DC : no change to signal amplitude as time progresses

$v = V_0$

Upper case = not changing

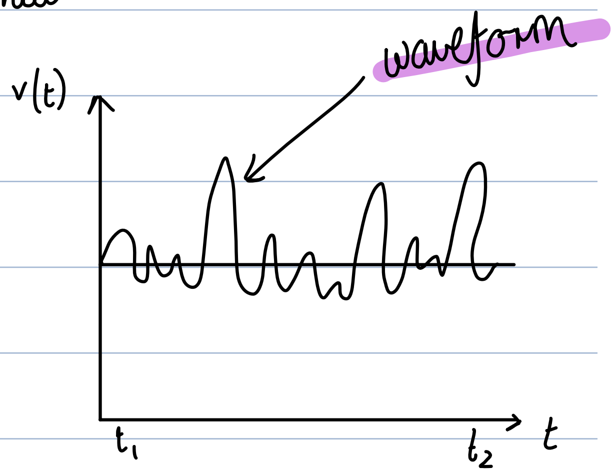
How do we establish characteristics of Signal :

- Mean (average) value of the signal

$$\longrightarrow \quad \bar{V} = \frac{1}{t_2-t_1}\int_{t_1}^{t_2} v(t)\, dt$$

Time period

area under graph



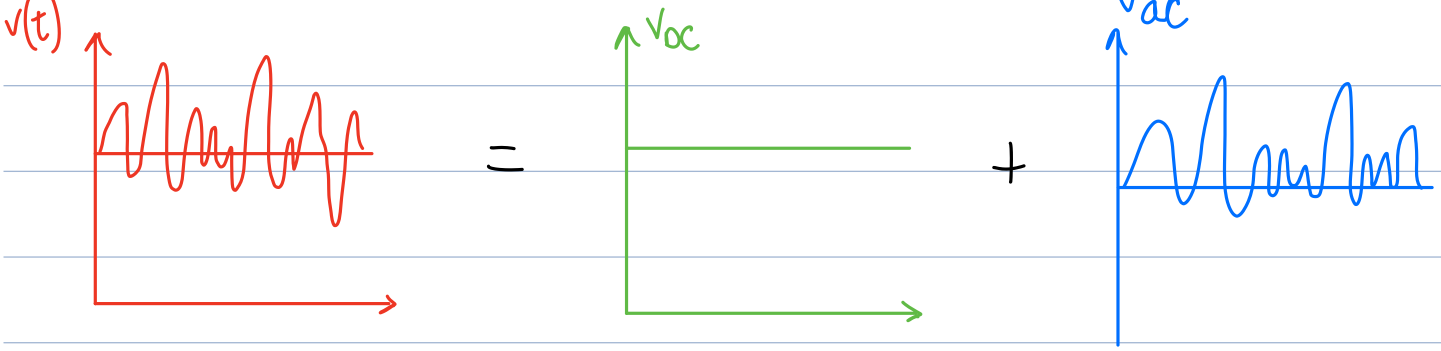
$\bar{v}$ is mean value = DC component

DC and AC parts of signal :

$v(t) = V_{DC} + v_{ac}$

lower case 'v' implies value that changes with time

v_{ac} has same waveform as v(t) but has zero average value.



Varying part of signal carries information

For sine waveform:

$v(t) = V_0 \sin(\omega t + \phi)$ where $\omega = 2\pi f$ or $\frac{2\pi}{T}$

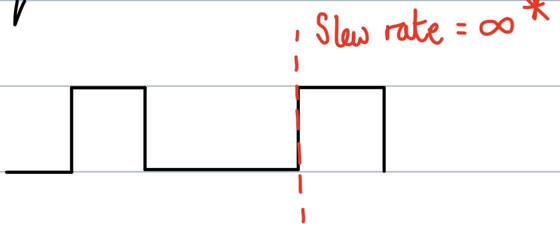
Mean (V_{DC}) of this waveform found accurately by integrating over a whole number of periods - this number can be 1:

$$\bar{V} = \frac{1}{t_2 - t_1}\int_{t_1}^{t_2} v(t)\, dt$$

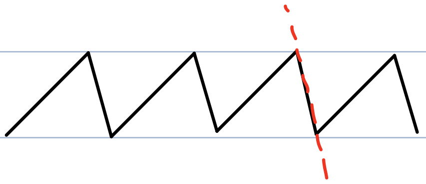
Slew rate - max rate of change of any signal

↳ if signal is not periodic we establish statistically

For square wave:



Triangular:



* Real square wave impossible as would require ∞ power

- Slew rate varies with amplitude and frequency

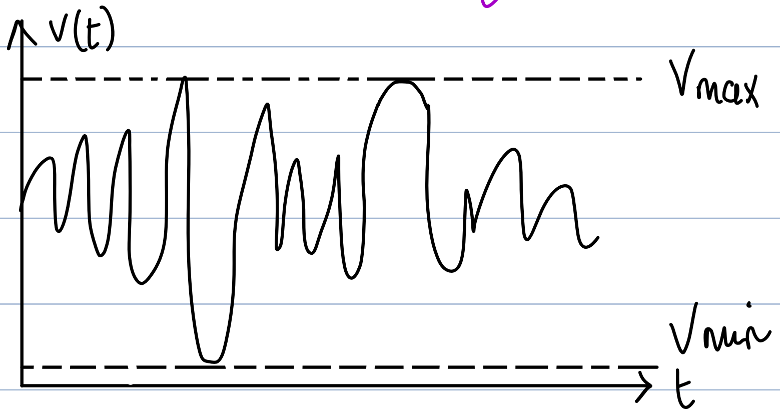
$$\text{Slew rate} = \max\left(\left|\frac{dv}{dt}\right|\right)$$

Relevance of slew rate:

- Any system has max capability of slew rate, therefore the input slew rate must be less than system max

Range of Signal:

- Peak-to-peak value
- Dynamic range is difference between largest and smallest useable signal



$$V_{p\text{-}p} = V_{max} - V_{min}$$

peak to peak

→ A 'long' observation time is needed for non-periodic signal to be sure of range.

Magnitude Metrics for Signals:

- Mean (average, DC) value

- Peak-to-peak amplitude (range, AC value)

- Power-related amplitude metric : r.m.s

  ↖ root of mean squared

  ↳ this is equivalent amplitude of a DC only signal for which a resistor will dissipate energy / heat at the same rate (power)

→ For the special case of the sine waveform :

$$V_{r.m.s} = \frac{V_{0-pk}}{\sqrt{2}} \quad I_{r.m.s} = \frac{I_{0-pk}}{\sqrt{2}}$$