EEE 4107 Signals and Communication I.

Dr. Ciira Maina
ciira.maina@dkut.ac.ke

20th February, 2019

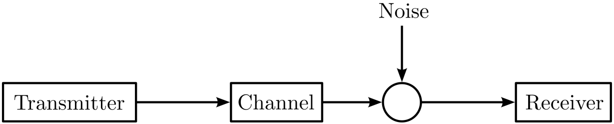
Course Content

1. Representation and characterisation of signals
2. Linear systems
3. Fourier Series
4. Fourier transform
5. Amplitude and Frequency modulation
6. Multiplexing schemes
7. Transmitter circuits

Today's Lecture

1. Signal classification
2. Basic signals

Communication Systems



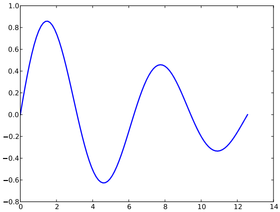
Source: Wikipedia

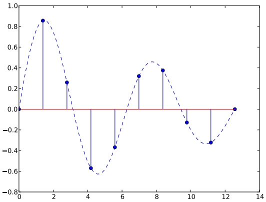
Signals

- Mathematically we define a signal as an information bearing function of one or more variables.
- Examples include speech and images.

Classification of Signals

- Continuous time and discrete time signals:





Classification of Signals

- Even and odd signals
  - For an even signal we have

$$x(-t) = x(t) \quad \forall t$$

  - For an odd signal we have

$$x(-t) = -x(t) \quad \forall t$$

Classification of Signals

- Periodic and non-periodic signals:
  - A signal $x(t)$ is said to be periodic if there exists a positive constant T such that

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

  - The smallest value T for which this relation holds is known as the *fundamental period*.

Classification of Signals

- Energy vs Power signals
- Random vs Deterministic Signals

Signal Classification - Examples

- Examples in Jupyter notebook

Basic Signals

- The unit step is defined as

$$u(t) = \begin{cases} 1 & t > 0 \\ 0 & t < 0 \end{cases}$$

- The unit ramp

$$r(t) = \begin{cases} t & t \geq 0 \\ 0 & t < 0 \end{cases}$$

Basic Signals

- The Dirac delta pulse is defined as follows

$$\delta(t) = 0, t \neq 0$$

and

$$\int_{-\infty}^{\infty} \delta(t)dt = 1$$

The sifting property will be useful when we explore sampling.

$$\int_{-\infty}^{\infty} x(t)\delta(t - t_0)dt = x(t_0)$$

The Dirac delta pulse can be seen as the limit of

$$p_\Delta(t) = \begin{cases} \frac{1}{\Delta} & |t| < \frac{\Delta}{2} \\ 0 & \text{Otherwise} \end{cases}$$

as $\Delta \to 0$.

Basic Signals and Operations - Examples

- Examples in Jupyter notebook