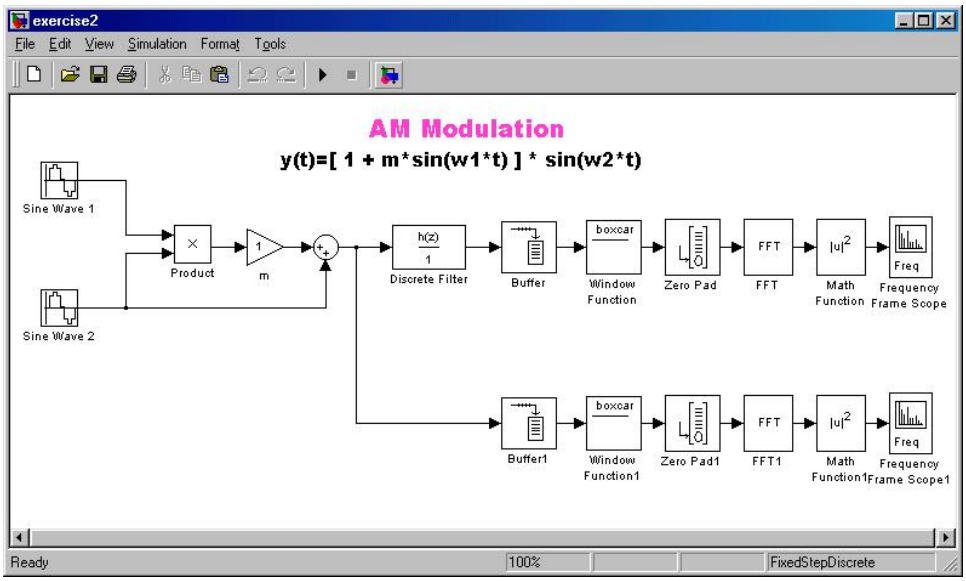
# Matlab/Simulink Exercise: Design of FIR Filter

The simulink diagram below illustrates the implementation of a conventional AM modulator, whereby the representation of the AM modulated signal is given by

$$y(t) = [1 + m\sin(\omega_1 t)]\sin(\omega_2 t)$$

It is further assumed that:

| | |
|---|---|
| Modulation index: | $m = 1$, |
| Information bearing signal: | $\omega_1 = 2\pi 10^3$ rad/s, |
| Carrier angular frequency: | $\omega_2 = 2\pi 10^4$ rad/s, |
| Sampling Frequency: | $f_s = 40$ kHz. |




1. Determine and plot the spectrum of the modulated signal.

2. Change the modulation index from 1 to 0.5 and explain how it affects the spectrum derived in part 1.

3. Design and apply an FIR bandpass filter around the upper sideband with the following specifications:
Passband: 10800-11200
Stopband: 10200-12800
Passband Ripple: $R_p = 0.1$ dB Stopband attenuation: $R_s = 50$ dB
Sampling frequency: $f_s = 40$ kHz

4. Design a highpass FIR filter that could be used to eliminate both the lower sideband and the carrier and thus achieve a similar result.

5. Design and apply an FIR bandpass filter around the lower sideband with the following specifications:
Passband: 8800-9200
Stopband: 8200-9800
Passband Ripple: Rp = 0.1dB
Stopband attenuation: Rs = 50 dB
Sampling frequency: fs = 40kHz

6. Design a lowpass FIR filter that could be employed to suppress both the upper sideband and the carrier and thus achieve a similar result.