AM receiver theory

The transmitted AM signal is of the form:

$$s(t) = a(t)\cos(2\pi f_c t + \phi) = A_c[1 + k_a m(t)]\cos(2\pi f_c t + \phi)$$

Where $m(t)$ represent the modulation waveform and k_a is the modulation index.

We assume for convenience that $\phi = 0$ so that

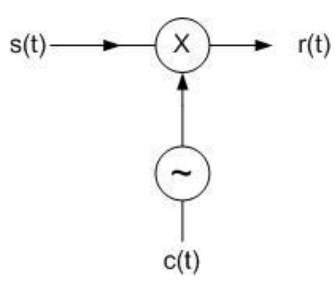
$s(t) = a(t)\cos(2\pi f_c t) = A_c[1 + k_a m(t)]\cos(2\pi f_c t)$ For a message, $m(t) = A_m \cos(2\pi f_m t)$, the resulting AM wave is given by

$$s(t) = A_c[1 + k_a A_m \cos(2\pi f_m t)]\cos(2\pi f_c t)$$

The AM receiver recovers *m(t)* from *s(t)*. One method of AM demodulation is to recover $m(t)=1+k_a m(t)$ and subtract the DC component to obtain *m(t)*.

We recover $m(t)=1+k_a m(t)$ by multiplying the AM signal *s(t)* by a carrier wave $c(t) = \cos(2\pi f_c t)$ and low pass filtering the result.

$$r(t) = s(t)c(t)$$
$$r(t) = a(t)c(t)c(t)$$
$$r(t) = a(t)\cos^2(2\pi f_c t)$$
$$r(t) = a(t)[\frac{1}{2}(1 + \cos 4\pi f_c t)]$$
$$r(t) = \frac{1}{2}a(t) + \frac{1}{2}\cos 4\pi f_c t$$



After low pass filtering, $r_{LP}(t) = 0.5a(t) = 0.5[1 + k_a m(t)]$

After a DC block, $r_{LP,DCblock} = 0.5k_a m(t)$