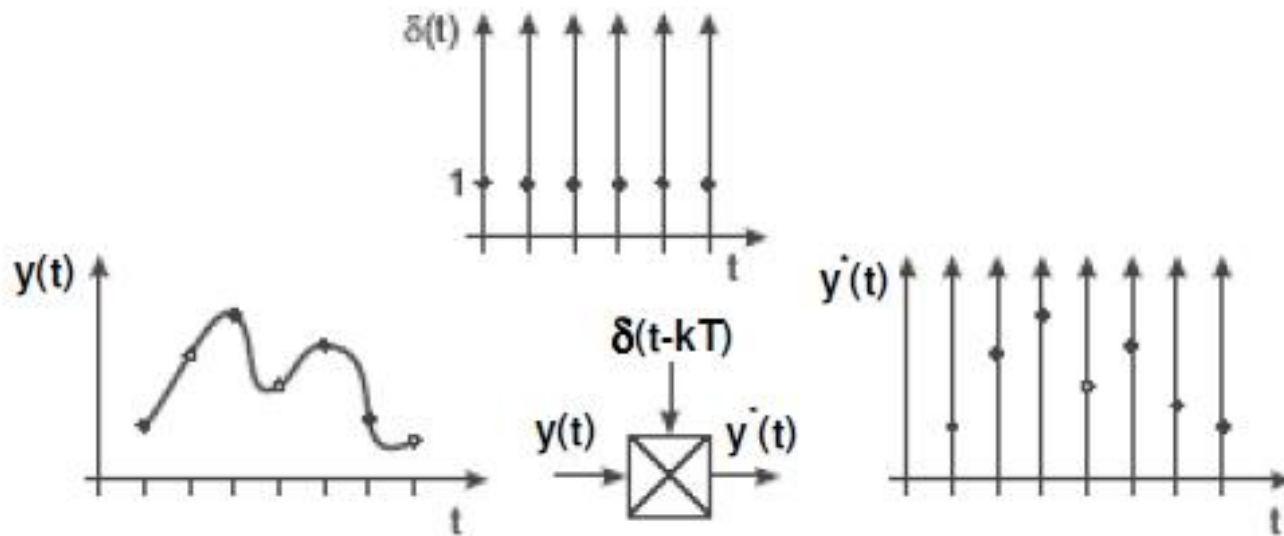




# TECNICAS DIGITALES III

# Conversor AD

$$y(t) \cdot \sum_{k=-\infty}^{\infty} \delta(t-kT) = y^*(t)$$

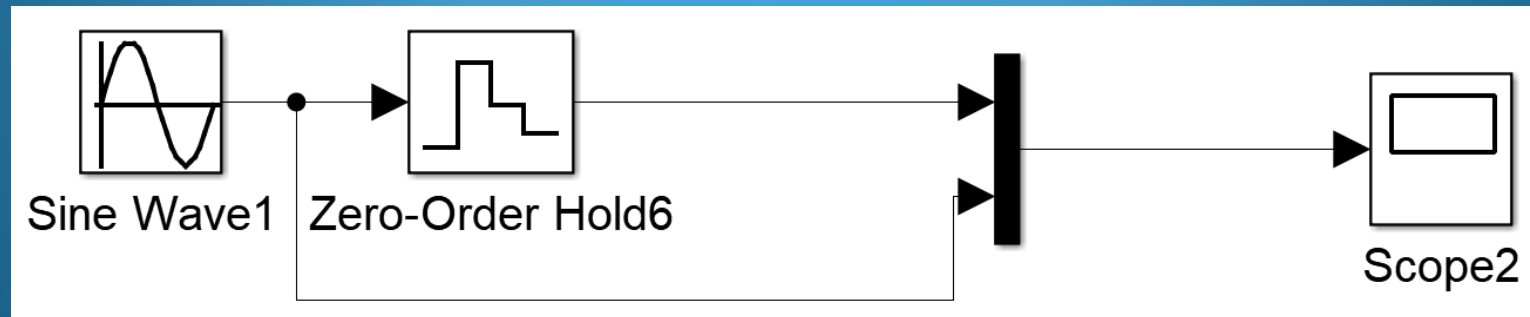


Modelo gráfico de un convertidor A/D.

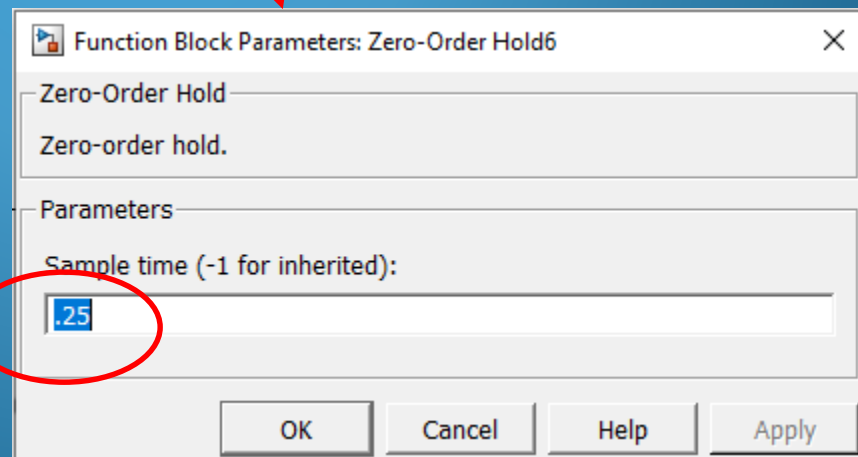
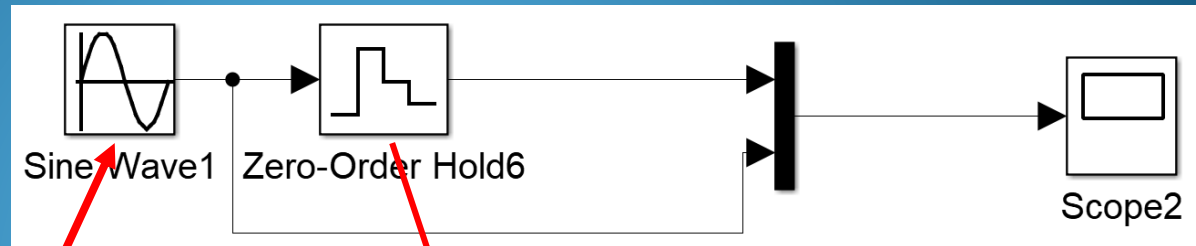
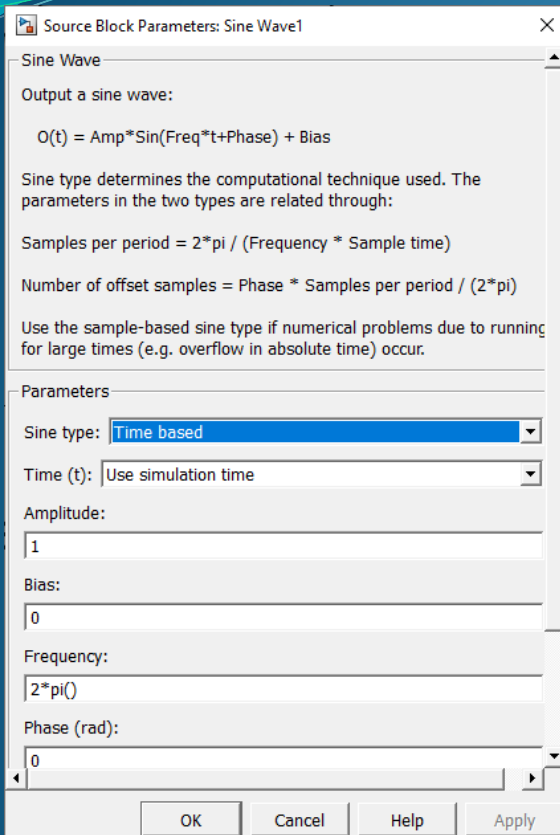
# Conversión AD Y DA

Muestreo: Es la conversión de una señal en tiempo continuo, a una señal en tiempo discreto, obtenida tomando muestras de la señal de tiempo continuo en instantes de tiempo discreto.

$$x_a(t) \rightarrow x_a(nT) \rightarrow x(n)$$

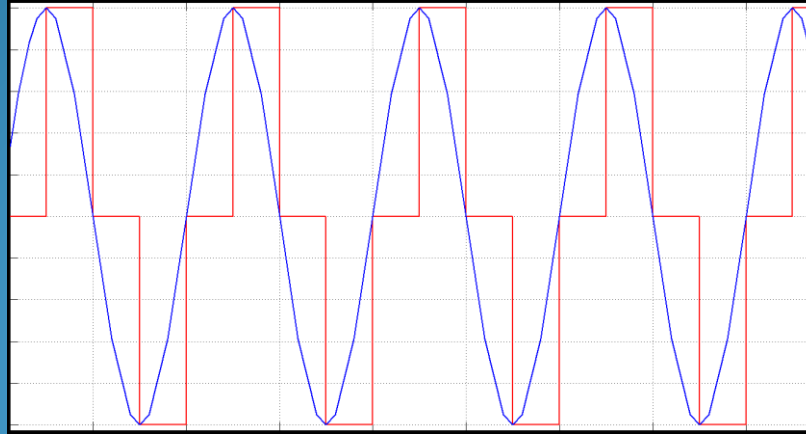


# Conversión AD Y DA

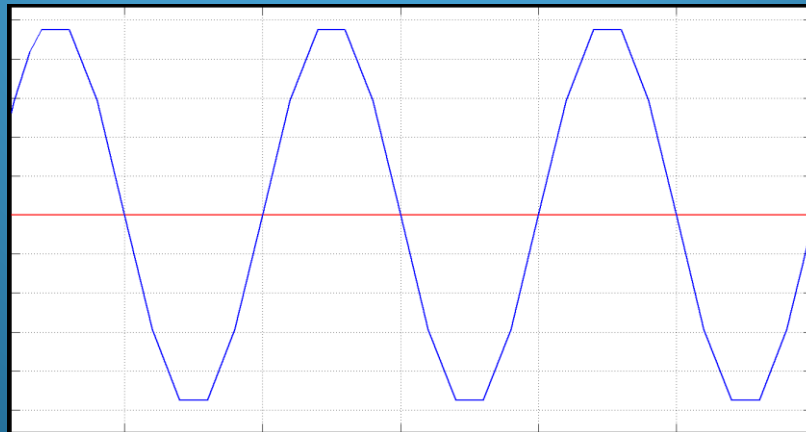


# Conversión AD Y DA

Tiempo de muestreo 0.25 seg

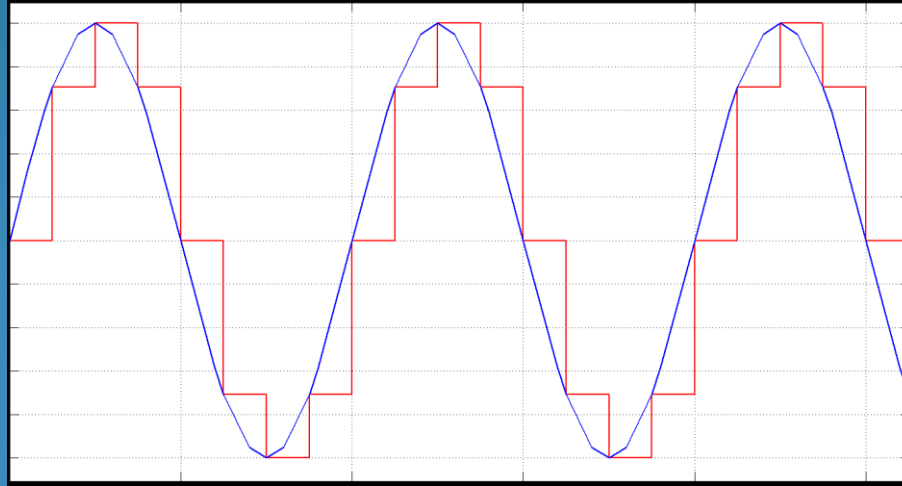


Tiempo de muestreo 0.5 seg

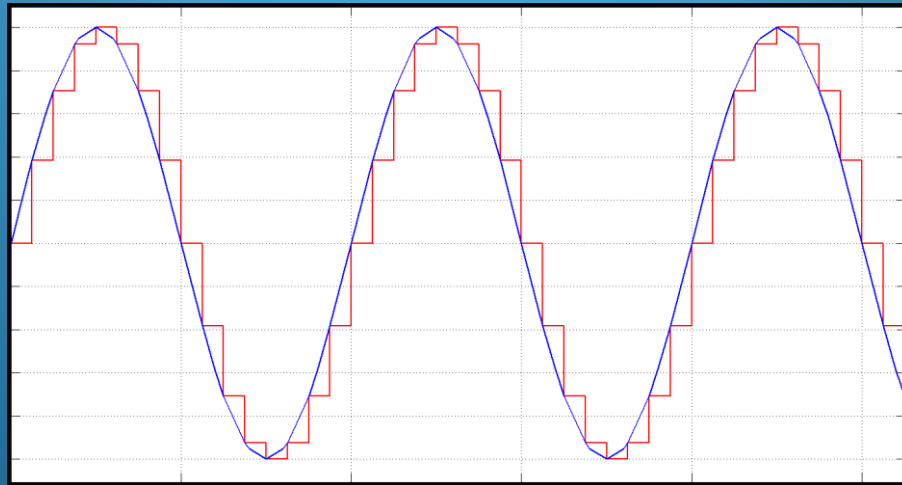


# Conversión AD Y DA

Tiempo de muestreo 0.125 seg

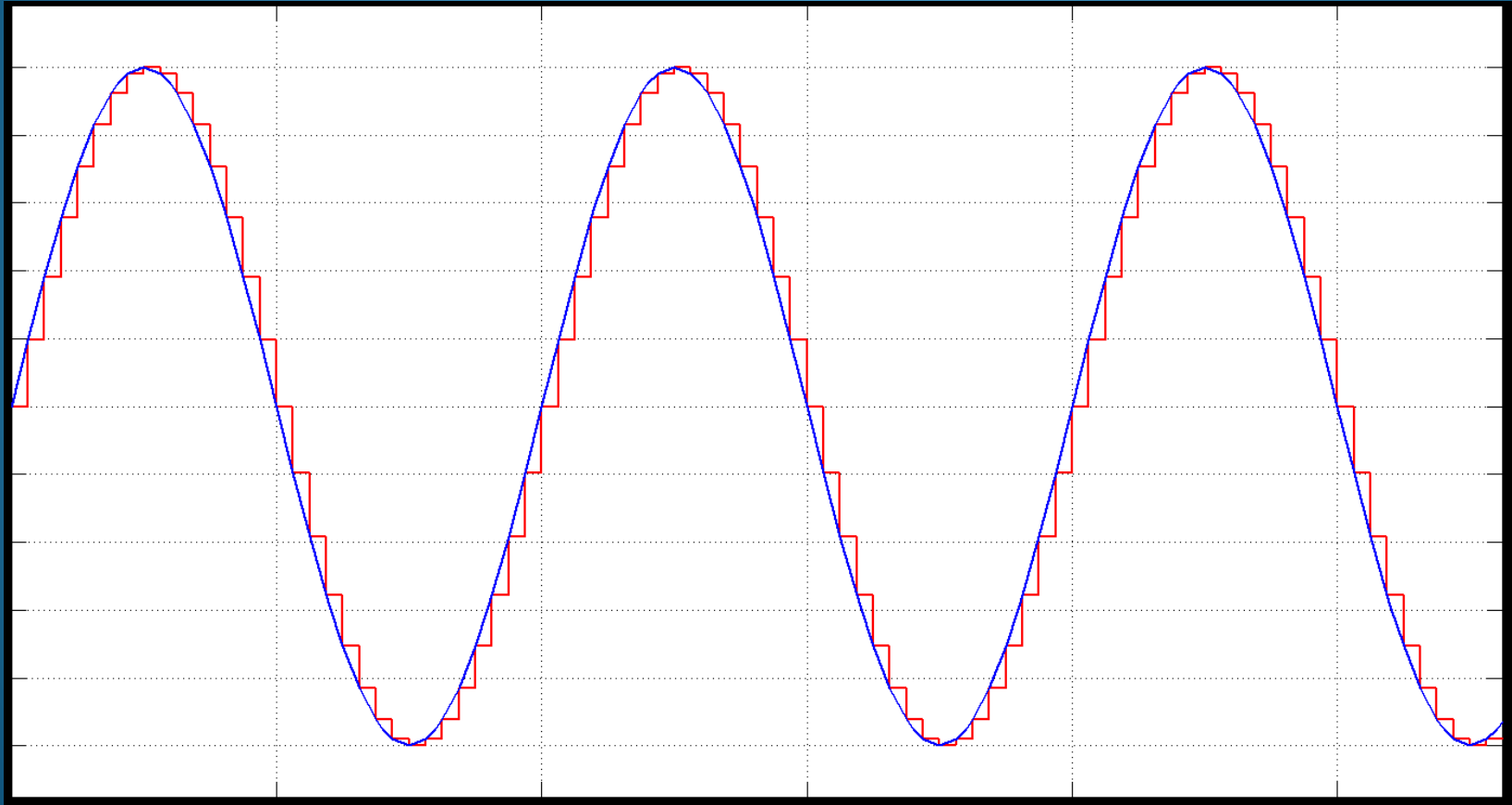


Tiempo de muestreo (0.125 / 2) seg



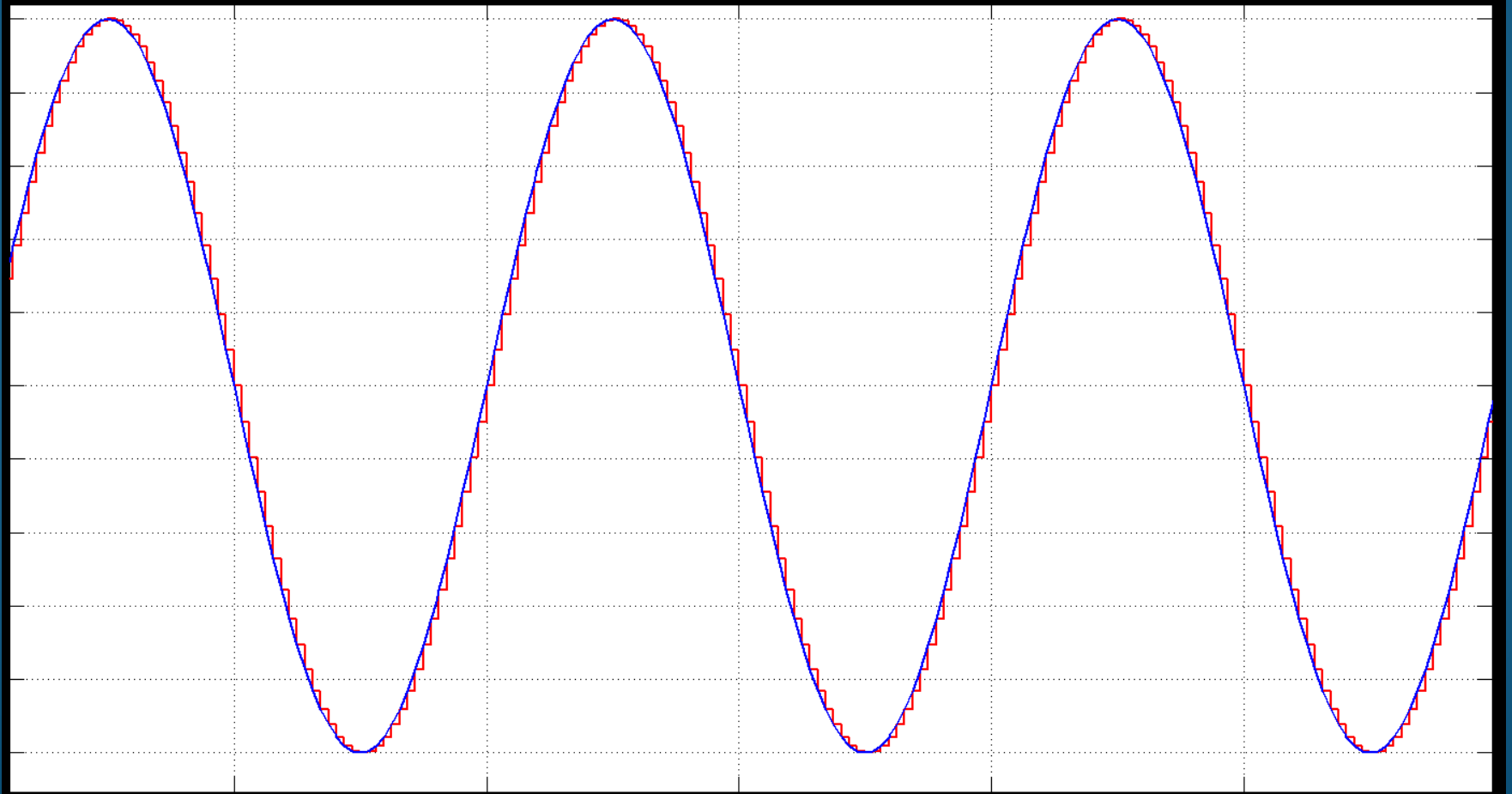
# Conversión AD Y DA

Tiempo de muestreo (0.125/4) seg



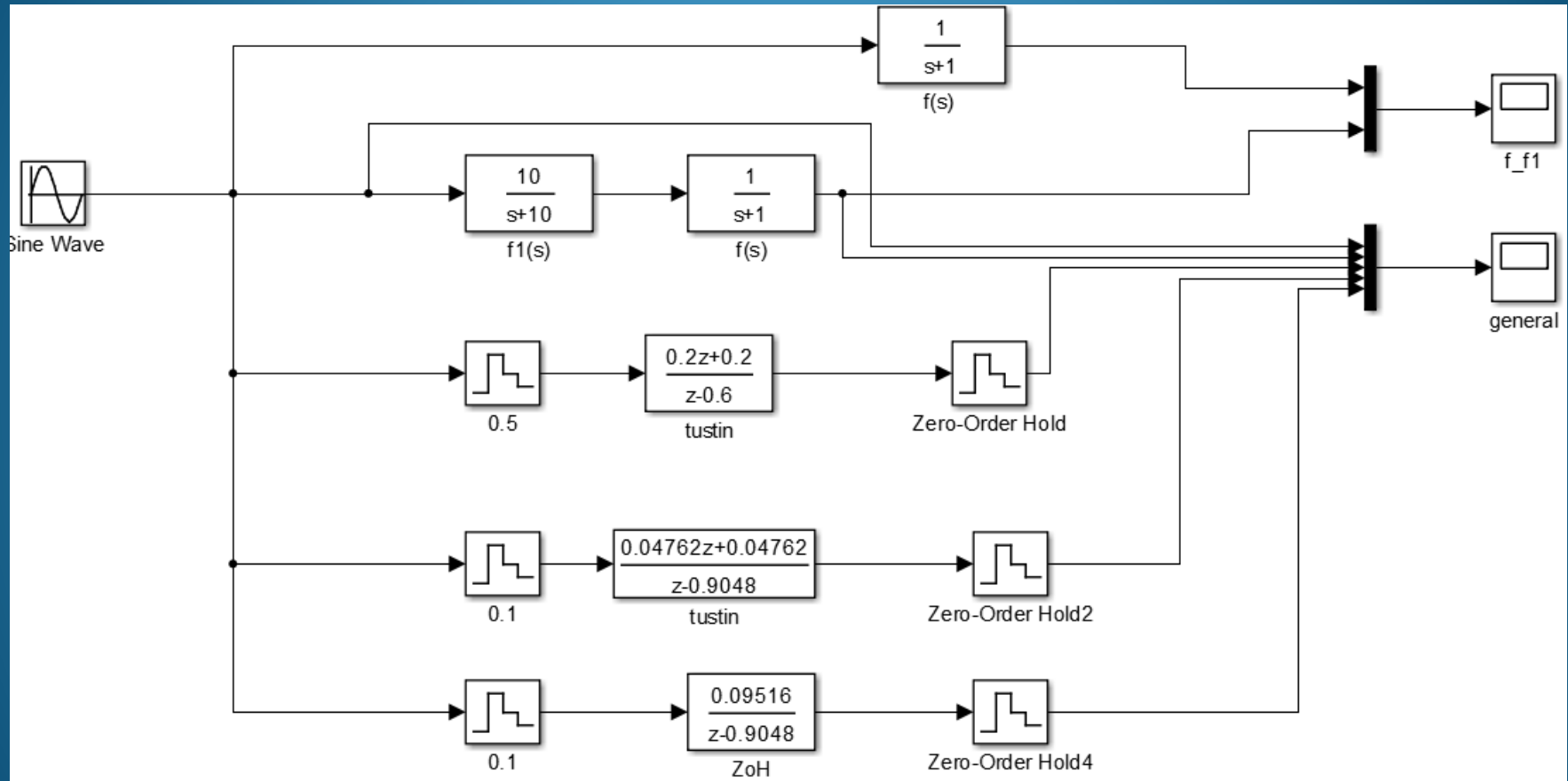
# Conversión AD Y DA

Tiempo de muestreo (0.125 / 8) seg

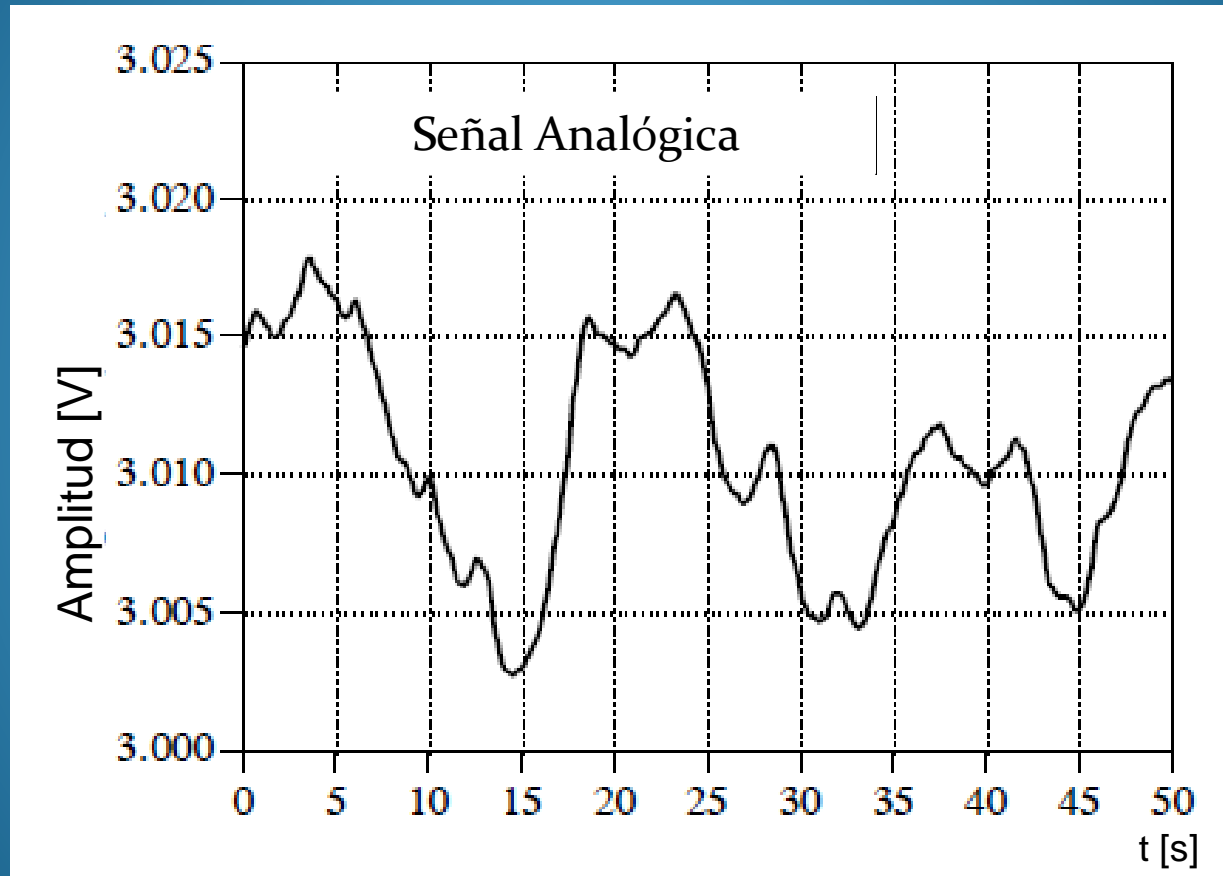




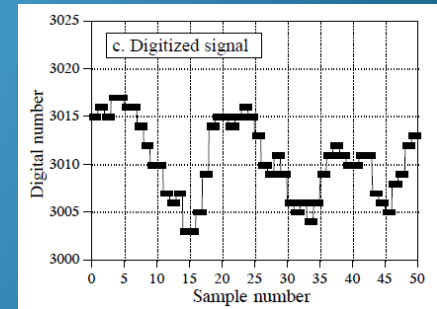
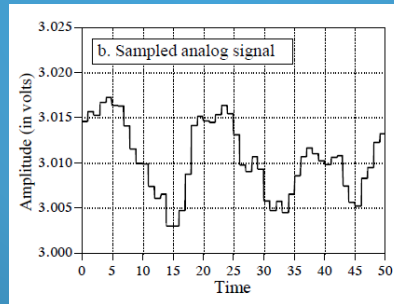
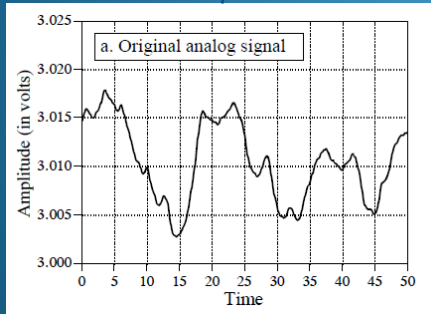
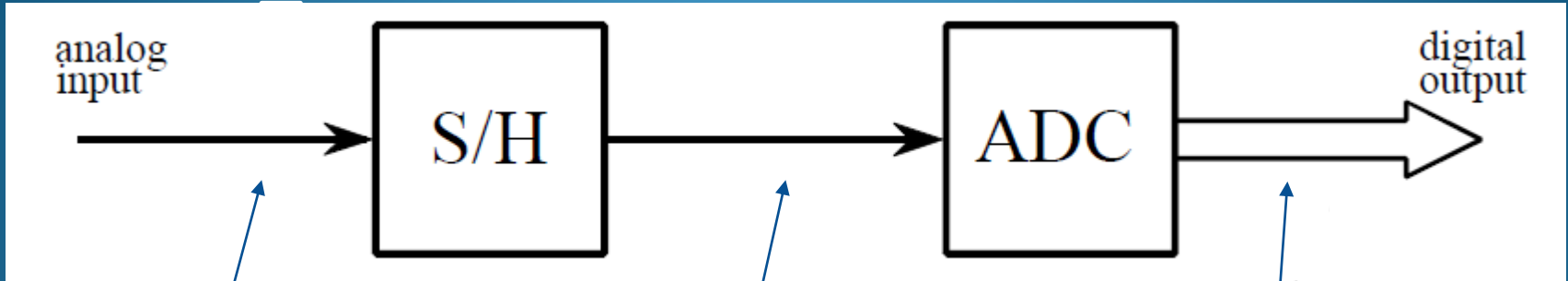
# Digitalización de sistemas



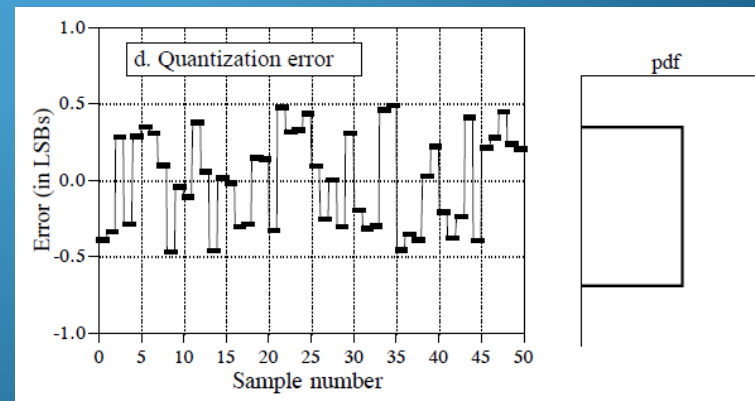
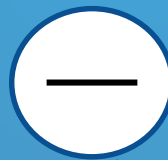
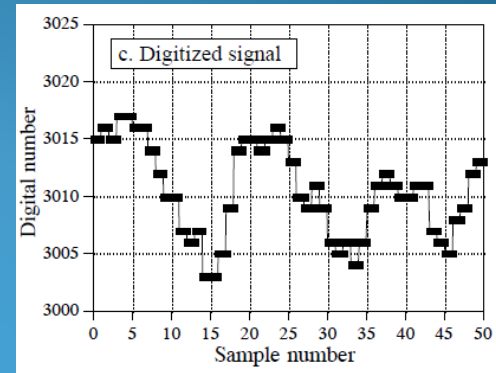
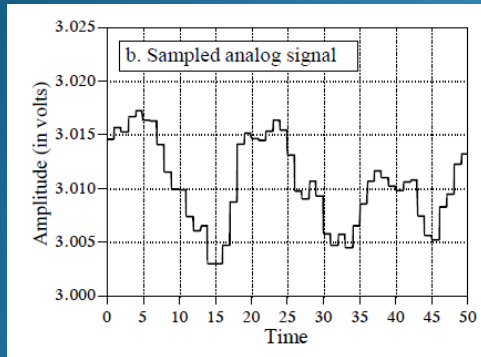
# Conversor Analógico Digital



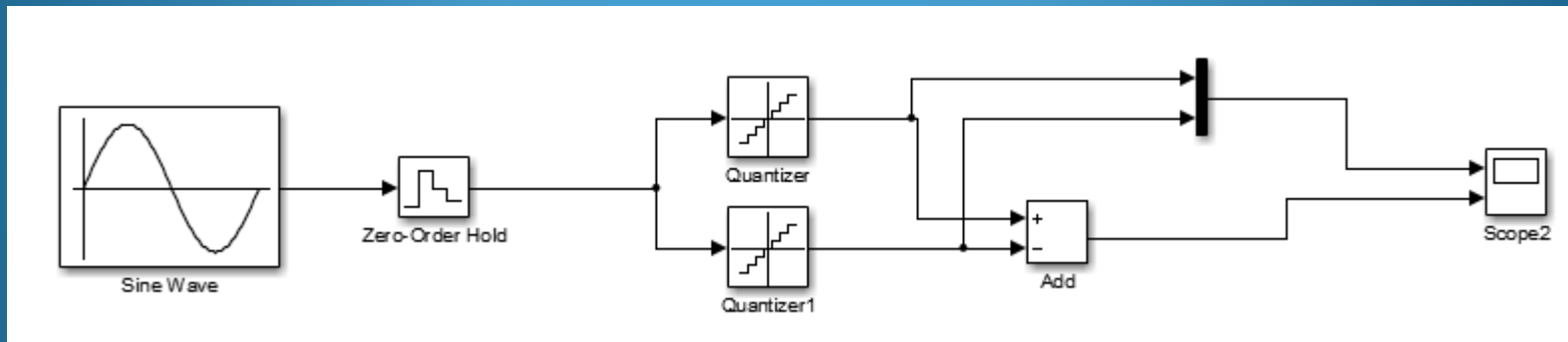
# Conversor AD




# Conversor Analógico Digital



# Conversor AD



 Source Block Parameters: Sine Wave

Sine Wave

Output a sine wave:

$$O(t) = \text{Amp} * \sin(\text{Freq} * t + \text{Phase}) + \text{Bias}$$

Sine type determines the computational technique used. The parameters in the two types are related through:

Samples per period =  $2 * \pi / (\text{Frequency} * \text{Sample time})$

Number of offset samples =  $\text{Phase} * \text{Samples per period} / (2 * \pi)$

Use the sample-based sine type if numerical problems due to running for large times (e.g. overflow in absolute time) occur.

Parameters

Sine type:

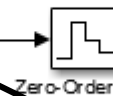
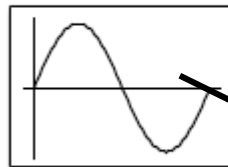
Time (t):

Amplitude:

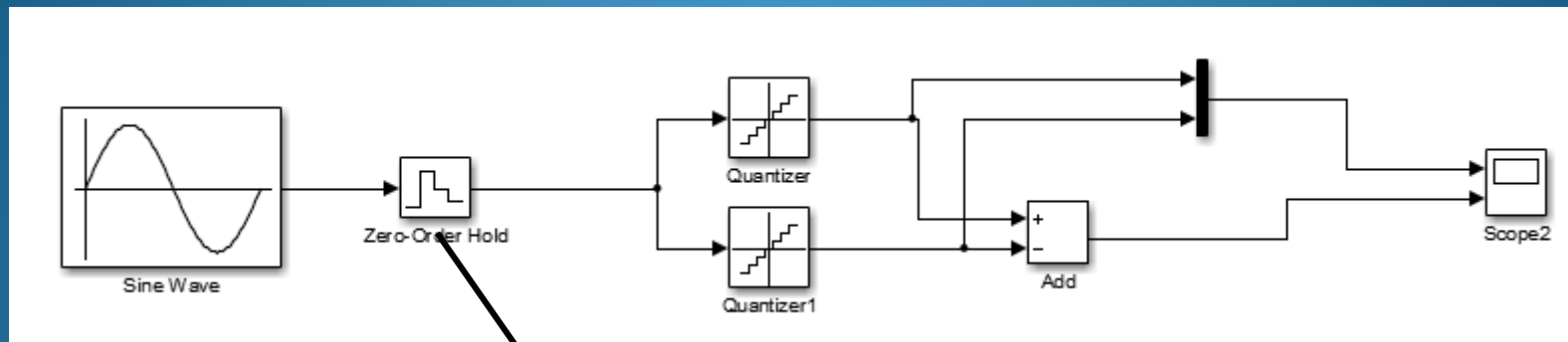
Bias:

Frequency:

Phase (rad):



# Conversor AD



Function Block Parameters: Zero-Order Hold

Zero-Order Hold

Zero-order hold.

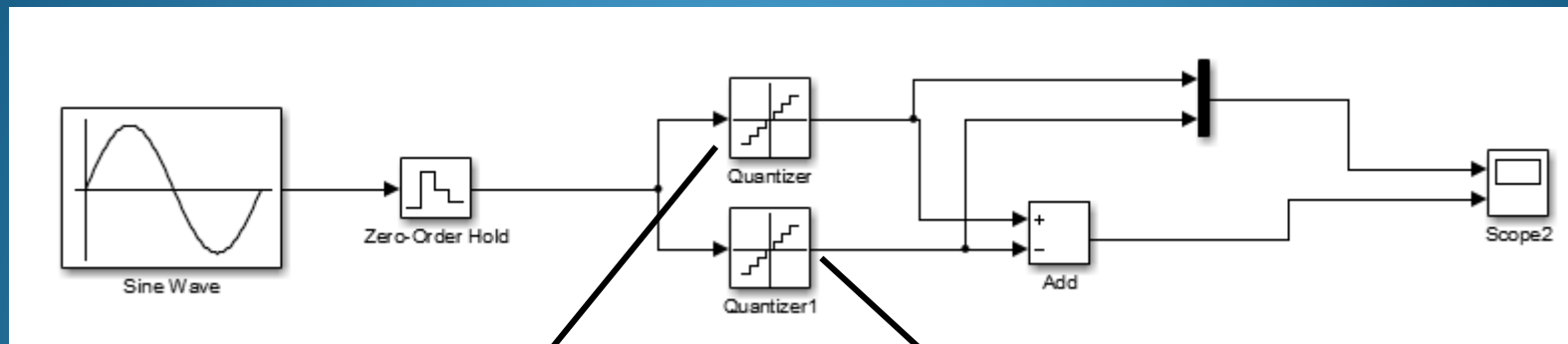
Parameters

Sample time (-1 for inherited):

0.1

OK Cancel Help Apply

# Conversor AD



Function Block Parameters: Quantizer

Quantizer

Discretize input at given interval.

Parameters

Quantization interval:

0.0195

☐ Treat as gain when linearizing

Sample time (-1 for inherited):

-1

OK Cancel Help Apply

Function Block Parameters: Quantizer1

Quantizer

Discretize input at given interval.

Parameters

Quantization interval:

0.0012

☐ Treat as gain when linearizing

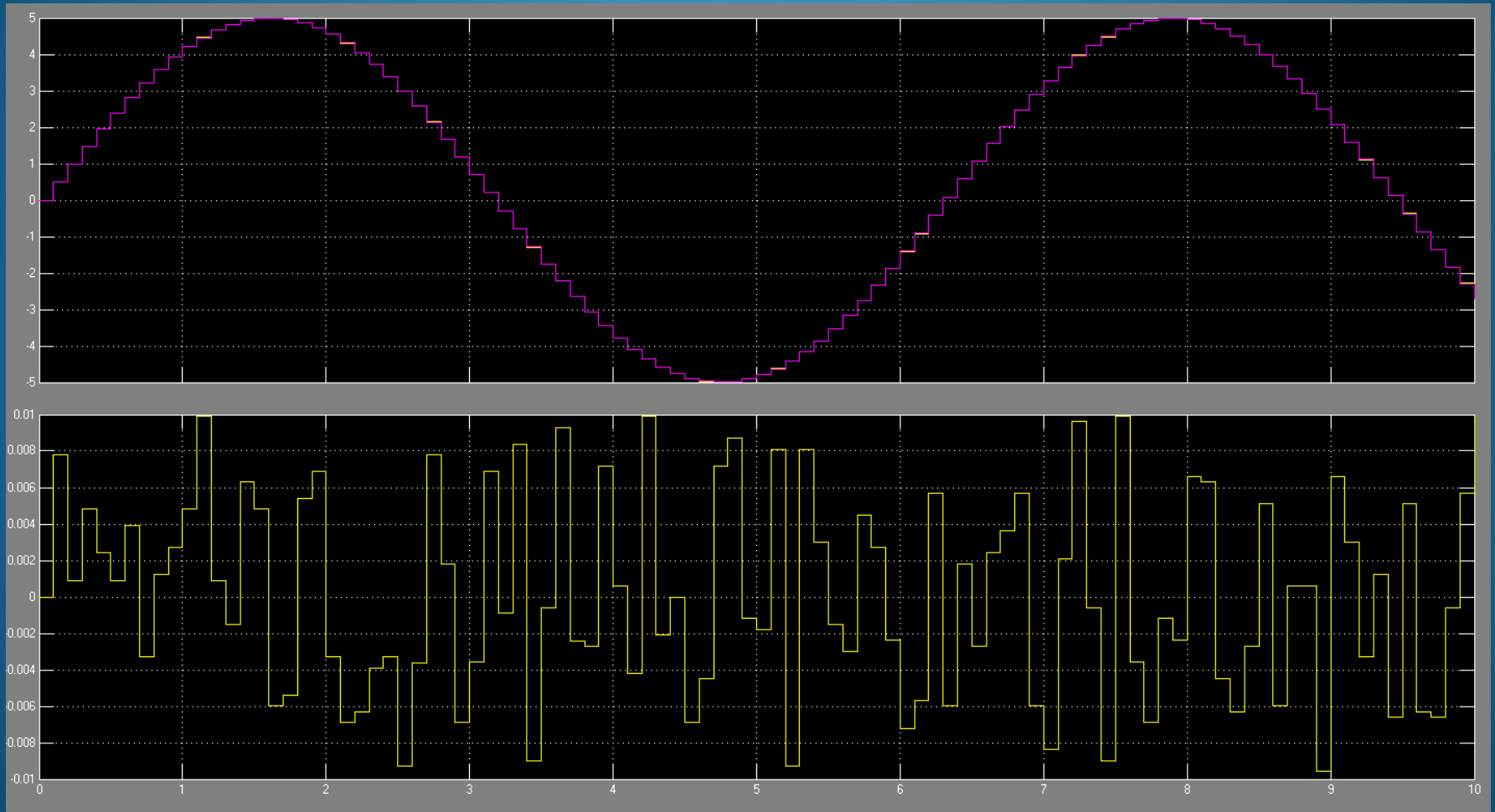
Sample time (-1 for inherited):

-1

OK Cancel Help Apply

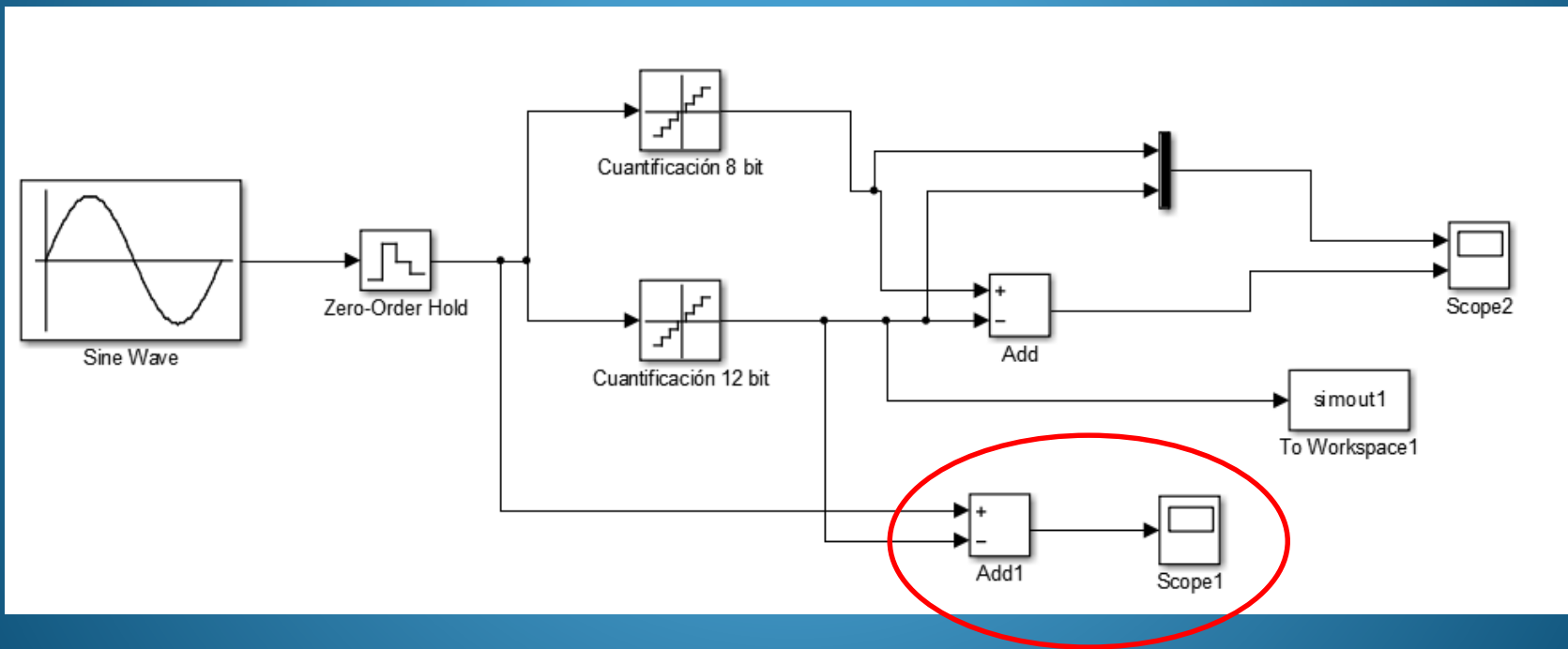


# Conversor AD



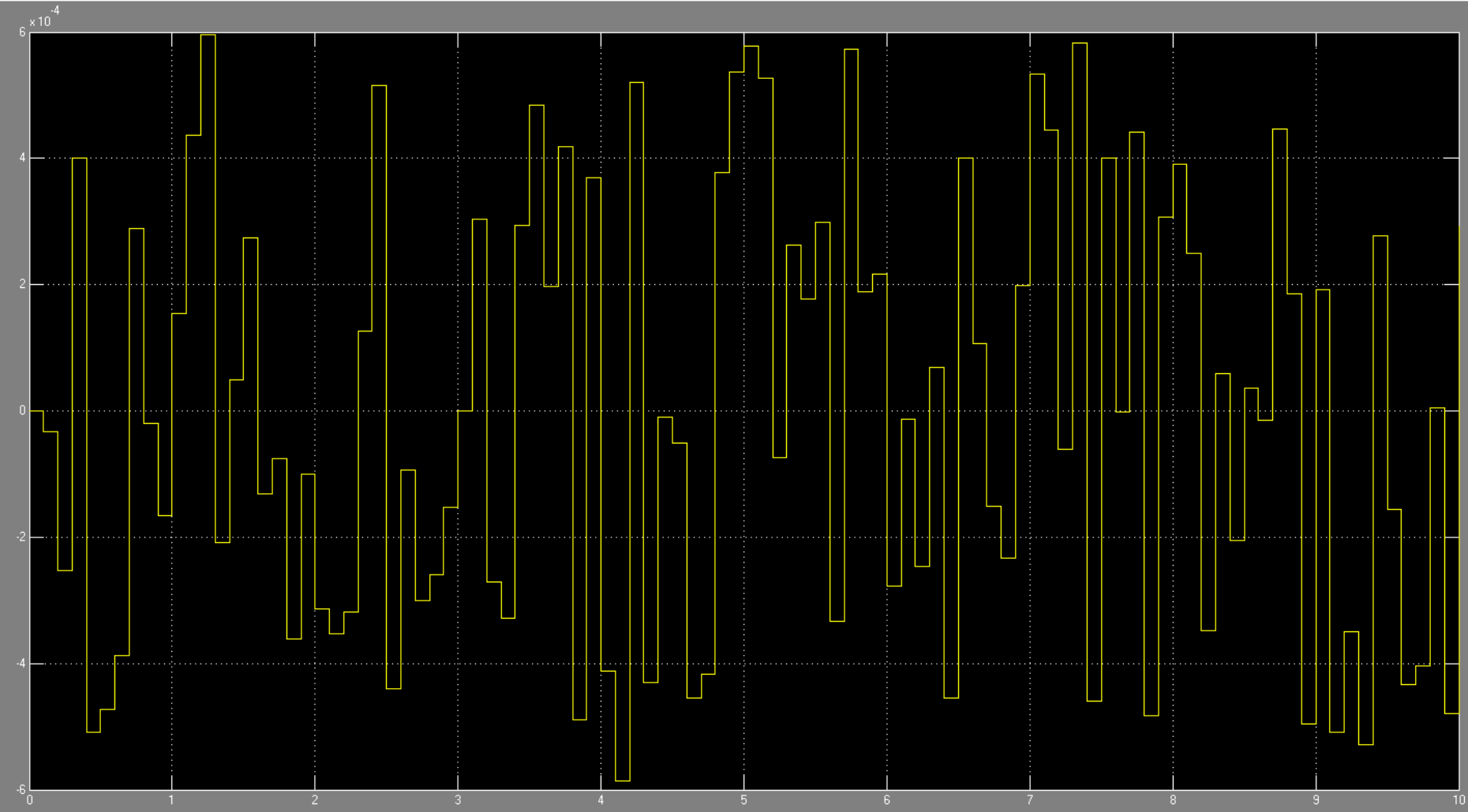
# Error de cuantificación 12 bit

Para una señal de 5V el paso es de 0,0012V o 1.2mV.

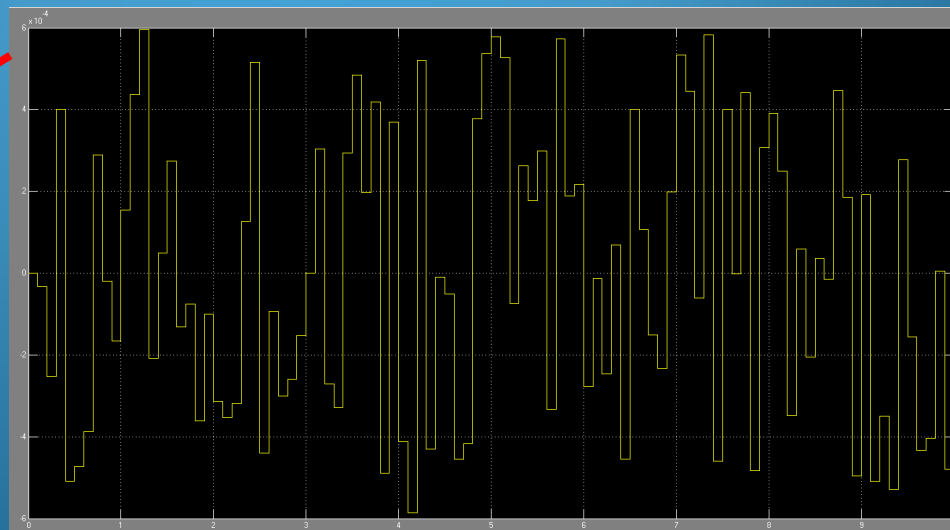
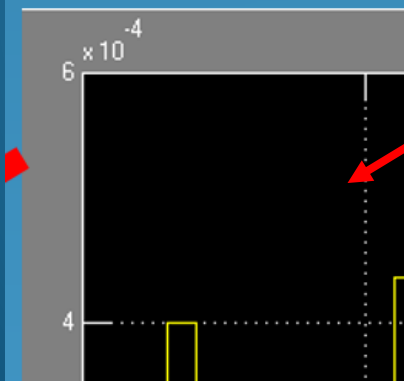
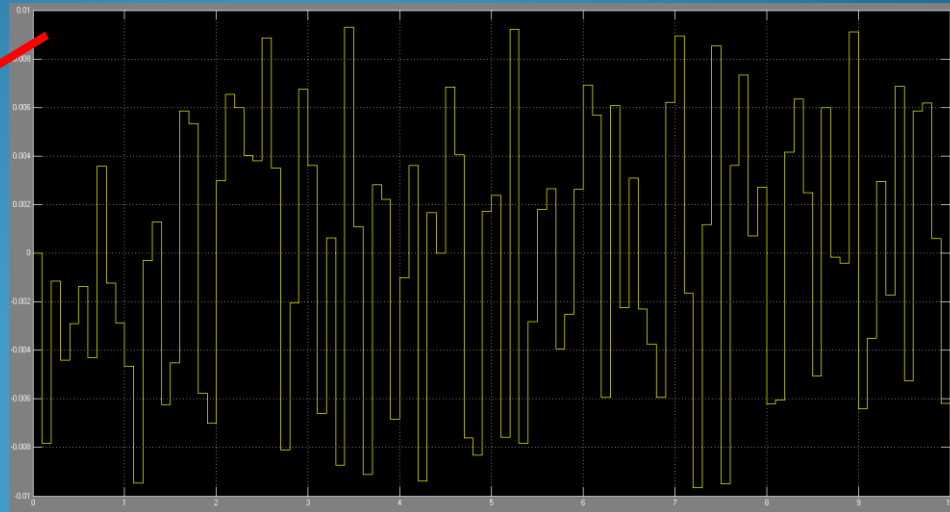
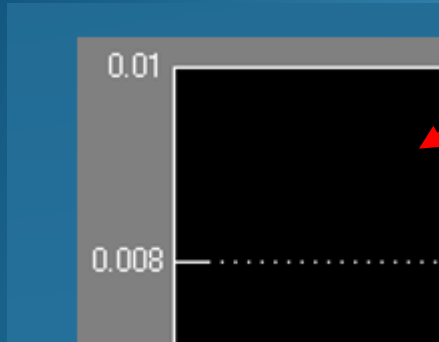


# Error para cuantificación de 12 bits

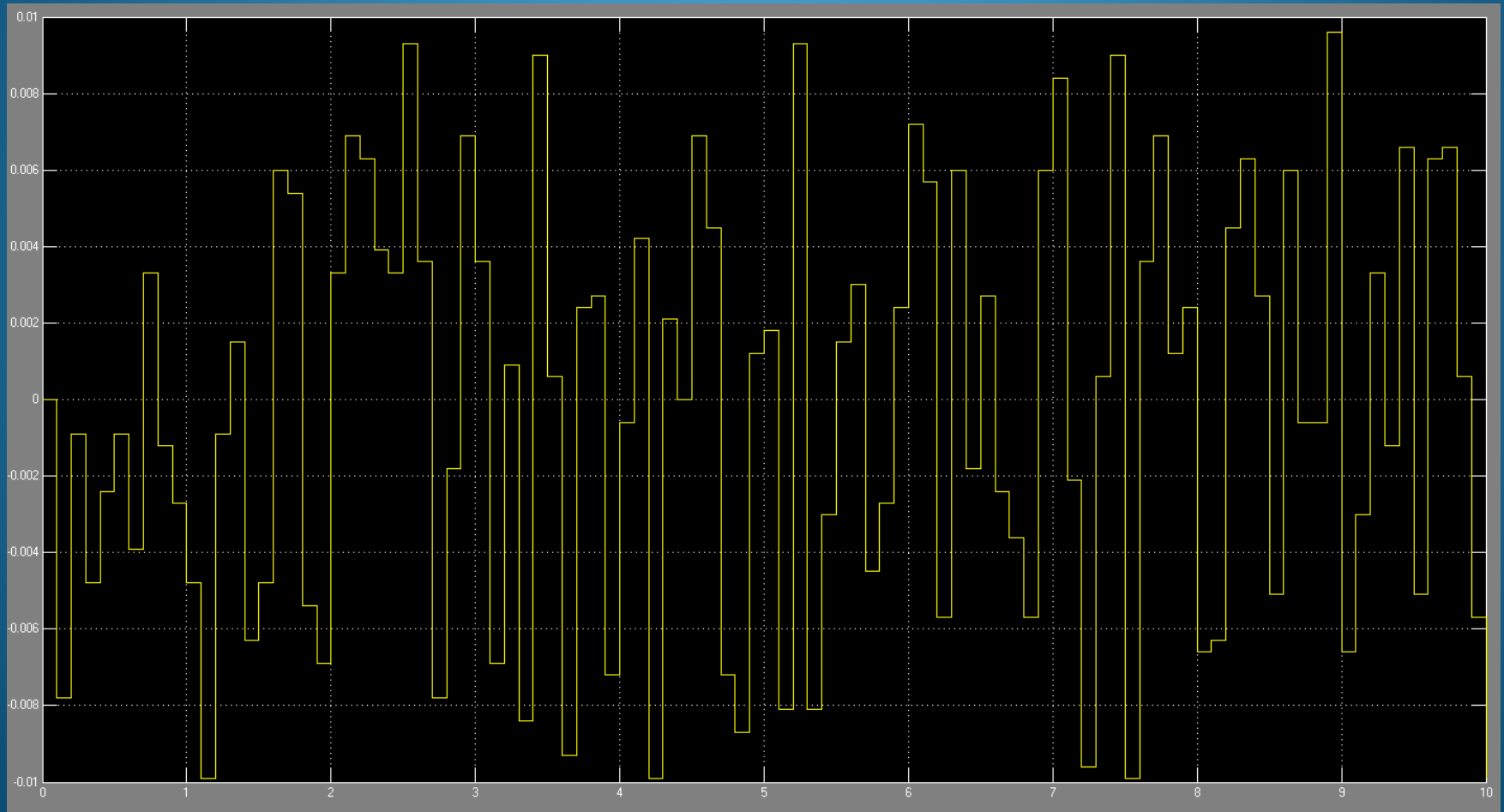
El error se presenta como un ruido blanco



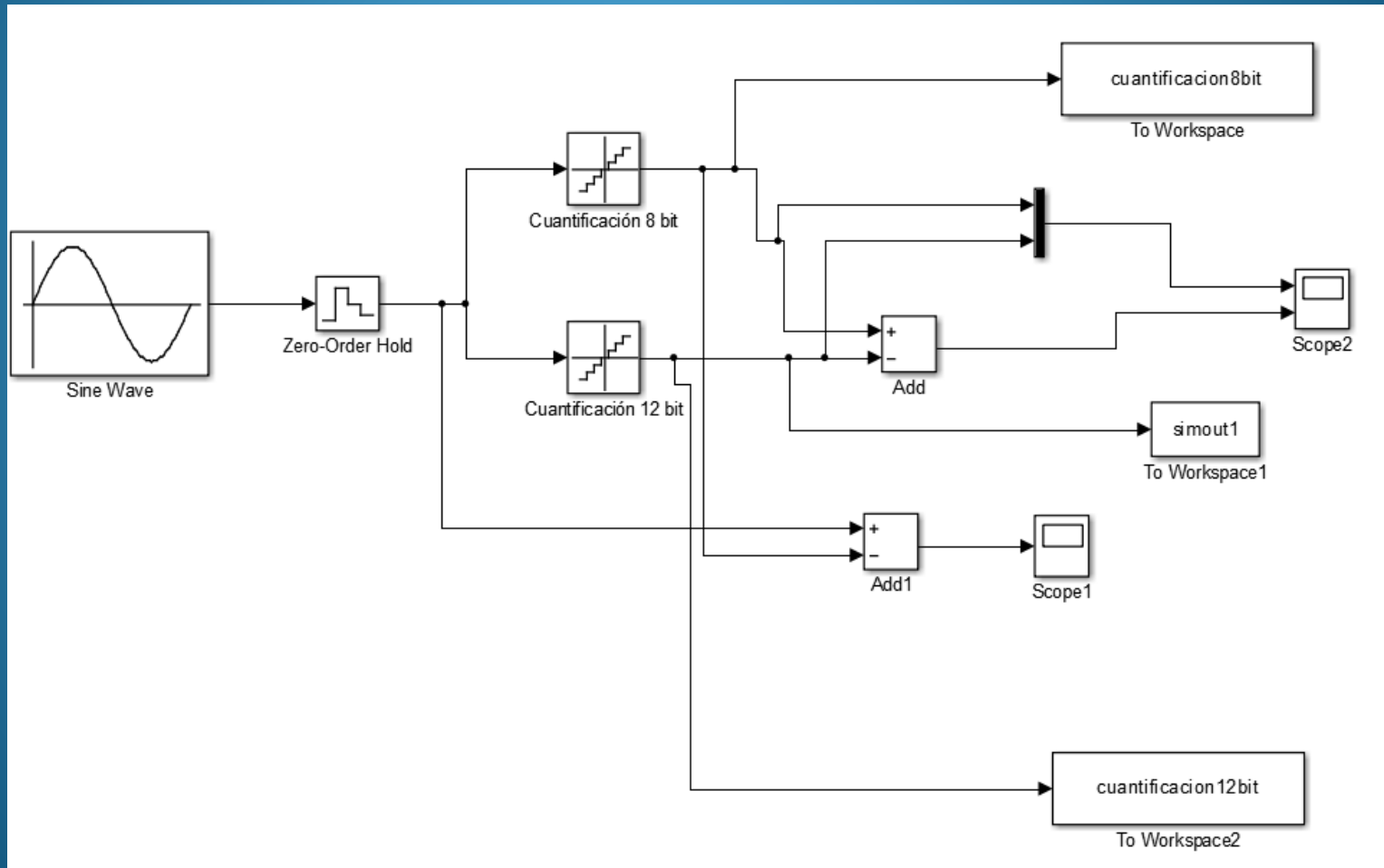
# Error para cuantificación de 8 bits



# Diferencia entre los errores de cuantificación



# Valores numéricos de la cuantificación



# Valores numéricos de la

**Sink Block Parameters: To Workspace**

**To Workspace**

Write input to specified timeseries, array, or structure in a workspace. For menu-based simulation, data is written in the MATLAB base workspace. Data is not available until the simulation is stopped or paused. For command-line simulation using the `sim` command, the workspace is specified using `DstWorkspace` field in the option structure.

To log a bus signal, use "Timeseries" save format.

**Parameters**

Variable name:

Limit data points to last:

Decimation:

Sample time (-1 for inherited):

Save format:

☐ Log fixed-point data as a fi object

**OK** **Cancel** **Help** **Apply**

**Sine Wave**

**cuantificacion8bit**  
To Workspace

**Scope2**

**simout1**  
To Workspace1

**Scope1**

**cuantificacion12bit**  
To Workspace2

# Valores numéricos de la cuantificación

The image shows the MATLAB R2012b interface. The 'Variables' window is open, displaying the 'cuantificacion8bit' variable as a 1x1 double timeseries. The 'Time series name' field is empty. The 'Time' and 'Data:1' columns are visible, showing values from 0 to 0.9000. The 'Command Window' displays a warning message: 'Warning: The model 'untitled' does not have continuous states, hence Simulink is using the solver 'VariableStepDiscrete' instead of solver 'ode45'. You can disable this diagnostic by explicitly specifying a discrete solver in the solver tab of the Configuration Parameters dialog, or by setting the 'Automatic solver parameter selection' diagnostic to 'none' in the Diagnostics tab of the Configuration Parameters dialog.'

Current Folder: untitled.mdl.autosave

Variables - cuantificacion8bit

cuantificacion8bit <1x1 double timeseries>

Time series name:

Time	Data:1
0	0
0.1000	0.5070
0.2000	0.9945
0.3000	1.4820
0.4000	1.9500
0.5000	2.3985
0.6000	2.8275
0.7000	3.2175
0.8000	3.5880
0.9000	3.9195

☐ Show event table

Current time: uniform 0 to 10 seconds

Attributes... Add Row Delete Rows Uniform Time Vector...

Command Window

New to MATLAB? Watch this [Video](#), see [Examples](#), or read [Getting Started](#).

Warning: The model 'untitled' does not have continuous states, hence Simulink is using the solver 'VariableStepDiscrete' instead of solver 'ode45'. You can disable this diagnostic by explicitly specifying a discrete solver in the solver tab of the Configuration Parameters dialog, or by setting the 'Automatic solver parameter selection' diagnostic to 'none' in the Diagnostics tab of the Configuration Parameters dialog

Workspace

Name	Value	Min
cuantificacion12bit	<1x1 double timeseri...>	-4.999
cuantificacion8bit	<1x1 double timeseri...>	-4.992
simout1	<1x1 double timeseri...>	-4.999
tout	<101x1 double>	0

Command History

```
%-- 15/6/2022 17:16 --%  
digitalization  
simulink  
digitalization  
simulink  
%-- 28/7/2022 15:34 --%  
simulink  
plot(prueba)  
grid on  
hold  
plot(prueba)  
grid on  
hold  
plot(prueba,'red')  
%-- 3/8/2022 21:24 --%  
simulink
```

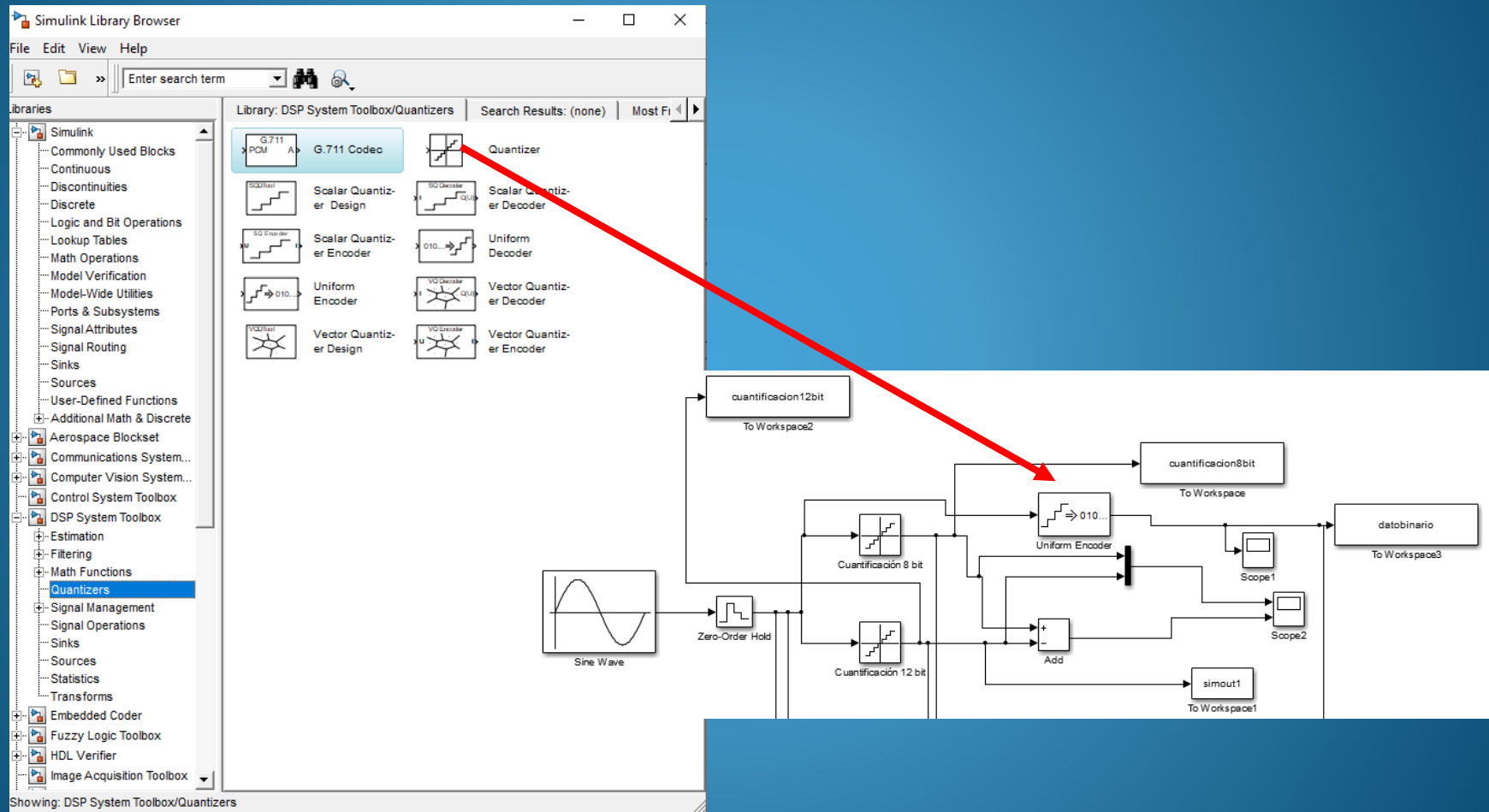


# Valores numéricos de la cuantificación

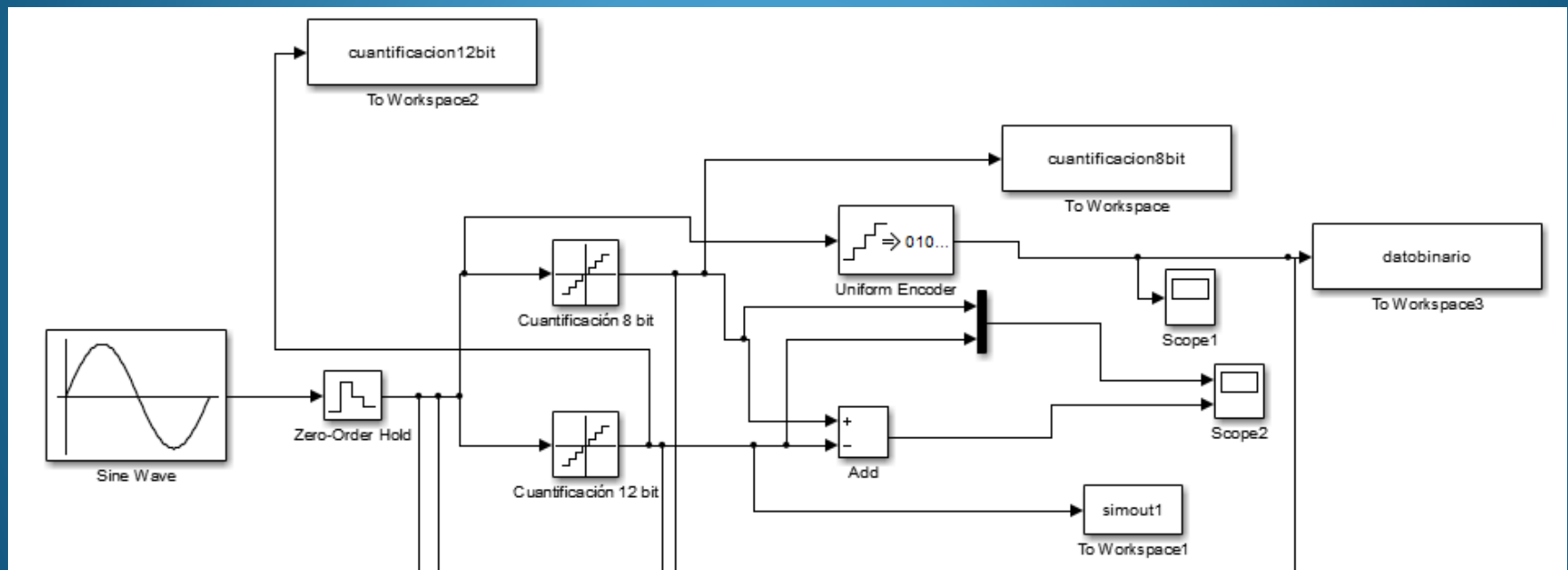
Time	Data:1
0	0
0.1000	0.5070
0.2000	0.9945
0.3000	1.4820
0.4000	1.9500
0.5000	2.3985
0.6000	2.8275
0.7000	3.2175
0.8000	3.5880
0.9000	3.9195

Time	Data:1
0	0
0.1000	0.4992
0.2000	0.9936
0.3000	1.4772
0.4000	1.9476
0.5000	2.3976
0.6000	2.8236
0.7000	3.2208
0.8000	3.5868
0.9000	3.9168

# Biblioteca DPS

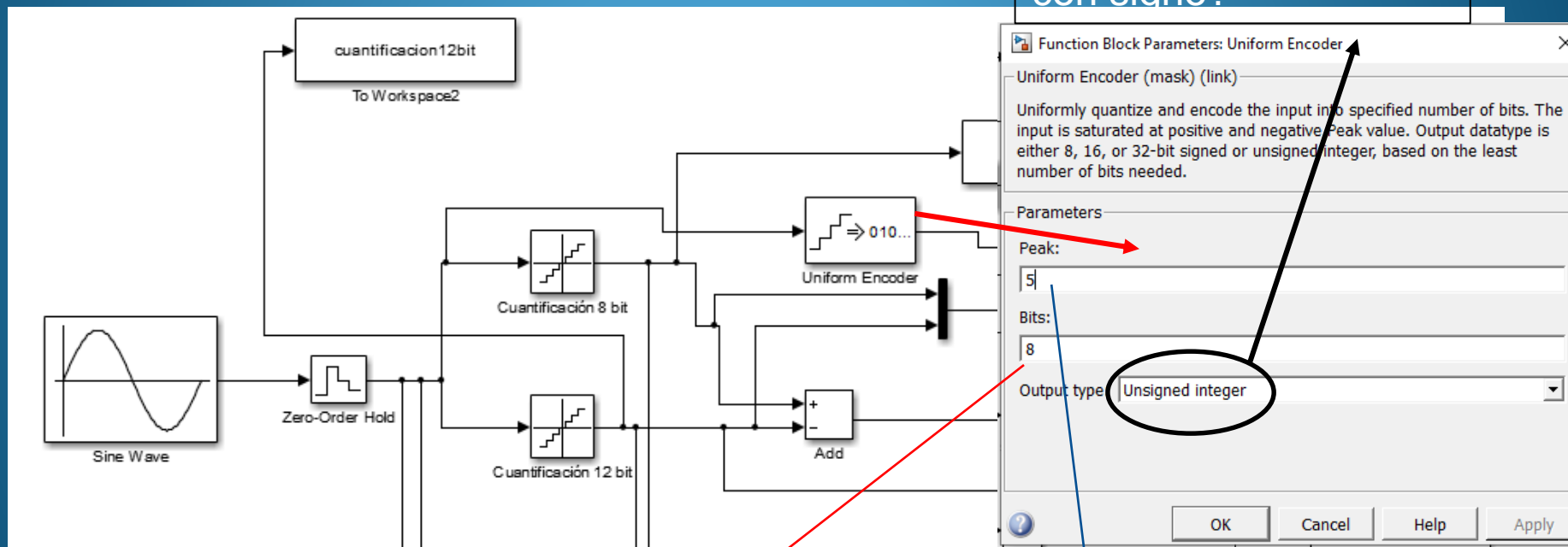


# Cuantificación con la biblioteca DSP



# Cuantificación con la biblioteca DSP

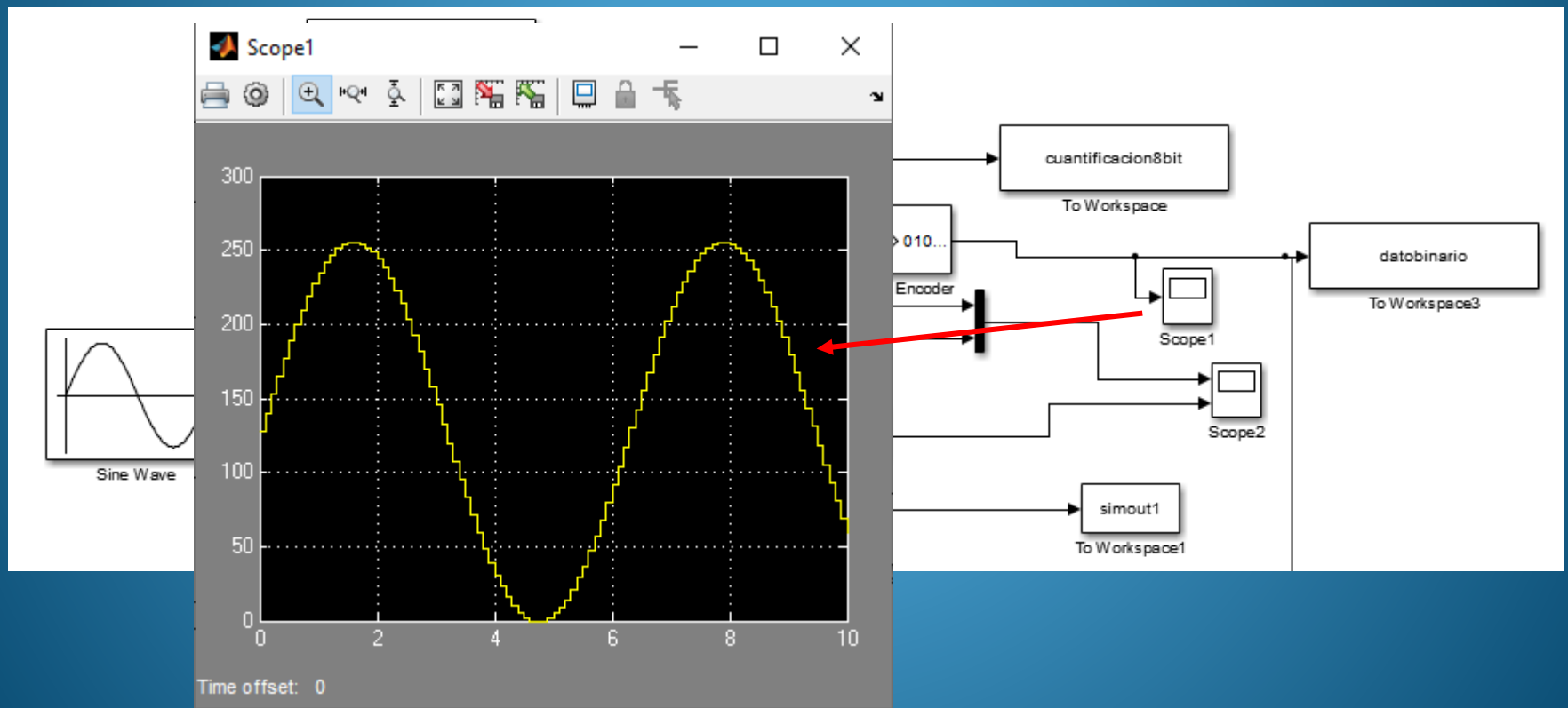
Que numero muestra  
con signo?



Numero de Bits

Máxima tensión

# Cuantificación de 8 bits con la librería DSP



# Cuantificación Dato binario de 8 bits

Variables - datobinario

datobinario x

datobinario <101x1 int

	1	2
89	74	
90	64	
91	52	
92	40	
93	28	
94	15	
95	3	
96	-10	
97	-23	
98	-35	
99	-47	
100	-59	
101	-70	

Con signo

Sin signo

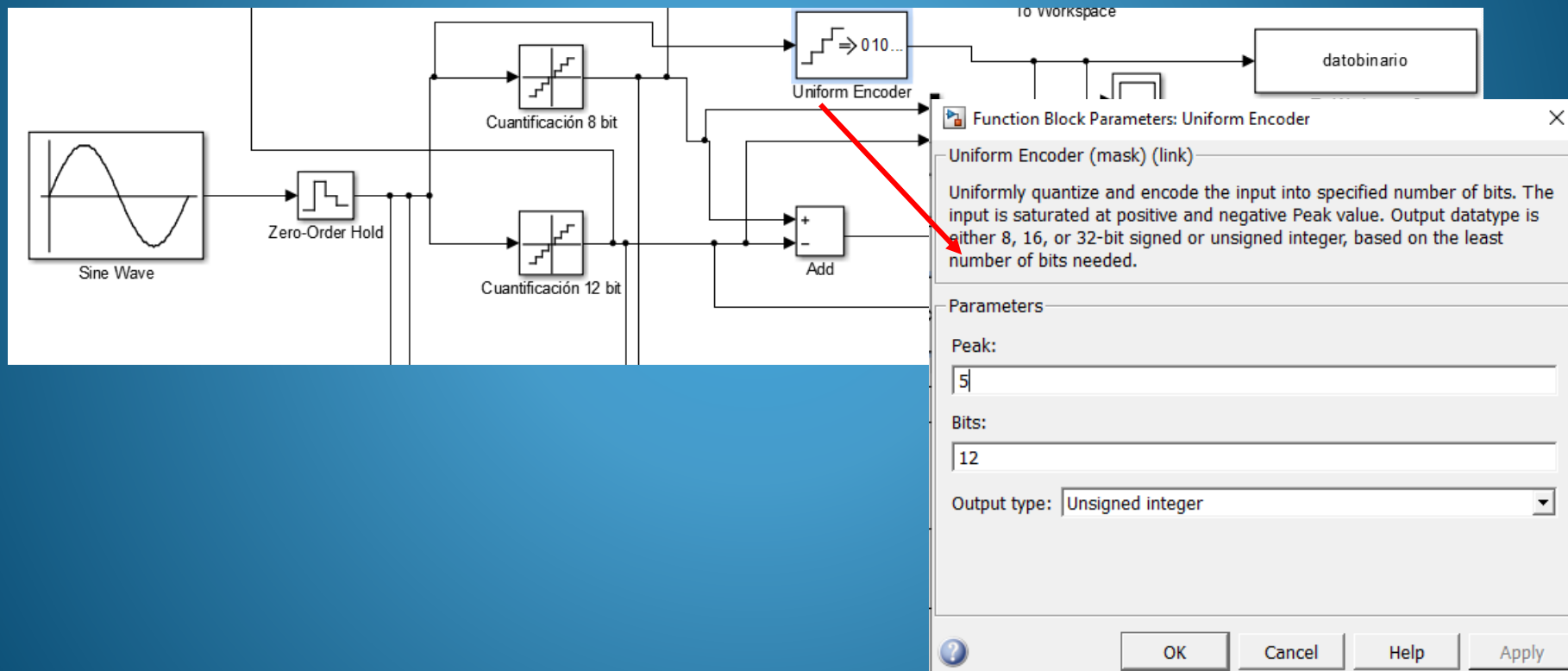
Variables - datobinario

datobinario x

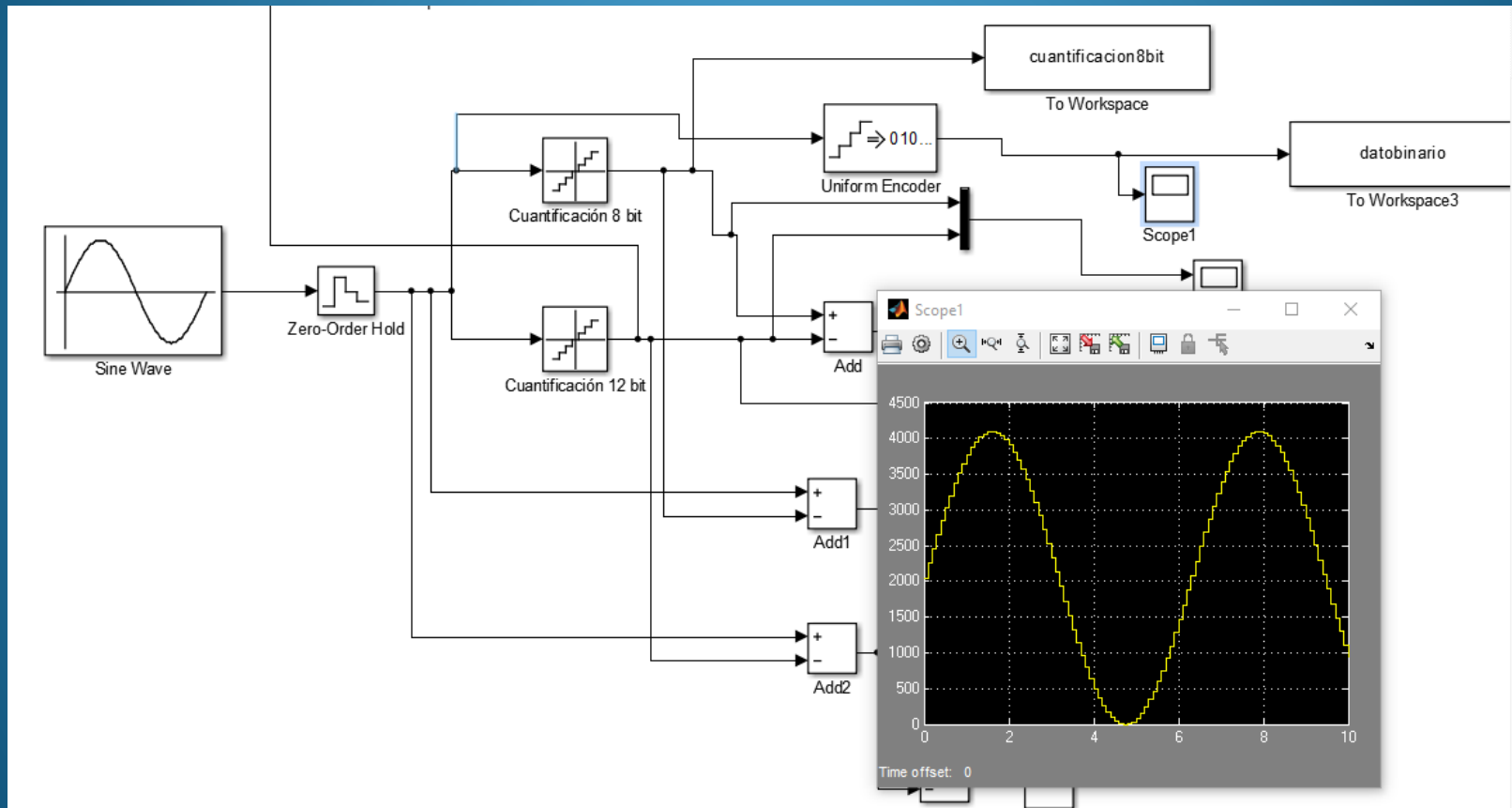
datobinario <101x

	1	
89	202	
90	192	
91	180	
92	168	
93	156	
94	143	
95	131	
96	118	
97	105	
98	93	
99	81	
100	69	
101	58	
102		

# Cuantificación de 12 bits



# Cuantificación de 12 bits





# Cuantificación de 12 bits

Variables - datobinario

datobinario x

datobinario <101x1 int

	1	2
89	1197	
90	1026	
91	844	
92	653	
93	456	
94	254	
95	50	
96	-154	
97	-358	
98	-557	
99	-751	
100	-938	
101	-1115	
102		

Con signo

bin 1111 1011 1010 0101

Sin signo

Variables - datobinario

datobinario x

datobinario <101x1 int

	1	
89	3245	
90	3074	
91	2892	
92	2701	
93	2504	
94	2302	
95	2098	
96	1894	
97	1690	
98	1491	
99	1297	
100	1110	
101	933	
102		

bin 0000 0011 1010 0101