CT Report-4

Question-a

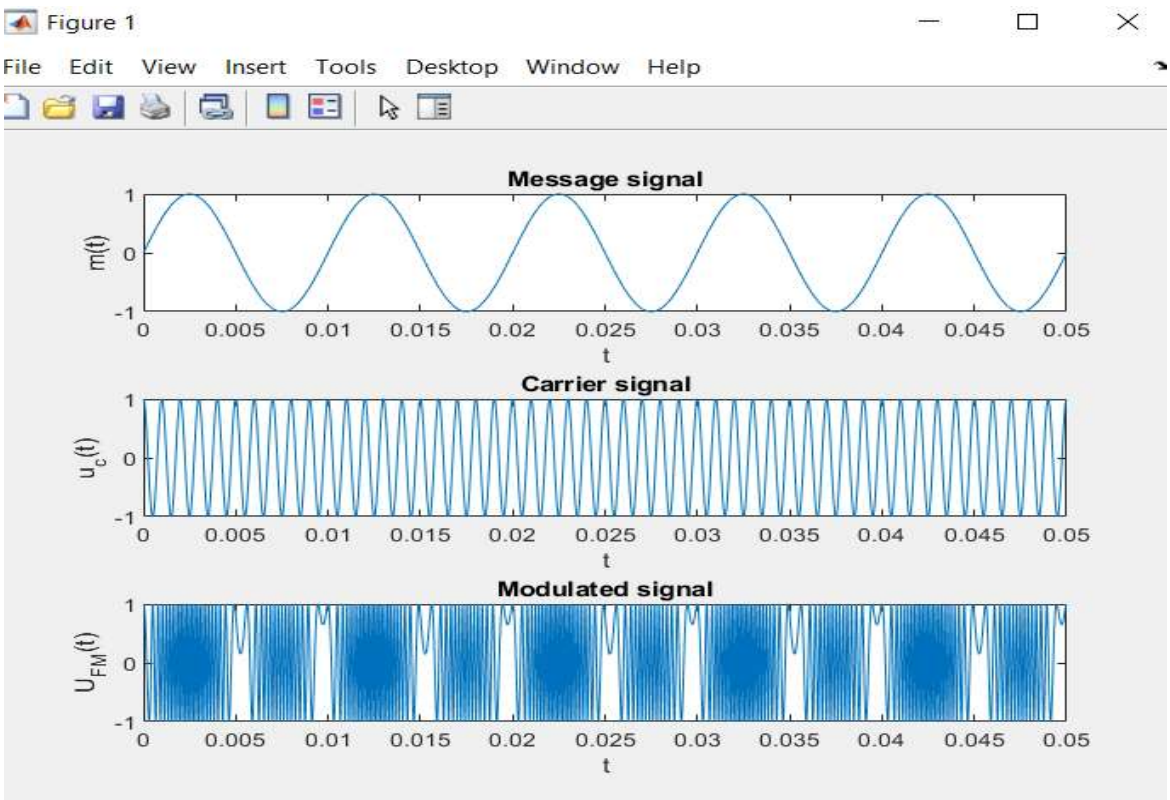
We need to generate a message signal with **f_m=100Hz.**

We need to generate a carrier signal with **f_c=1kHz.**

Then we need to generate a frequency modulated signal with Kf=0.06

Note that these values are carried on for a), b), c) questions and will not be mentioned again.

Plots

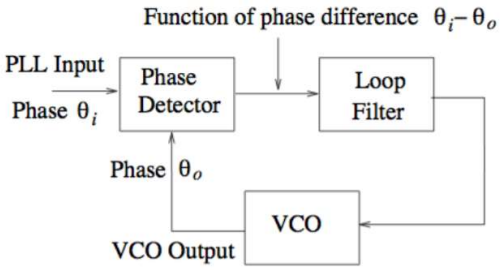


Explanation

- The message signal=**cos(200 π t).** The carrier signal = **cos(2000πt).** These two plots are self explanatory.
- The third plot is **U_{FM}(t)= cos(2000πt+theta(t)).**
  Where theta(t)=2πK_f*integral(from 0 to t) m(T)dT. Because of Kf, the value of U_{FM}(t) will be out of phase with the carrier signal.

Question-b

We are expected to perform a phase locked loop to the FM signal and then try to obtain the message signal.



The above diagram clearly explains PLL. We try to keep the phase difference in a lock ie maintain it to be constant to see that we get the output frequency to be same as that of the message frequency. The oscillator(VCO) generates a periodic signal, and the phase detector compares the phase of that signal with the phase of the input periodic signal, adjusting the oscillator to keep the phases matched.

Parameters:

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kp=0.15;
ki=0.1; are used in the filter
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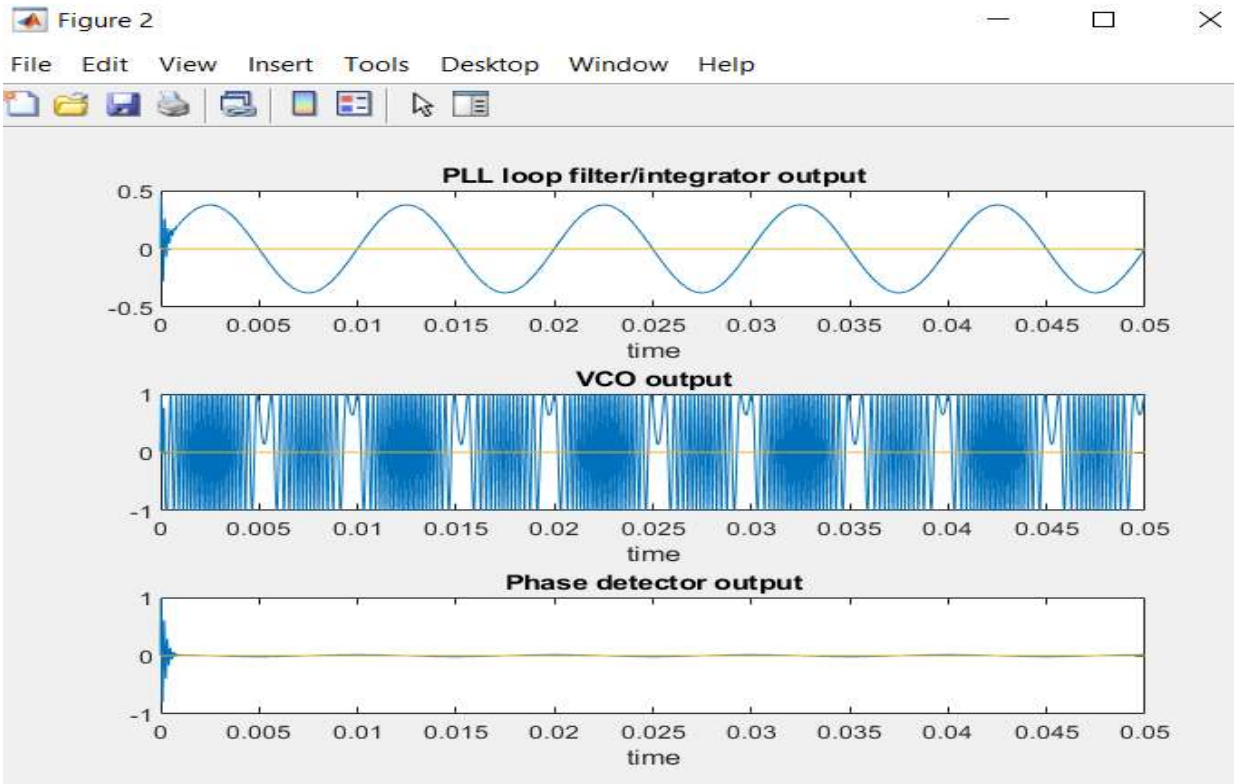
Plots



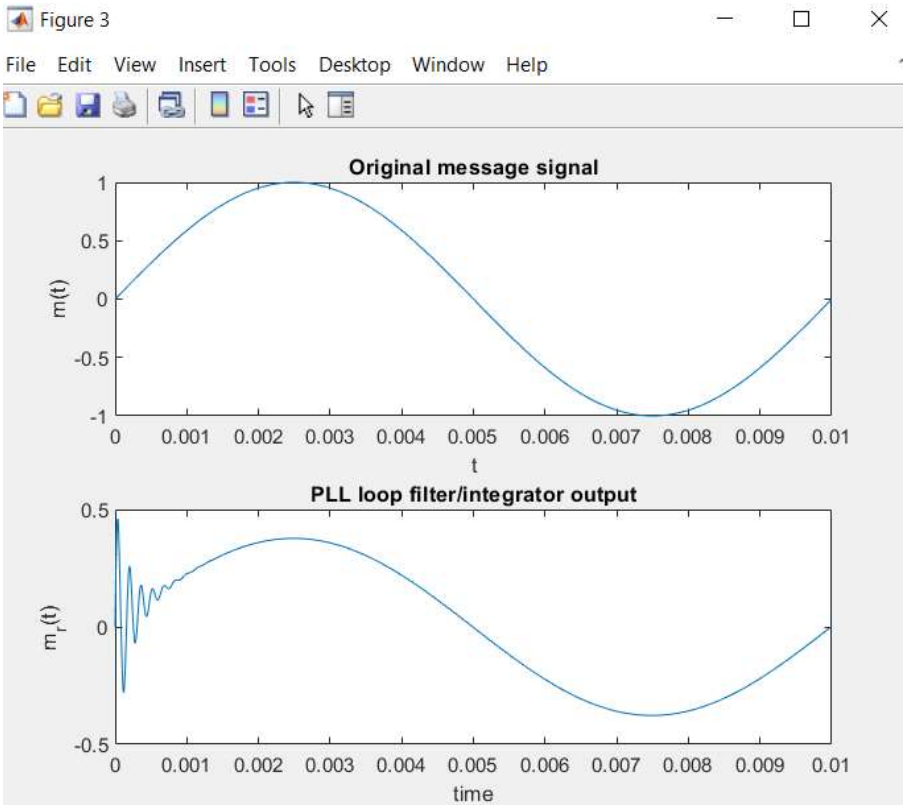
Explanation

- The outputs are expected. We get a signal that is similar to that of the fm signal as the output of the vco.
- We get the difference in phase which due to the PLL is decreasing and eventually becomes 0.
- Initially we get a distorted signal due to the phase change but as the phase gets locked, we notice that we get back the original message signal(scaled version) as the output of the filter.

Question-c

We have to plot the original message signal and the recovered signal

Plots



Note that this plot does not cover the entire time period and is a zoomed version

Explanation

As mentioned above, we initially get the recovered signal to be slightly different due to the fact that the phase difference between them is not zero in the beginning. But later on, we see that they is no difference, they are in phase with each other and the demodulated signal is simply a scaled version of the message signal.