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% Parameters
Fs = 40000; % Sampling frequency in Hz
Fc = 4000; % Carrier frequency in Hz
Fm = 100; % Message frequency in Hz
t = 0:1/Fs:0.05; % Time vector
Am = 1; % Amplitude of message signal
Ac = 1; % Amplitude of carrier signal
mod_index = 0.5; % Modulation index (should be between 0 and 1)

% Message Signal (modulating signal)
m = Am * cos(2 * pi * Fm * t);

% Carrier Signal
c = Ac * cos(2 * pi * Fc * t);

% Amplitude Modulation (with modulation index)
y = (1 + mod_index * m) .* c;

% Envelope Detection (Demodulation)
y_rectified = abs(y); % Rectify the signal
[b, a] = butter(5, Fm/(Fs/2)); % Design a low-pass filter
m_demod = filter(b, a, y_rectified); % Low-pass filtering to get demodulated
signal

% Plotting
figure;

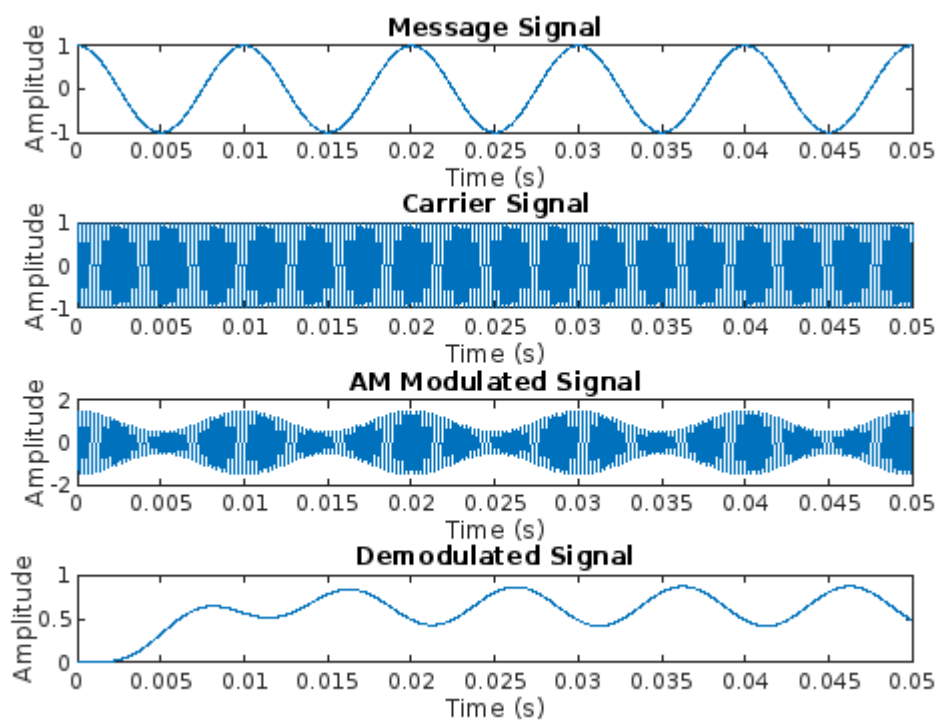
subplot(4,1,1);
plot(t, m);
title('Message Signal');
xlabel('Time (s)');
ylabel('Amplitude');

subplot(4,1,2);
plot(t, c);
title('Carrier Signal');
xlabel('Time (s)');
ylabel('Amplitude');

subplot(4,1,3);
plot(t, y);
title('AM Modulated Signal');
xlabel('Time (s)');
ylabel('Amplitude');

subplot(4,1,4);
plot(t, m_demod);
title('Demodulated Signal');
xlabel('Time (s)');
ylabel('Amplitude');
```

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