

2. Signals

A signal is a function representing a physical quantity or variable that contains information from a phenomenon, the signal can be one-dimensional as a sound wave, two-dimensional as an image, or a multidimensional signal.

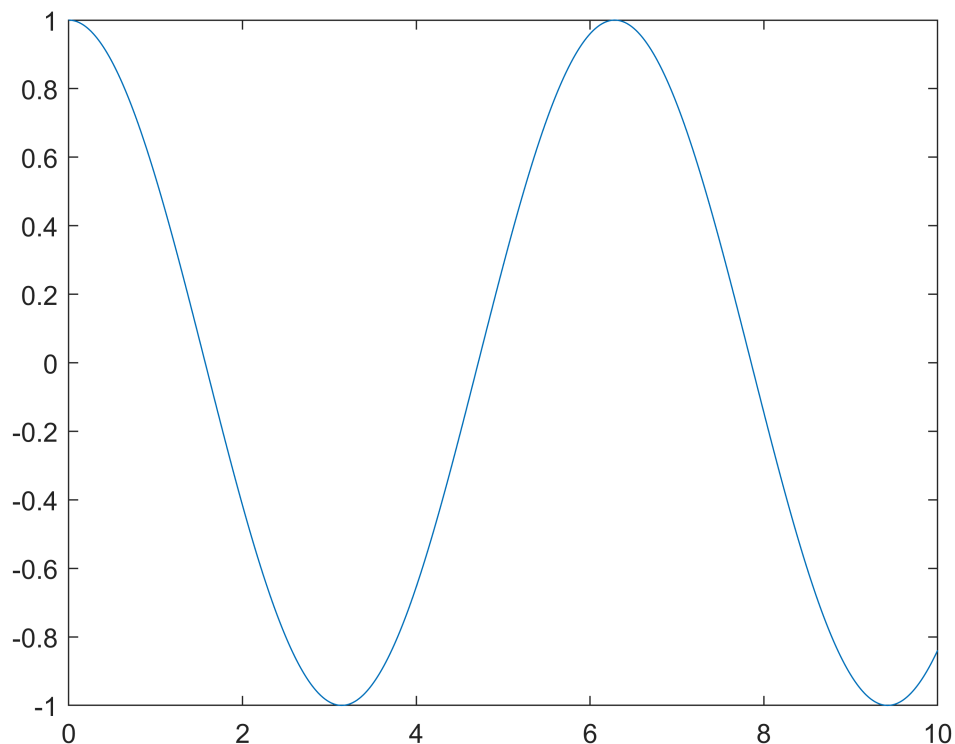
2.1 Categorization

2.1.1 Continuous-Time signals

A signal is called continuous-time (analog) signal if the independent variable (time) is defined in a continuous interval, and is expressed by the function $x(t)$ where t takes real values.

Note: Matlab is unable to work with continuous-time signals, however, it is possible to approximate them using a discrete-time representation with a small time step.

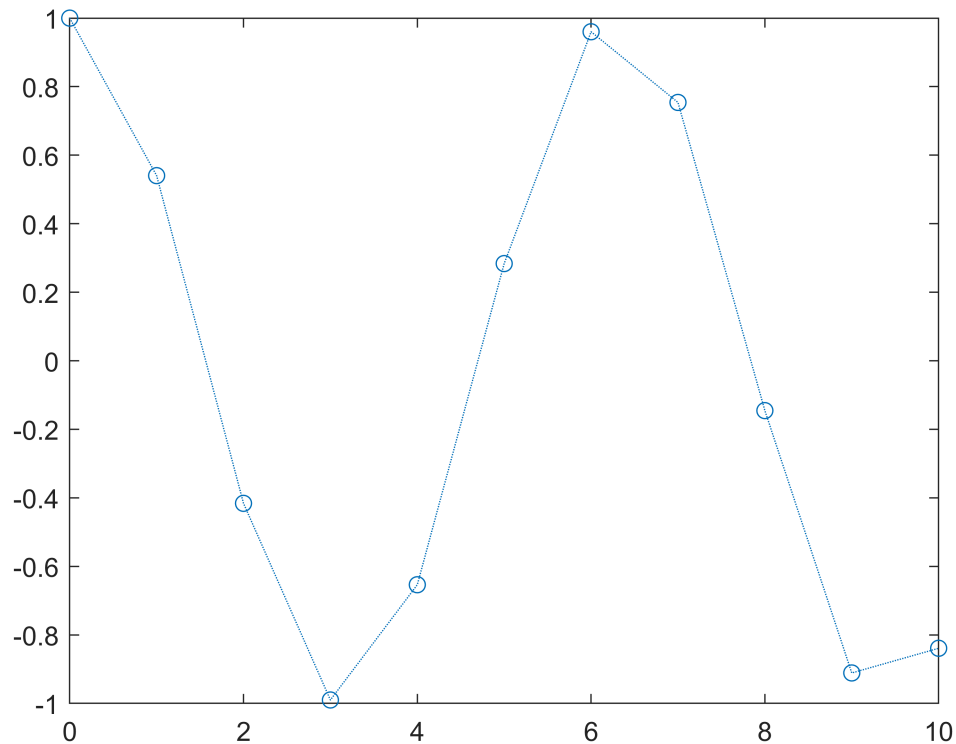
```
t = 0:0.01:10; % Time independent variables, time step = 0.01  
y = cos(t); % Dependent variable continuous in the interval  
plot(t,y) % Function graph
```



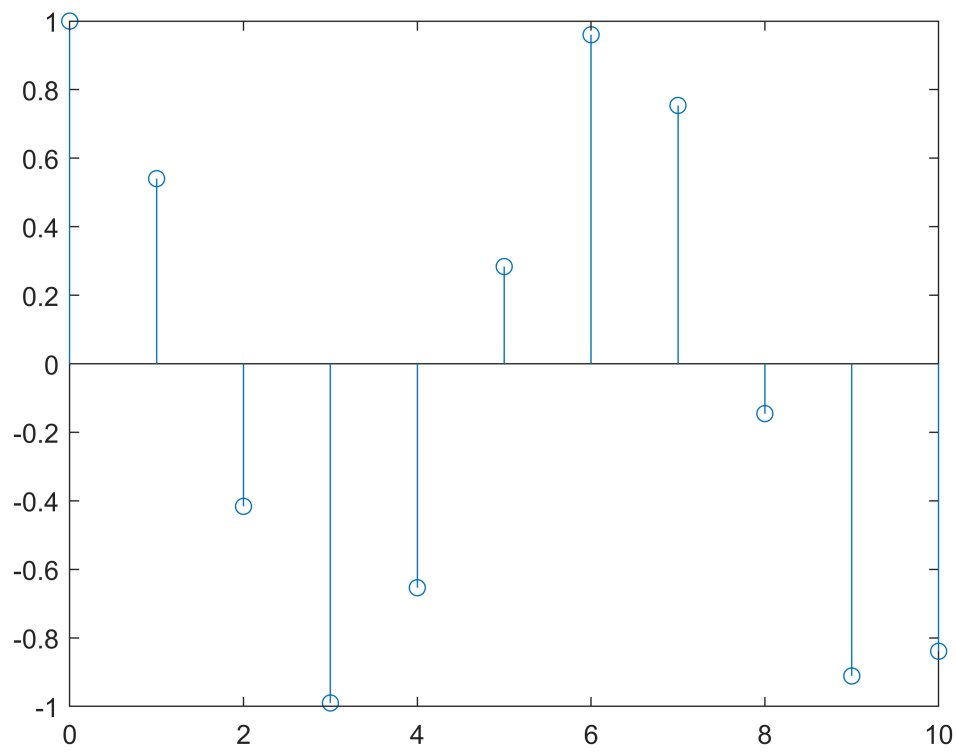
2.1.2 Discrete-Time Signals

It is often defined as a sequence of numbers defined in discrete times as is denoted by the function $x[n]$, the independent variable is defined in a discrete interval, while the dependent variable is defined in a continuous set of values.

```
n = 0:10; % Discrete time with step 1  
y = cos(n); % Dependent variable y[n], continuous set of values  
plot(n,y, 'o')
```



```
stem(n,y) % Plots a discrete time signal
```



Usually a discrete-time $\mathbf{x}[n]$ signal is obtained by sampling a continuous-time signal $\mathbf{x}(t)$ at a constant rate, for a sampling rate defined by T_s , the discrete-time signal is defined as $\mathbf{x}[nT_s]$,