

Class Exercises: To be submitted on March 27, 2020 (Section 3B)

- For efficient transmission and reception in wireless communication, the size of an antenna should have to be on the order of the wavelength (say $\lambda/2$).
 - How long should the antenna be if a telephone-quality speech signal contains frequencies between 200 Hz to 3400Hz?
 - What frequency of EM wave is well matched to an antenna with a length of 10 cm?
1. < 100 kHz 2. 1 MHz 3. 10 MHz 4. 100 MHz 5. > 1 GHz
- Modulation refers to the notion of changing the parameter of one signal in accordance with another signal. For instance, a sinusoidal signal $A_c \cos(2\pi f t + \varphi)$ have three parameters (Amplitude, frequency and phase) and we can use another signal to vary one of these parameters.

Modulation is an important concept in communication for the purpose of

- Transmitting a narrow passband signals
 - Designing realizable and efficient transmission equipment such as antenna
 - Efficiently share the radio spectrum so that multiple information is transmitted at the same time which is referred to as Multiplexing.
- Discuss the different multiplexing techniques and how we are able to achieve multiple transmission of information signals.
 - Consider an amplitude modulation system as given in Figure 1 where a double-tone message signal $m(t)=3\cos(200\pi t)+\cos(600\pi t)$ is used to modulate the carrier $c(t)=\cos(2 \times 10^5 t)$.

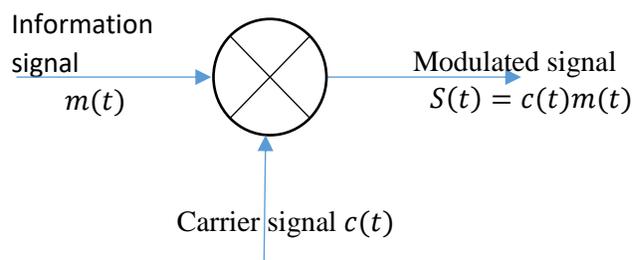


Figure 1

- Find the time domain and frequency domain representation of the modulated signal.
- Implement the modulator on Simulink and plot the spectrum (Fourier transform) of the modulated, carrier and message signals. (Include you Matlab/Simulink code in your submission)
- What is the power content and bandwidth of the modulated signal?