

Modulation-Demodulation Exercise

Exercise-1

- (a) Generate the signal $m(t) = \cos(2\pi f_m t) + \cos(4\pi f_m t)$ ($f_m = 100$ Hz) sampled at a rate of 4000 Hz for 1 second. Compute and display the power spectral density estimates of the signal $m(t)$.
- (b) Double-sideband (DSB-SC) amplitude modulate the signal with a carrier frequency of 1000 Hz. Compute and display the power spectral density estimates of the modulated sequences. Mark the USB and LSB on the graph.
- (c) Double-sideband (DSB-TC) amplitude modulate the signal with a carrier frequency of 1000 Hz. Compute and display the power spectral density estimates of the modulated sequences. Mark the USB, LSB and carrier frequency component on the graph.
- (d) Single-sideband (SSB) amplitude modulate the signal with the same carrier frequency. Compute and display power spectral density estimates. Mark the side band on the graph, is it the USB or LSB?

Exercise-2

- (a) Generate a 4 Hz sinusoidal signal $m(t) = \cos(8\pi t)$ sampled at a rate of 400 Hz for 1 second.
- (b) Double-sideband (DSB-SC) amplitude modulate the signal with a carrier frequency of 40 Hz. Compute and display the modulated signal $x(t)$.
- (c) Demodulate the signal $x(t)$ and display the demodulated signal.