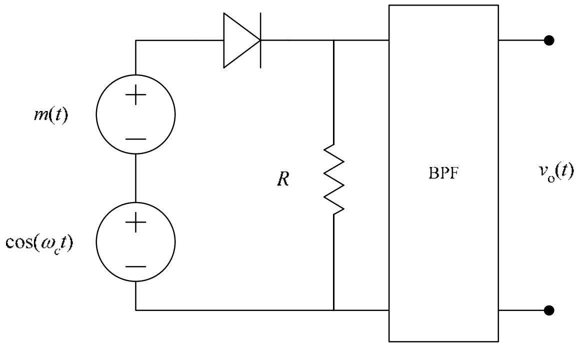
The advantage of AM over DSBSC is the ability of easily modulating and demodulating it. A simple AM modulator is shown below.

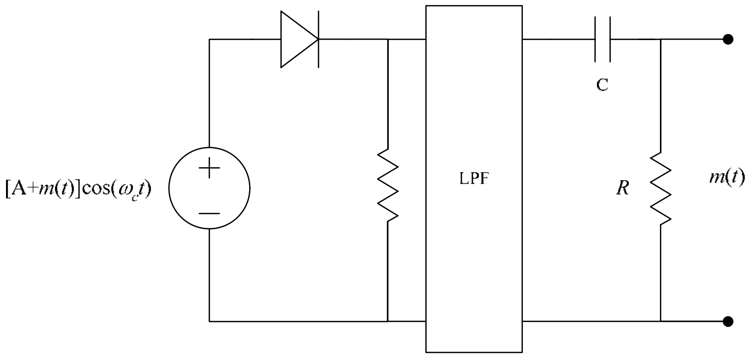


The signal generated by the combined sources is the sum of the message and carrier. The signal at the other side (the right hand side) of the diode is the half–wave rectified signal of the sum of the message and carrier. The spectrum of this half–wave rectified signal contains many components at frequencies around $0, \omega_c, 2\omega_c, 3\omega_c, \ldots$ etc., including the terms $\cos(\omega_c t)$ and $m(t)\cdot\cos(\omega_c t)$. In fact, these two signals are the only ones around ω_c and therefore, will only be the signals that pass through the BPF to create the AM signal.

Demodulation of AM Signals

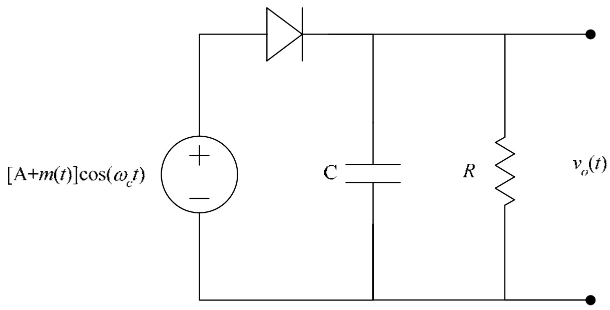
1. Rectifier Detector

The circuit below is similar in nature to the circuit above where the AM signal is fed to the diode which rectifies the signal. The signal to the right of the diode is one that contains many components at frequencies around $0, \omega_c, 2\omega_c, 3\omega_c, \ldots$ etc., including the message unmodulated signal $m(t)$ and a DC component A. All components other than these two are filtered by the LPF and the capacitor at the end has the function of blocking that DC component so that the output of the signal is a scaled version of $m(t)$ without any DC.

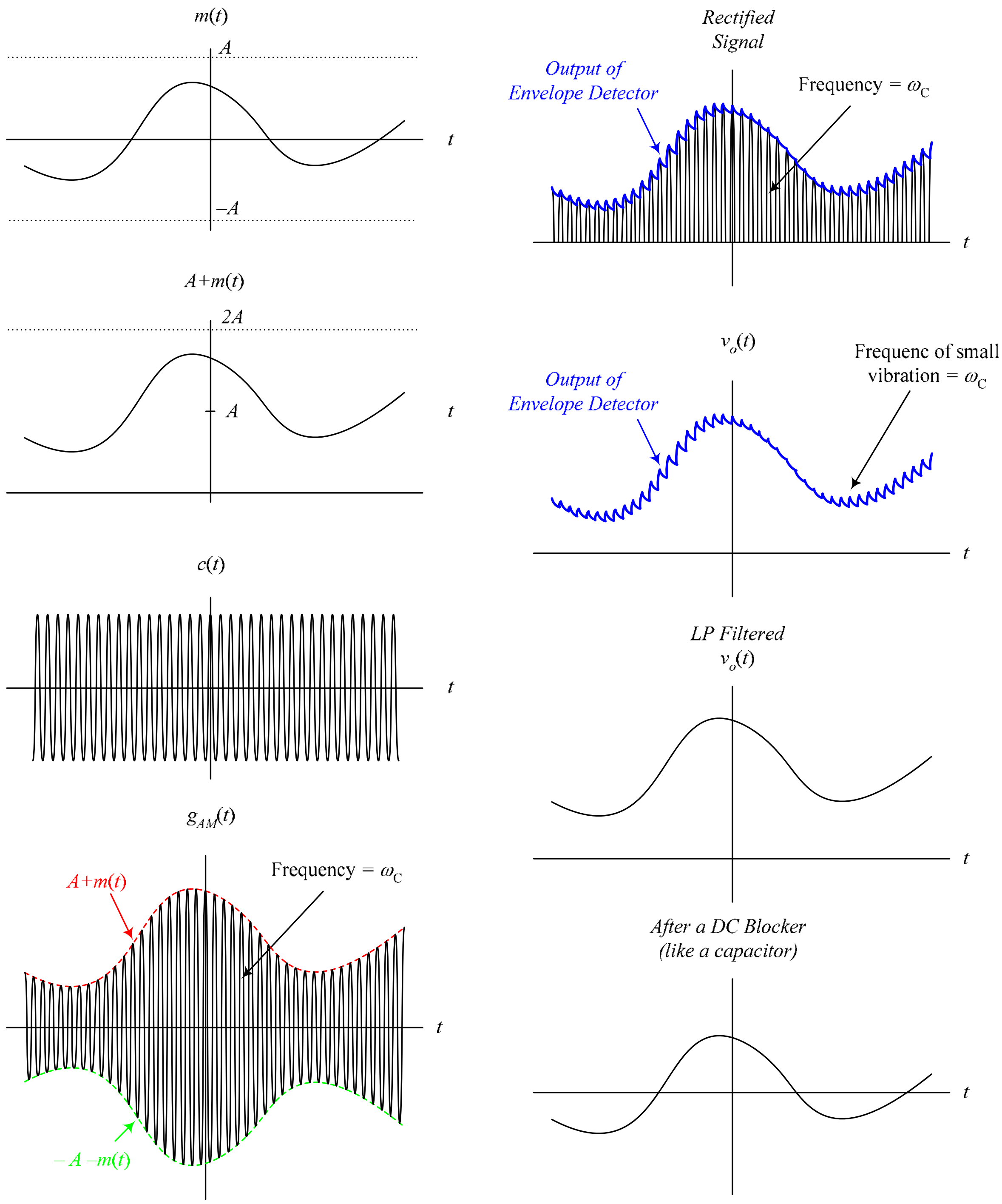


2. Envelope Detector

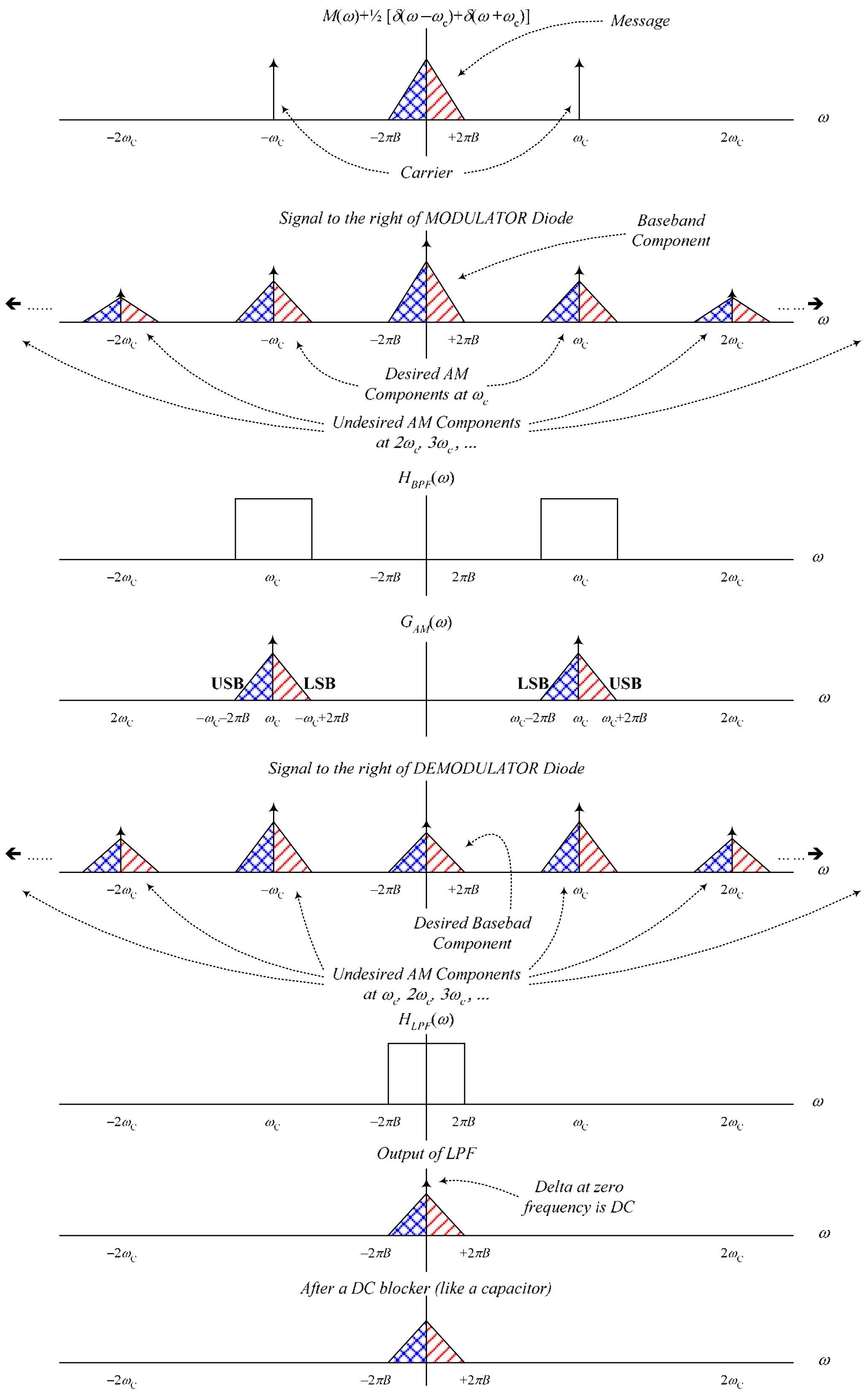
The envelope (cover of a sinusoidal wave) detector shown below is a modification of the rectifier detector. The diode is either forward–biased (when the AM signal is higher in value than the voltage across the capacitor), or reverse–biased (when the AM signal is lower in value than the voltage across the capacitor). When the diode is forward biased, it acts like a short circuit and the voltage across the capacitor follows the voltage of the source. When the diode is reverse–biased, it is acting like an open circuit and the capacitor simply discharges through the resistor. If the value of the time–constant of the capacitor and resistor $\tau = RC$ is suitable (not too large or too small), the charging and discharging of the capacitor results in a signal that follows the message signal with some small ripples. If the value of $\tau = RC$ is too large, the discharge may be too slow that some parts of the envelope of the AM signal are not followed. If the value of $\tau = RC$ is too small, the discharge may be too fast that the output signal contains extremely large ripples and it may be hard for any added lowpass filter to remove these large ripples.



The following figure illustrates the modulation and demodulation of AM signals in time–domain.



The following figure illustrates modulation and demodulation of AM in frequency–domain (Note: the demodulation techniques used above and below are slightly different (above an envelope detector is used and below, a rectifier detector is used)).


M(ω)+½ [δ(ω−ω_c)+δ(ω+ω_c)]
Message
Carrier
Signal to the right of MODULATOR Diode
Baseband Component
Desired AM Components at ω_c
Undesired AM Components at 2ω_c, 3ω_c, ...
H_BPF(ω)
G_AM(ω)
USB
LSB
LSB
USB
Signal to the right of DEMODULATOR Diode
Desired Basebad Component
Undesired AM Components at ω_c, 2ω_c, 3ω_c, ...
H_LPF(ω)
Output of LPF
Delta at zero frequency is DC
After a DC blocker (like a capacitor)
−2ω_c
−ω_c
−2πB
+2πB
ω_c
2ω_c
−ω_c−2πB
−ω_c+2πB
ω_c−2πB
ω_c+2πB
ω