Amplitude Modulation & Demodulation

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Important Instructions

- Try to complete all tasks within 2 hours. After 2 hrs, evaluation starts.
- For each subtask, create mfiles (eg. *CT_HT*.m) and save them with suitable name.
- Prepare a word document naming your name and ID. In it, save all results including plots.
- In all plots, put x-label, y-label, legend, font 'Arial'(Size = 10), and, Width '2'.

Task 1.(a): Amplitude Modulation (AM)

- Consider single-tone modulation, that is, $m(t) = A_m cos(2\pi f_m t)$
- Understand following commands or library functions
  - clf, clc, clear
  - linspace
  - modulate
  - ammod
- Use the following
  - Generate million points between 0 and 0.01 using linspace
  - carrier frequency=18 KHz; message signal frequency = 900 Hz;
  - carrier peak amplitude = 10 volt; message peak amplitude = 4 volt;

- Questions:
  1. What is the value of depth of modulation or modulation index ?
  2. Write a program to plot message signal, carrier signal, and, modulated signal without using MATLAB library function. In other words, use AM signal expression directly. Give x-label, y-label, title etc. to all subplots.
  3. Assume $R = 1\Omega$. Compute carrier power P_c, transmit power P_t, power in sidebands, % power efficiency, and bandwidth.

- Question:
  1. Write a program to plot message signal, carrier signal, and, modulated signal using MATLAB library function **ammod**. Use the same set of parameters given in task 1.(a). Give x-label, y-label, title etc. to all subplots

- Understand following commands or functions
  - amdemod
  - butter
- Use the following
  - Same set of parameters in AM (plus)
  - sampling frequency = 80000;
  - [*num*, *den*] = butter(10,fc*2/fs); (Butterworth LPF)
- Question:
  1. Write a program to plot modulated signal using MATLAB library function **ammod** and demodulated (an estimate of message signal) using MATLAB library function **amdemod**
  2. Give x-label, y-label, title etc. to all subplots

- Question:
    1. Write a program to plot variations of carrier power and total sideband power (normalized with respect to the total average power) with %modulation
        - modulation index μ = 0:0.05:1;
    2. Give x-label, y-label, title etc. to all subplots
- Which curve has positive slope? Which curve has negative slope?