جامعة المستقبل
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قسم الانظمة الطبية الذكية

Lecture 4- Signals

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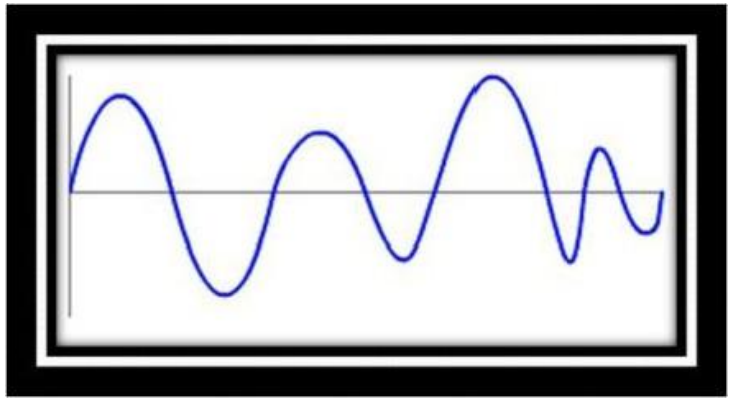
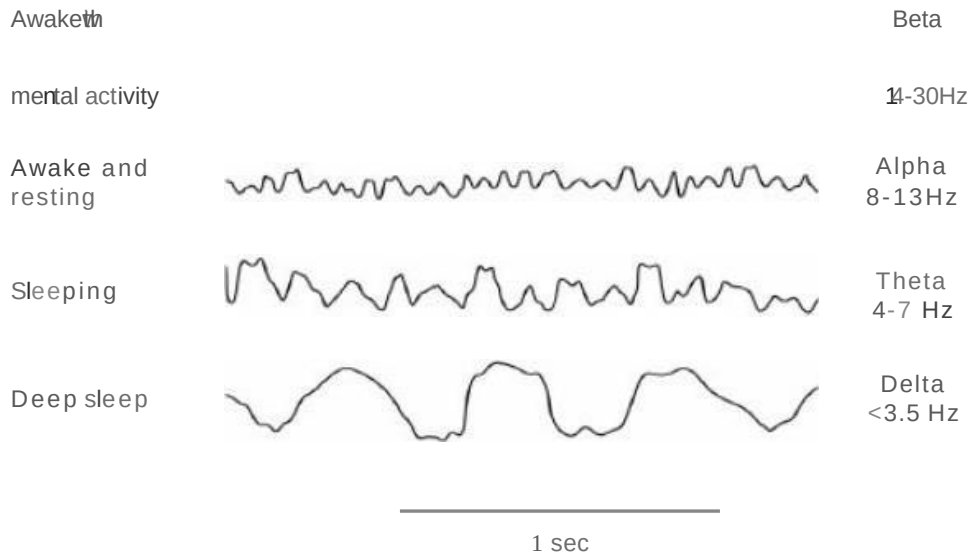
The first operation in DAQ system is the conditioning of signal. The signal from the sensor must firstly be sent to electronic system to transform the increasing or decreasing level of amplitud. However, in order to be useful to the interface devices, the signal can be sent in some forms of conditioning. In general, all interface devices are designed to allow interfacing of sensing signals in a voltage range from 0 to 5 V that will be digitized from A/D converter. In general, conditioning devices are designed to be flexible in order to change this range

Signals

What is signal?

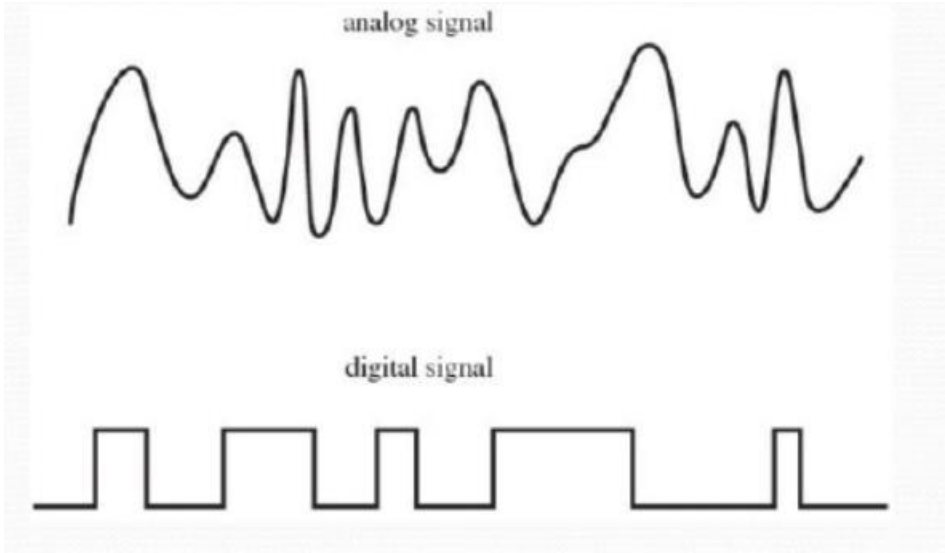
- In electrical engineering, the fundamental quantity of representing some information is called a signal. It does not matter what the information is i-e: Analog or digital information. In mathematics, a signal is a function that conveys some information. In fact any quantity measurable through time over space or any higher dimension can be taken as a signal. A signal could be of any dimension and could be of any form.





Analog and Digital Signal

- Analog signal is a continuous signal for which the time varying feature of the signal is a representation of some other time varying quantity.



- Digital Signal is a signal that represents a sequence of discrete values.

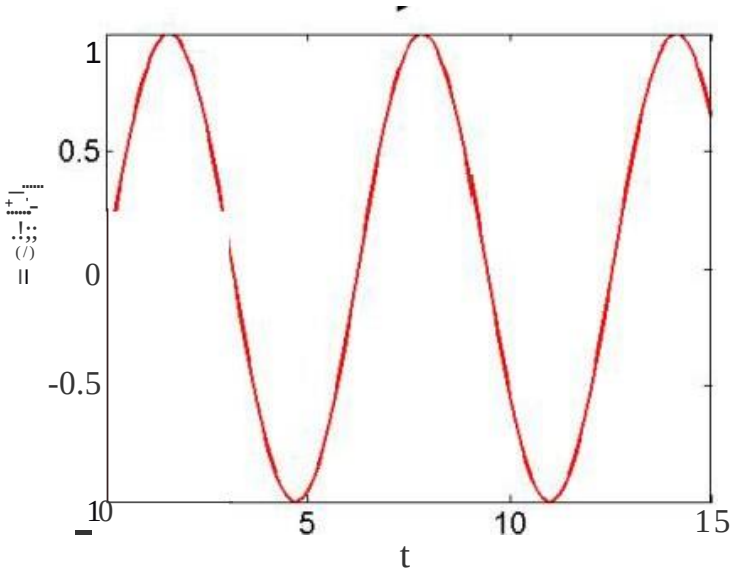
A logic signal is a digital signal with only two possible values, and

Periodic Signals

An important class of signals is the class of periodic signals. A periodic signal is a continuous time signal x(t), that has the property

$$x(t) = x(t + T)$$

where $T>o$, for all t.



Examples:

$\cos(t+2\pi) = \cos(t)$

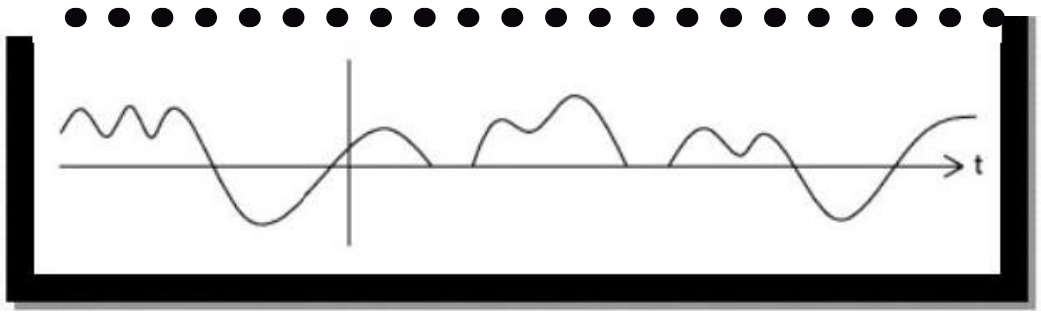
$\sin(t+2\pi) = \sin(t)$

Are both periodic with period 2π

for a signal to be periodic, the relationship must hold for all t.

Aperiodic signal

- Aperiodic signal: An aperiodic function never repeats, although technically an aperiodic function can be considered like a periodic function with an infinite period.



Examples: Sound signal, noise signal etc.

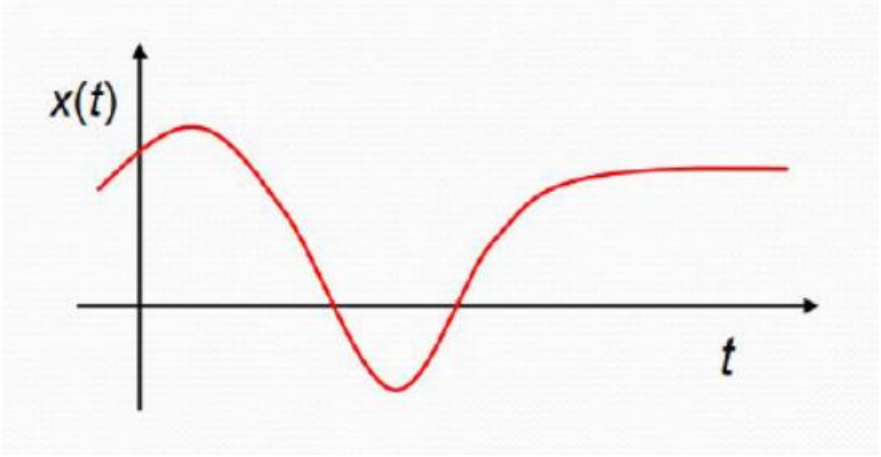
Continuous & Discrete Signals

Continuous-Time Signals

Most signals in the real world are continuous time, as the scale is infinitesimally fine.

E.g. voltage, velocity,

Denote by *x(t),* where the time interval may be bounded (finite) or infinite

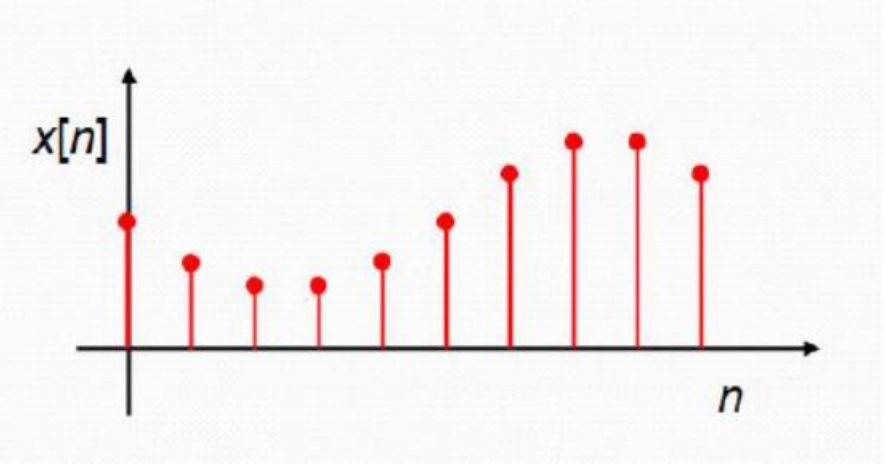


Discrete-Time Signals

Some real world and many digital signals are discrete time, as they are sampled

E.g. pixels, daily stock price (anything that a digital computer processes)

Denote by *x[n],* where *n* is an integer value that varies discretely



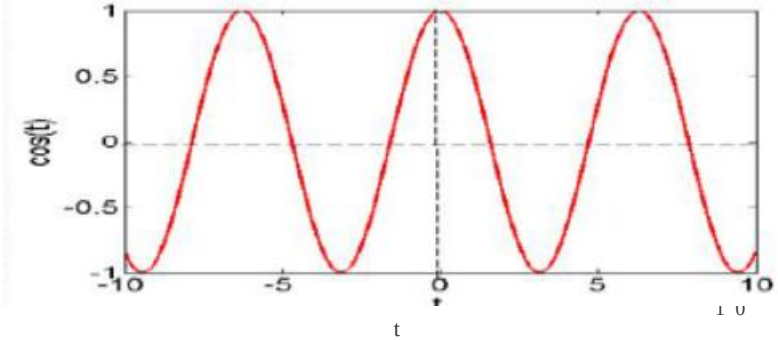
Sampled continuous signal

x[n] *=x(nk)*

Odd and Even Signals

An even signal is identical to its time reversed signal, i.e. it can be reflected in the origin and is equal to the original:

$$x(-t) = x(t)$$



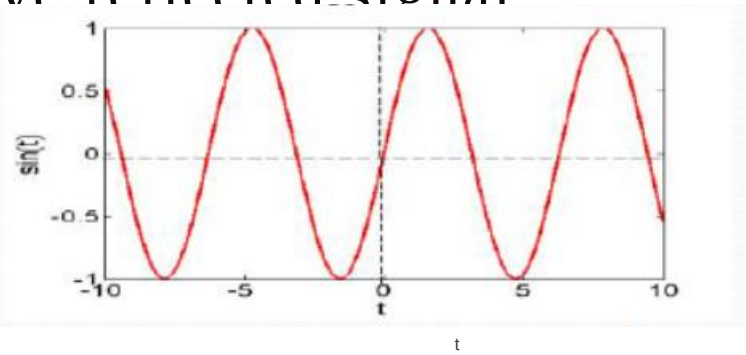
Examples:

$x(t) = cos(t)$

$x(t) = c$

An odd signal is identical to its negated, time reversed signal, i.e. it is equal to the negative reflected signal

$$x(-t) = -x(t)$$



Examples:

$x(t) = \sin(t)$

$x(t) = t$

This is important because any signal can be expressed as the sum of an odd signal and an even signal.