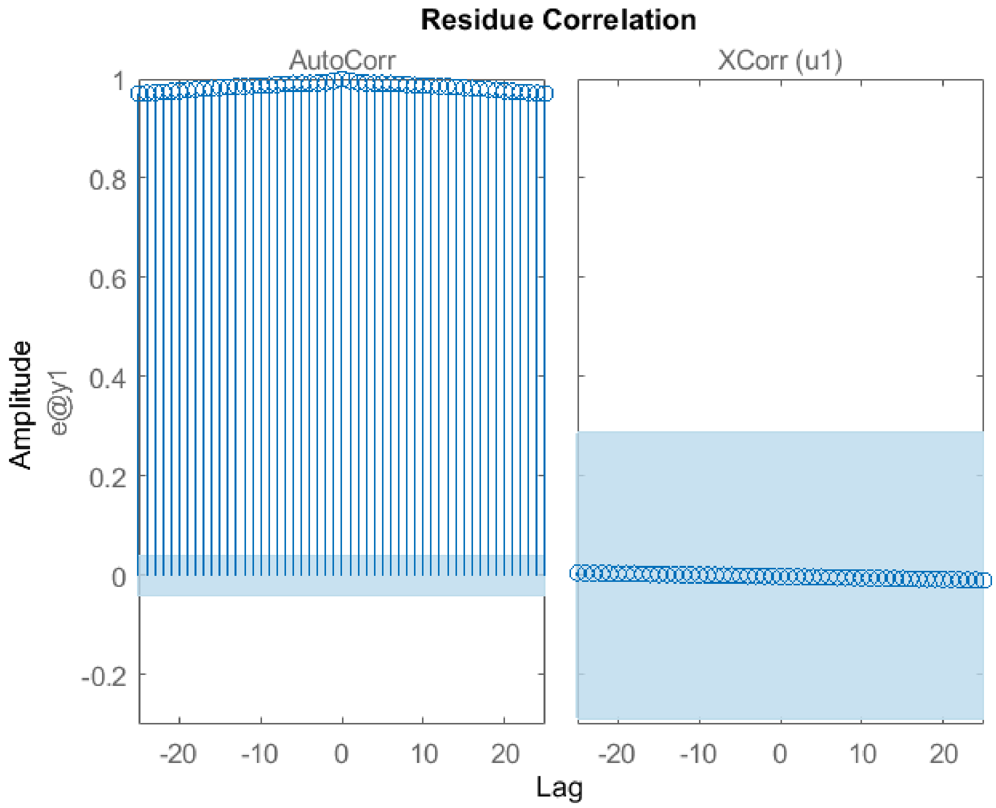
```
%grid on
```

MODELO 02:

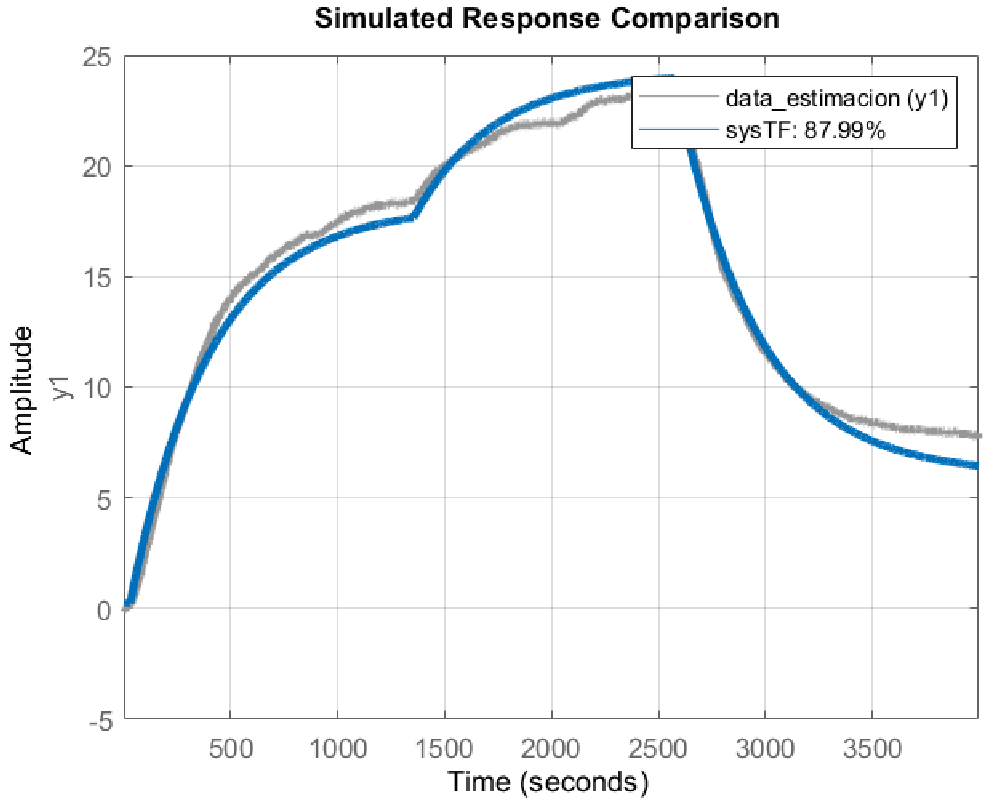
```
sysTF = tfest(data_estimacion,1,0,nan)
```

```
sysTF =
 
  From input "u1" to output "y1":
                 0.001621
  exp(-29*s) * ------------
               s + 0.002679
 
Continuous-time identified transfer function.

Parameterization:
   Number of poles: 1   Number of zeros: 0
   Number of free coefficients: 2
   Use "tfdata", "getpvec", "getcov" for parameters and their uncertainties.

Status:
Estimated using TFEST on time domain data "data_estimacion".
Fit to estimation data: 87.99%
FPE: 0.5305, MSE: 0.5297
```

```
resid(sysTF,data_estimacion);
```



```
compare(data_estimacion,sysTF)
set(findall(gca,'Type','Line'),'LineWidth',3);
grid on
```



MODELO 03:

```
sysInit = idtf(NaN,[1 NaN],'ioDelay',NaN);
sysInit.timeUnit = 'seconds';
```

```
sysInit.Structure.num.Value =  1;
sysInit.Structure.num.Minimum = 0;
sysInit.Structure.den.Value = [1 1];
sysInit.Structure.den.Minimum = [0 0];
```

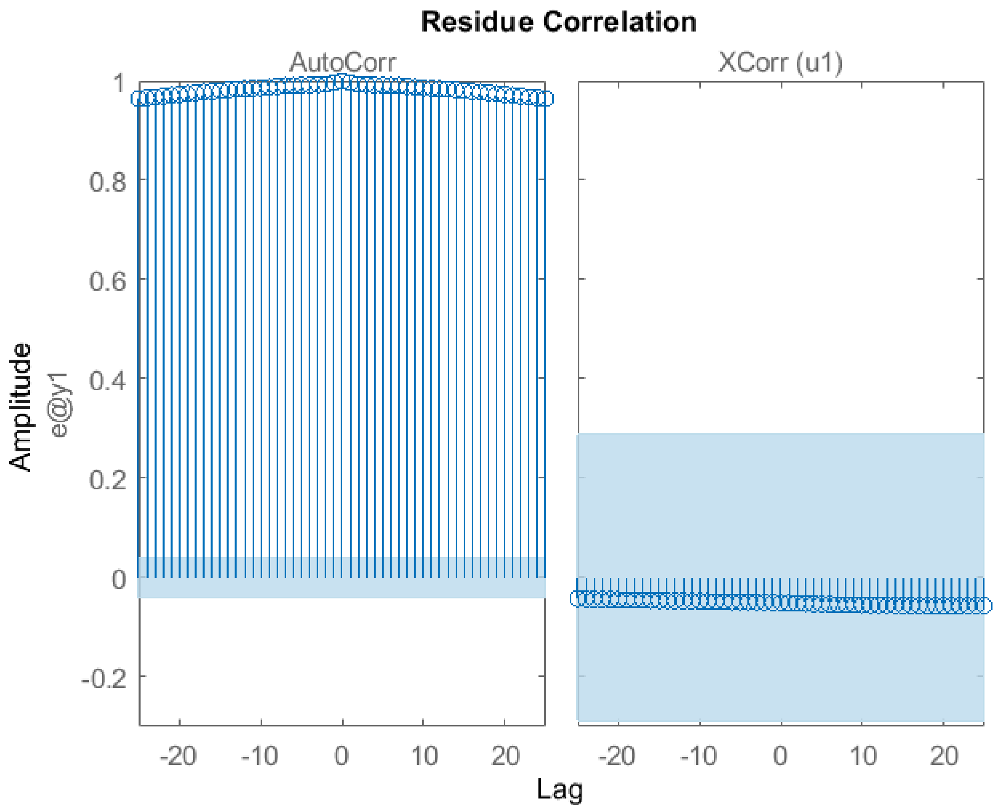
```
sysInit.Structure.ioDelay.Value = 0.2;
sysInit.Structure.ioDelay.Minimum = 0;
sysInit.Structure.ioDelay.Maximum = 1;
```

```
sysTF_initialized = tfest(data_estimacion,sysInit)
```

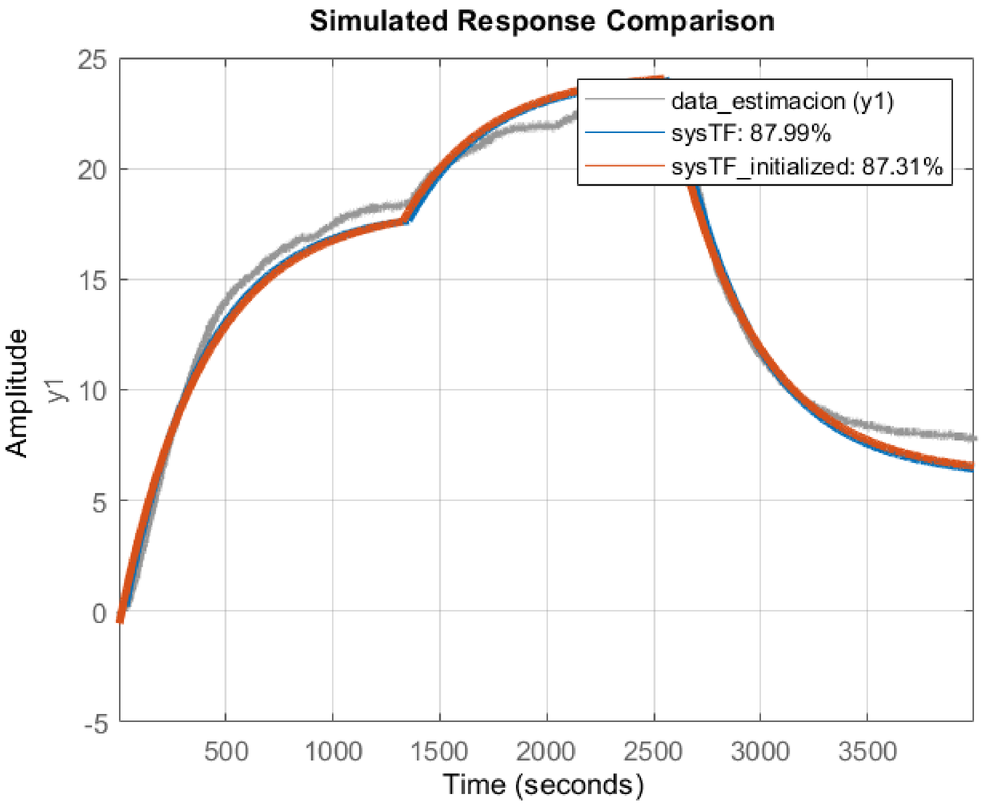
```
sysTF_initialized =

  From input "u1" to output "y1":
                 0.001535
```

```
   exp(-1*s) * ------------
                s + 0.002519

Continuous-time identified transfer function.

Parameterization:
   Number of poles: 1   Number of zeros: 0
   Number of free coefficients: 2
   Use "tfdata", "getpvec", "getcov" for parameters and their uncertainties.

Status:
Estimated using TFEST on time domain data "data_estimacion".
Fit to estimation data: 87.31%
FPE: 0.5928, MSE: 0.5919
```

```
resid(sysTF_initialized,data_estimacion)
```



```
clf
compare(data_estimacion,sysTF,sysTF_initialized)
set(findall(gca,'Type','Line'),'LineWidth',3);
grid on
```

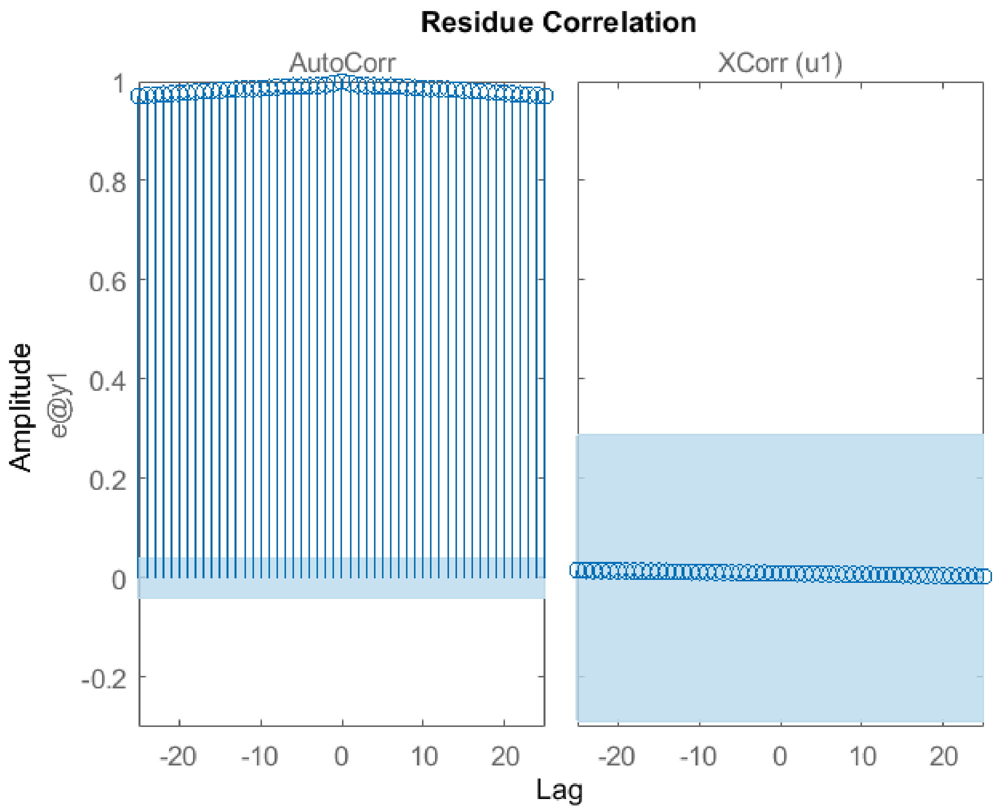


MODELO 04:

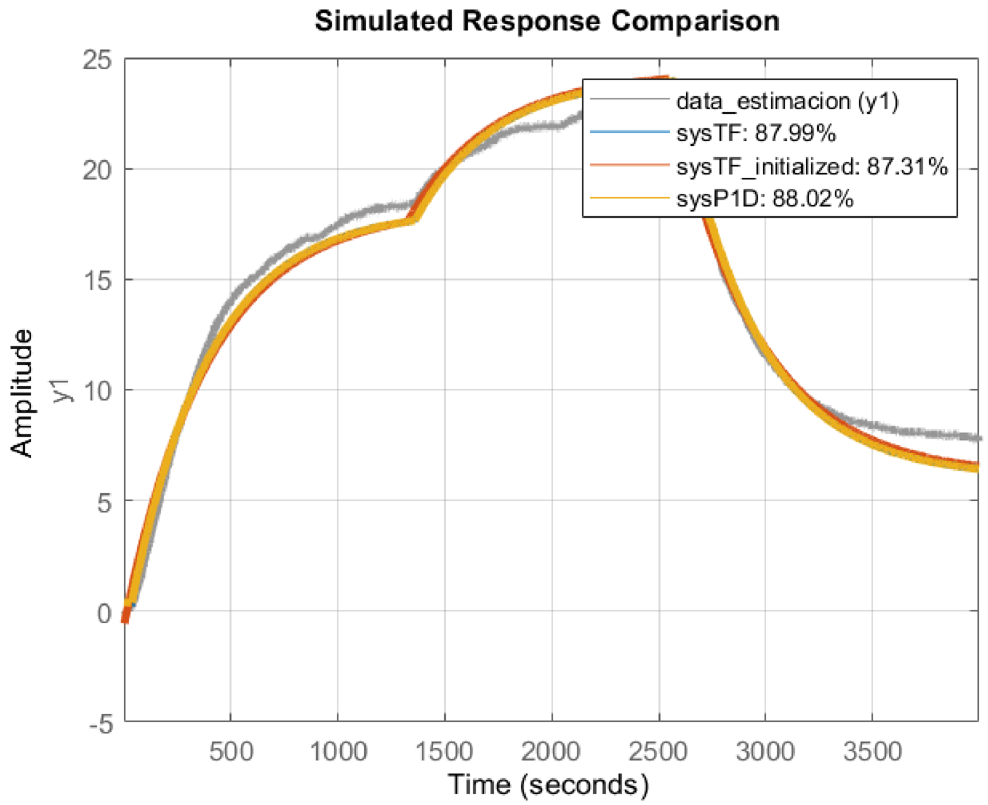
```
sysP1D = procest(data_estimacion,'P1D')
```

```
sysP1D =
Process model with transfer function:
             Kp
  G(s) = ---------- * exp(-Td*s)
          1+Tp1*s

        Kp = 0.60448
       Tp1 = 368.1
        Td = 34.923

Parameterization:
    {'P1D'}
   Number of free coefficients: 3
   Use "getpvec", "getcov" for parameters and their uncertainties.

Status:
Estimated using PROCEST on time domain data "data_estimacion".
Fit to estimation data: 88.02%
FPE: 0.5286, MSE: 0.5275
```

```
resid(sysP1D,data_estimacion)
```



```
compare(data_estimacion,sysTF,sysTF_initialized,sysP1D)
set(findall(gca,'Type','Line'),'LineWidth',3);
grid on
```



MODELO 05:

```
sysInit = idproc('P1D','TimeUnit','seconds');
```

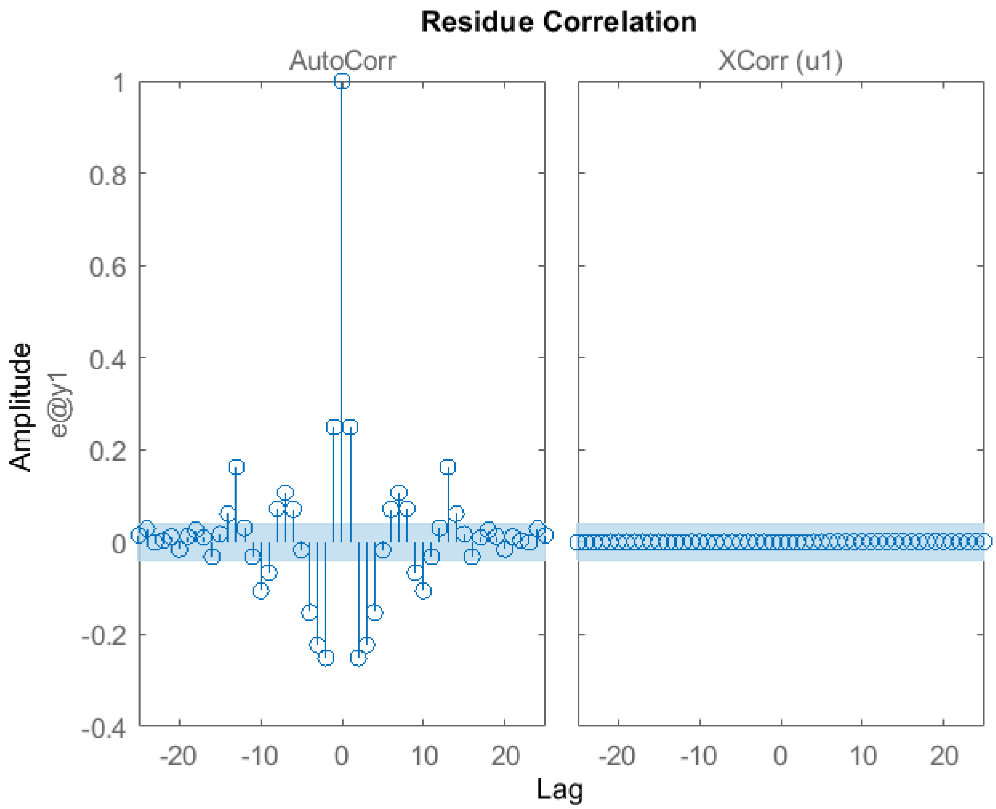
```
sysInit.Structure.Kp.Value = 1;
sysInit.Structure.Kp.Minimum = 0.1;
sysInit.Structure.Tp1.Value = 300;
sysInit.Structure.Tp1.Maximum = 400;
sysInit.Structure.Td.Value  = 30;
sysInit.Structure.Td.Minimum = 20;
sysInit.Structure.Td.Maximum = 40;
```

```
opt = procestOptions('DisturbanceModel','ARMA1');
sysP1D_noise = procest(data_estimacion,sysInit,opt)
```

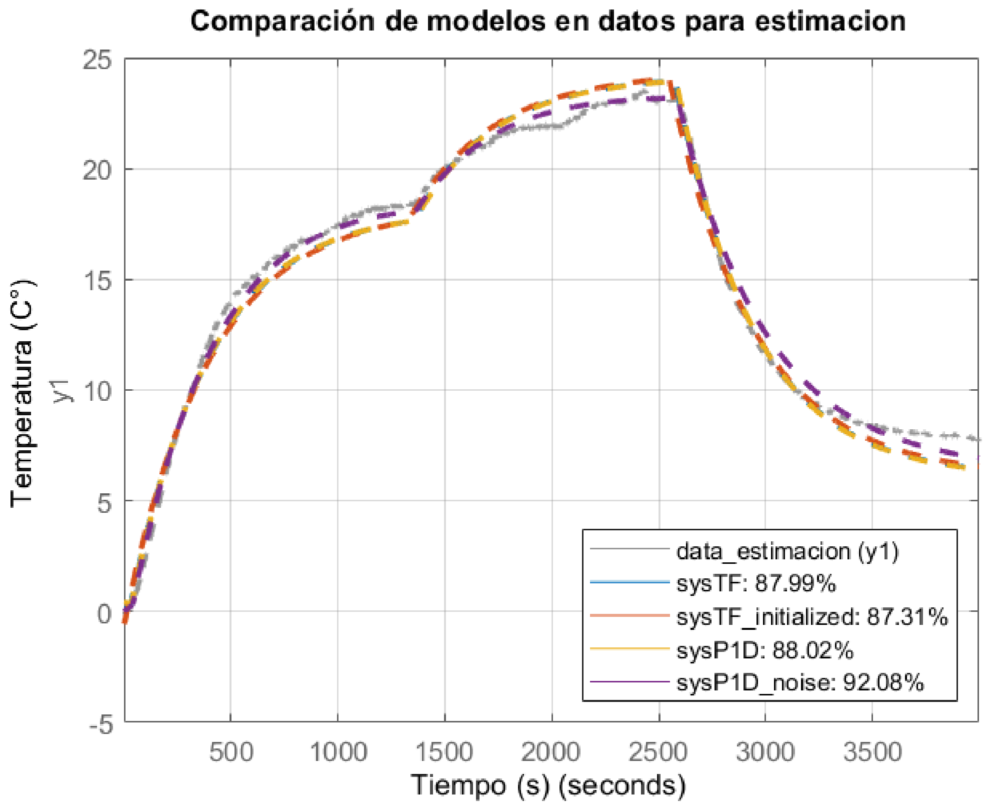
```
sysP1D_noise =
Process model with transfer function:
             Kp
  G(s) = ---------- * exp(-Td*s)
          1+Tp1*s

        Kp = 0.54643
       Tp1 = 396.46
        Td = 40

An additive ARMA disturbance model has been estimated
```

```
      y = G u + (C/D)e

      C(s) = s + 0.4258
      D(s) = s + 0.0003253

Parameterization:
    {'P1D'}
   Number of free coefficients: 5
   Use "getpvec", "getcov" for parameters and their uncertainties.

Status:
Estimated using PROCEST on time domain data "data_estimacion".
Fit to estimation data: 99.02% (prediction focus)
FPE: 0.003548, MSE: 0.003538
```

```
resid(sysP1D_noise,data_estimacion);
```



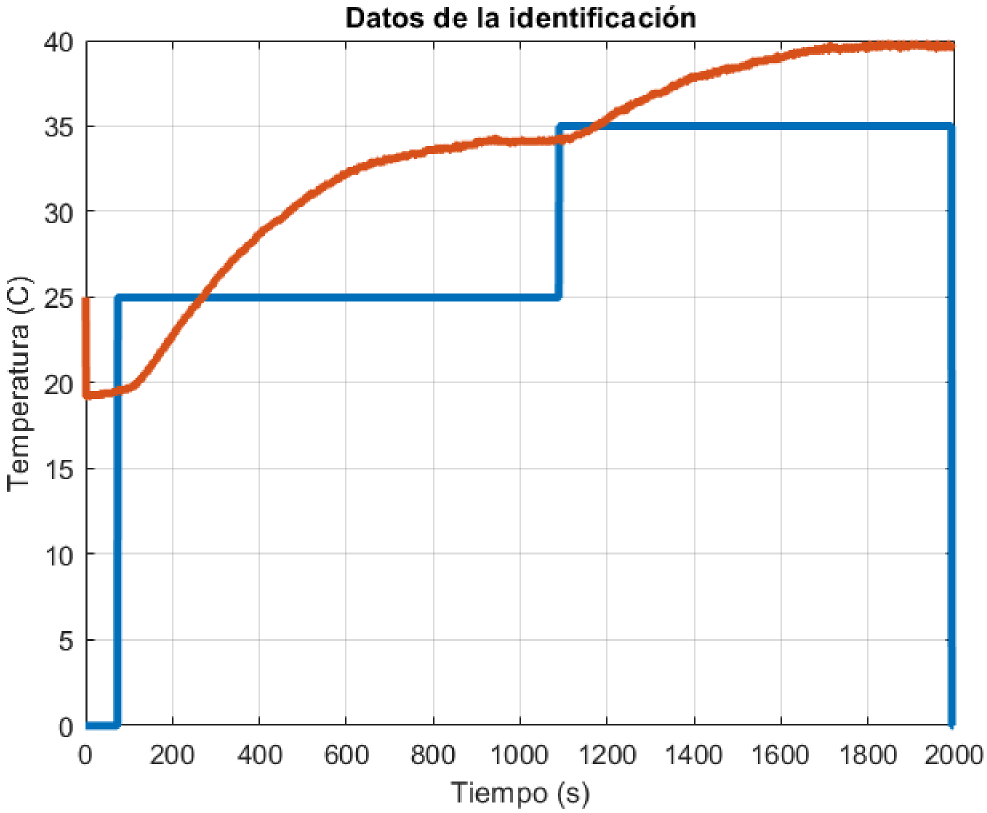
```
compare(data_estimacion, sysTF, sysTF_initialized, sysP1D, sysP1D_noise);
%set(findall(gca,'Type','Line'),'LineWidth',2);
set(findall(gca,'Type','Line'),'LineStyle','--','LineWidth',2);
xlabel('Tiempo (s)');          % Etiqueta del eje X
ylabel('Temperatura (C°)');              % Etiqueta del eje Y
title('Comparación de modelos en datos para estimacion'); % Título del gráfico
grid on
%lines = findall(gca, 'Type', 'Line'); % Encuentra todas las líneas
%set(lines(1), 'Color', 'g'); % Cambia el color de la primera línea a rojo
legend('Location', 'southeast') % Puedes cambiar 'northeast' por otra opción
saveas(gcf,'grafico2_entreno.png')
```



```
%print(gcf,'grafico','-dpdf','-r300')


% Comparar los modelos con los datos experimentales y guardar el handle
%[hFig, hLines] = compare(data, sysTF, sysTF_initialized, sysP1D, sysP1D_noise);
%grid on; hold on;

% Establecer estilos de línea para cada modelo
%set(hLines(1), 'LineStyle', '-',  'LineWidth', 2, 'Color', 'b');  % Línea continua (Datos real
%set(hLines(2), 'LineStyle', '--', 'LineWidth', 2, 'Color', 'r');  % Línea punteada larga (sysT
%set(hLines(3), 'LineStyle', '-.', 'LineWidth', 2, 'Color', 'm');  % Línea semipunteada (sysTF_
%set(hLines(4), 'LineStyle', ':',  'LineWidth', 2, 'Color', 'g');  % Línea punteada corta (sysP
%set(hLines(5), 'LineStyle', '--', 'LineWidth', 2, 'Color', 'k');  % Línea punteada larga (sysP

% Mejorar la apariencia
%set(gca, 'FontSize', 14, 'FontWeight', 'bold');
%xlabel('Tiempo (s)', 'FontSize', 16, 'FontWeight', 'bold');
%ylabel('Amplitud', 'FontSize', 16, 'FontWeight', 'bold');
%title('Comparación de Respuestas Simuladas', 'FontSize', 16, 'FontWeight', 'bold');

% Ajustar leyenda
%legend({'Datos experimentales', 'sysTF', 'sysTF_initialized', 'sysP1D', 'sysP1D_noise'}, ...
%        'Location', 'Best', 'FontSize', 12);

%hold off;
```

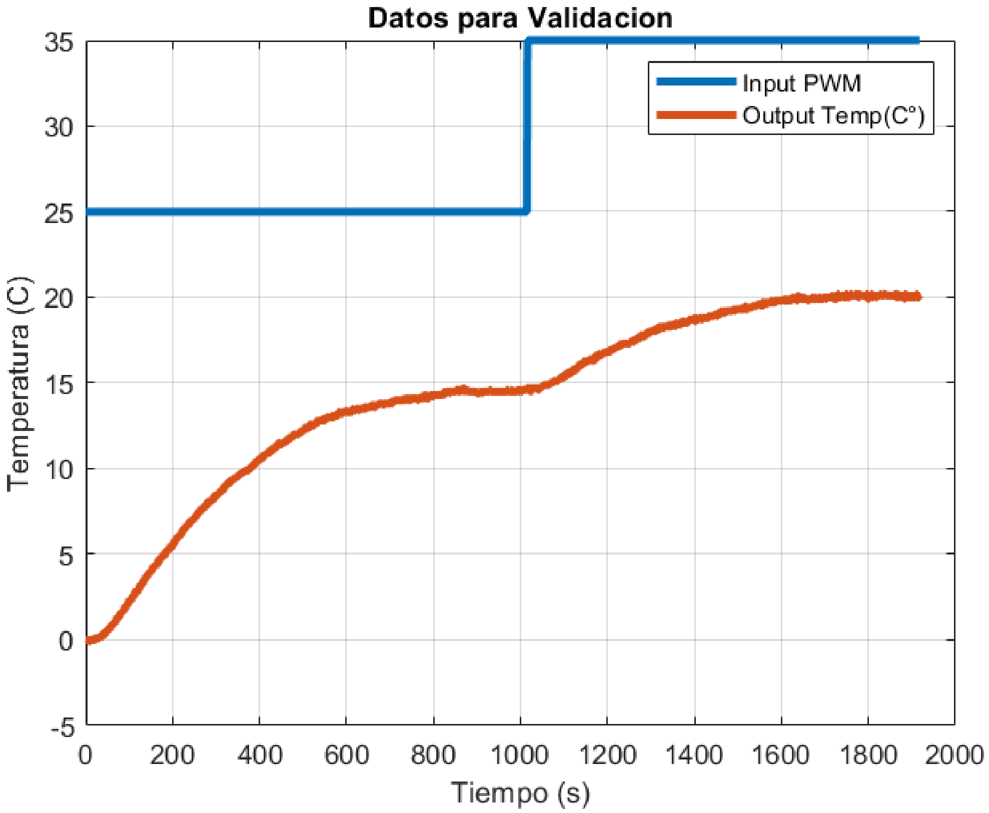
ETAPA DE VALIDACION:

```
load('systemIdentification_pr3.mat');
plot(ts,us,ts,ys,'linewidth',3),grid;
title('Datos de la identificación');
xlabel('Tiempo (s)');
ylabel('Temperatura (C)');
```



```
b1=25;
b2=35;

i=1;
while(us(i)<b1)
    i=i+1;
end
x1_start=i;
while(us(i)==b1)
    i=i+1;
end
x1_end=i-1;
while(us(i)<b2)
    i=i+1;
end
x2_start=i;
while(us(i)==b2)
    i=i+1;
end
```

```
x2_end=i-1;

ur=us(x1_start:x2_end)';
yr=ys(x1_start:x2_end)';
tr=ts(x1_start:x2_end)';

ut=ur-us(1);
yt=yr-yr(2);
tt=tr-tr(1);

%Graficar escalon Trasladado
figure(2)
plot(tt,ut,tt,yt,'linewidth',3),grid
title('Datos para Validacion')
xlabel('Tiempo (s)')
ylabel('Temperatura (C)')
legend('Input PWM','Output Temp(C°)')
saveas(gcf,'grafico1_validez.png')
```

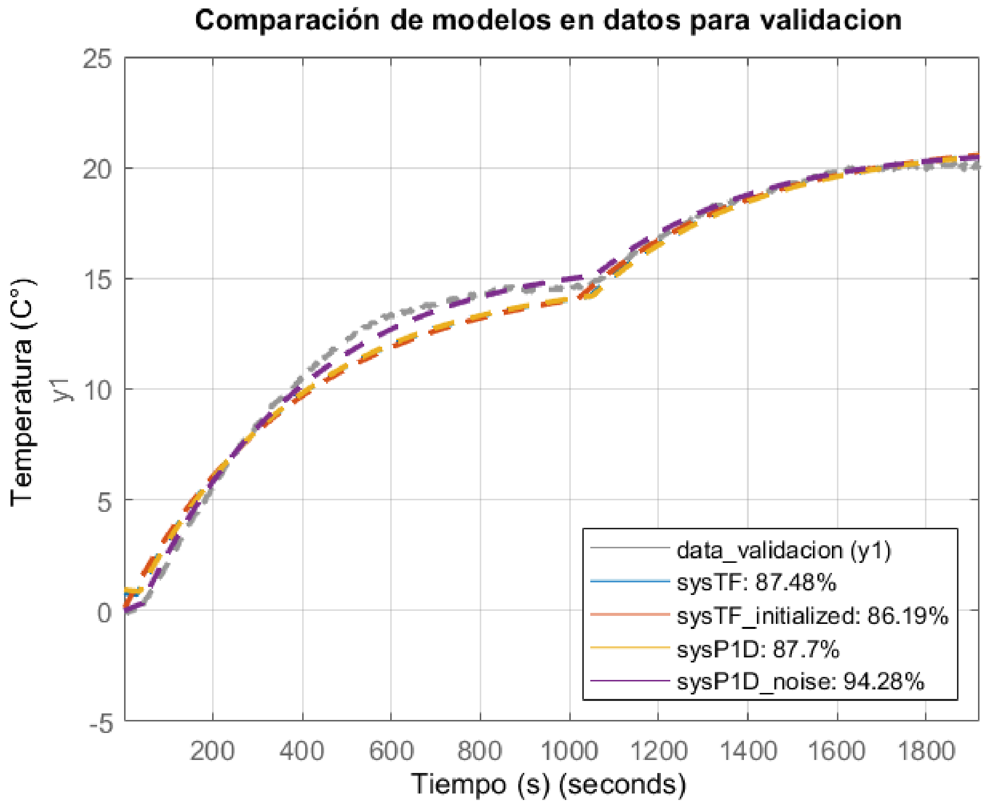


```
data_validacion = iddata(yt,ut,1)
```

```
data_validacion =

Time domain data set with 1919 samples.
Sample time: 1 seconds

Outputs      Unit (if specified)
   y1
```

```
Inputs       Unit (if specified)
   u1
```

```
clf
% Comparación de modelos y obtención de los manejadores de gráficos
compare(data_validacion, sysTF, sysTF_initialized, sysP1D, sysP1D_noise);
set(findall(gca,'Type','Line'),'LineStyle','--','LineWidth',2);
xlabel('Tiempo (s)');          % Etiqueta del eje X
ylabel('Temperatura (C°)');            % Etiqueta del eje Y
title('Comparación de modelos en datos para validacion'); % Título del gráfico
legend('Location', 'southeast')
grid on
saveas(gcf,'grafico2_validez.png')
```


Comparación de modelos en datos para validacion
Temperatura (C°)
y1
Tiempo (s) (seconds)
data_validacion (y1)
sysTF: 87.48%
sysTF_initialized: 86.19%
sysP1D: 87.7%
sysP1D_noise: 94.28%