LINEAR WAVE SHAPING

In electronic music waveshaping is a type of distortion synthesis in which complex spectra are produced from simple tones by altering the shape of the waveforms Waveshapers are used mainly by electronic musicians to achieve an extra-abrasive sound. This effect is most used to enhance the sound of a music synthesizer by altering the waveform or vowel. Rock musicians may also use a waveshaper for heavy distortion of a guitar or bass. Some synthesizers or virtual software instruments have built-in waveshapers. The effect can make instruments sound noisy or overdriven.

In digital modeling of analog audio equipment such as tube amplifiers, waveshaping is used to introduce a static, or memoryless, nonlinearity to approximate the transfer characteristic of avacuum tube or diode limiter

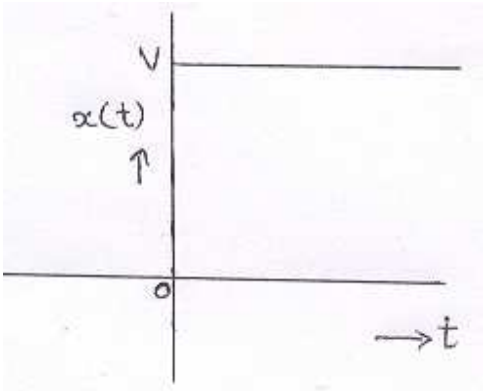
Wave shaping: The process of deriving the desired waveform from standard waveforms is known as wave shaping.
Wave shaping techniques are of two types. Those are
1. linear wave shaping
2. non linear wave shaping

linear wave shaping :
The process where by the form of non sinusoidal signal is altered when passing through a linear network is known as linear wave shaping.

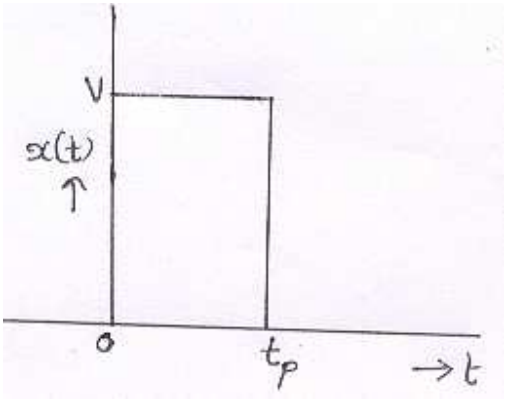
LINEAR NETWORK: the network which consists of only linear elements is known as a linear network.
resistor ,inductor, capacitors are Linear elements.

Non sinusoidal signals:

1. **step signal:** a signal x(t) is said to be a step signal if
   for $t<0$ $x(t) = 0$ and for $t\geq 0$ $x(t) = V$ as shown in figure

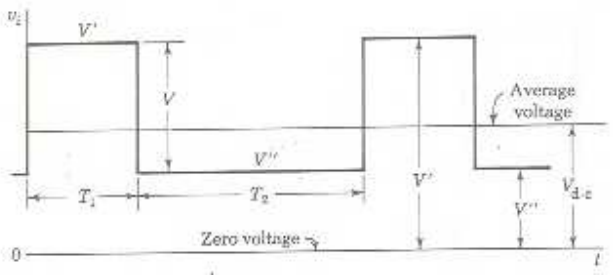


2. **pulse signal:** a signal x(t) is said to be a pulse signal if
for $t<0$ & $t>tp$ $x(t) = 0$ and for $0 \leq t \leq tp$ $x(t) = V$ as shown in figure



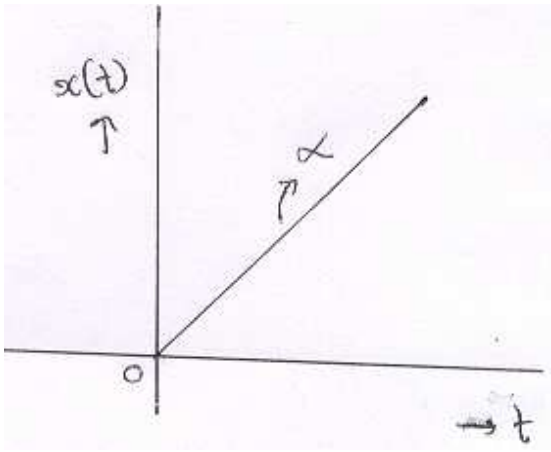
3.**square waveform:** a waveform which maintains itself at constant level V' for a time T1 and at another constant level V'' for a time T2 and which is repetitive with a period T=T1+T2 as shown in figure ,is called a square wave.

If T1=T2 ,square wave form is said to be symmetrical otherwise it is unsymmetrical.



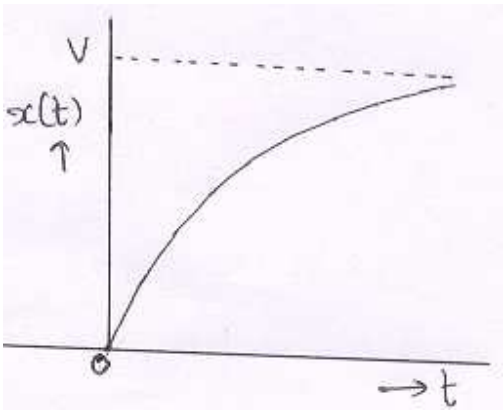
4.**ramp signal:** a waveform which is zero for t<0 and which varies linearly with time for t>0 is called a ramp or sweep signal.

for t<0 x(t) = 0 and for t>0 x(t) = αt as shown in figure

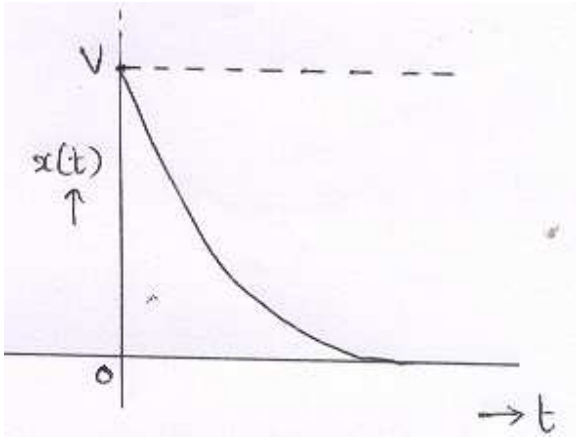


5.**exponential signal:** a waveform which is zero for t<0 and which varies exponentially with time for t>0 is called a exponential signal.
Exponential signalsareoftwo types
1.raising exponential
2.decayingexponential
General equation for exponential signals are
$Vo(t) = Vf + (Vi-Vf)\, e^{-(t-tx)/\tau}$
Where Vf = final voltage of output waveform(at $t = \infty$)
Vi = initial output voltage(at t=0)
And tx = the time at which the waveform will begins
= time constant of a circuit

raising exponential: a waveform which is zero for t<0 and which raises exponentially with time for t>0 is called a raising exponential signal.
For an raising exponential $Vo(t) = V(1-e^{-t/\tau})$, where V is the final value of the output waveform.



Decayingexponential : a waveform which is zero for t<0 and which decays exponentially with time for t>0 is called a decaying exponential signal.
For an decaying exponential $Vo(t) = Ve^{-t/\tau}$, where V is the initial value of the output waveform.



Different linear networks are

1. RC circuits
2. RL circuits
3. RLC circuits