Signals and Systems
Lab – 5

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Figure 1

We clearly see that, greater order (21) results in more steep and ideal like filter that fewer(4) number of order.

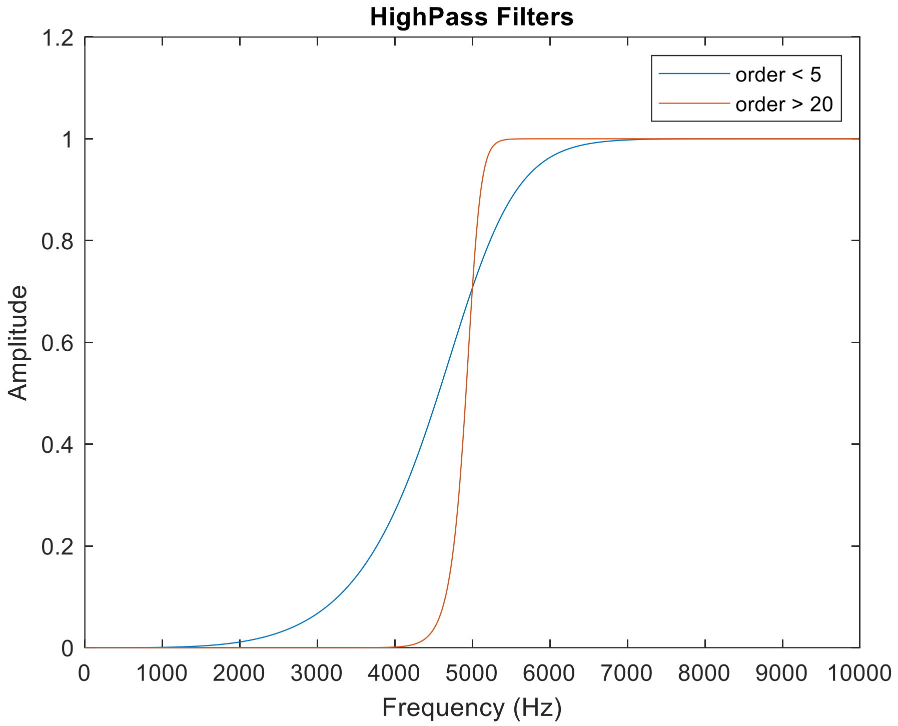


Figure 2

We see that filter with greater order filters much better than the filter which has lesser order. The lower side band signal passed through the filter at the second graph but not at the third graph. Because greater order generates more ideal like filter with steeper behavior. Also, we obtain peaks at fc+fm, fc-fm, -fc+fm and -fc-fm because of the trigonometric transformation and fourier transform of cosine.

$$m(t) * \cos(2\pi 5000t) => \frac{M(f-5000)}{2} + \frac{M(f+5000)}{2}$$

$$Fourier \gg 3/4[\delta(-5000-450) + \delta(-5000+450) + \delta(5000-450) + \delta(5000+450)]$$

We obtain the last graph by eliminating the signals which are between 1kHz and -1kHz because of my filter design.

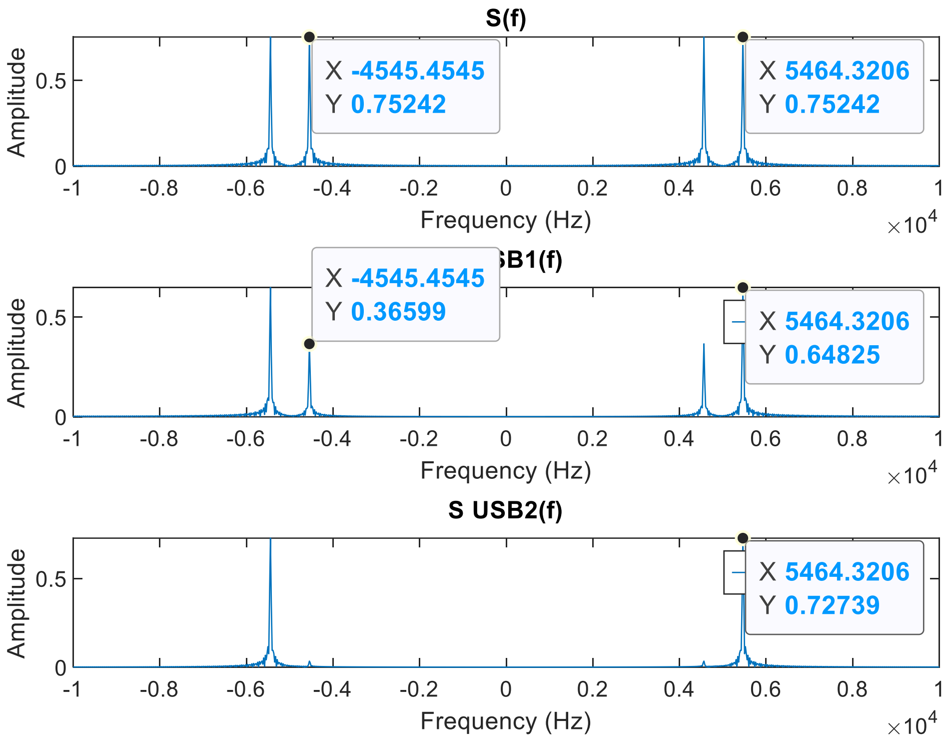


Figure 3

When we multiply s with local oscillator, we obtain the signal with ¼ times message signal. Thus, I have chosen 4 as amplitude of local oscillator. Thanks to this, we almost obtain the original message signal.

There are peaks at 450Hz because our message signal is a cosine with 450Hz frequency. Also, at V(f) we are supposed to see peaks at 2fc+fm and -2fc-fm. However, because of short frequency vector we see peak at +9550Hz and -9550Hz.

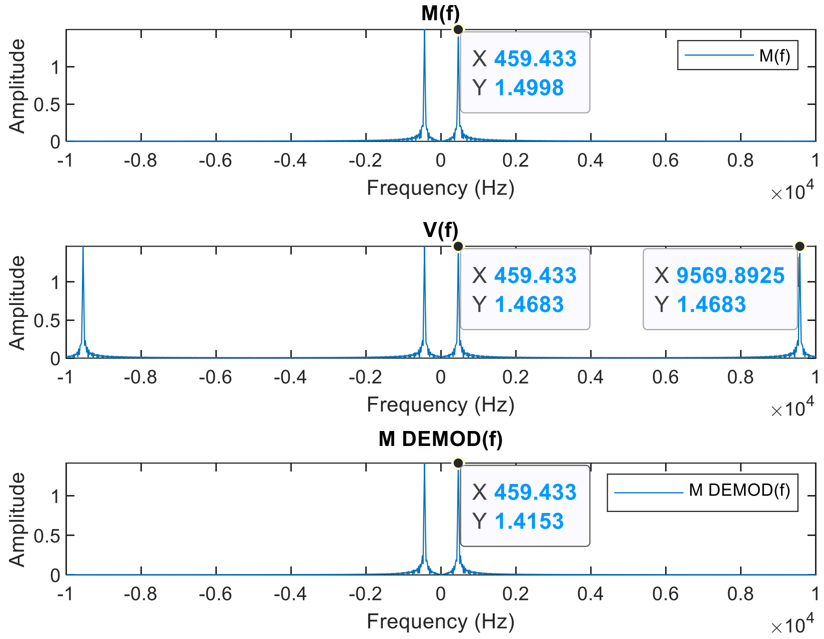
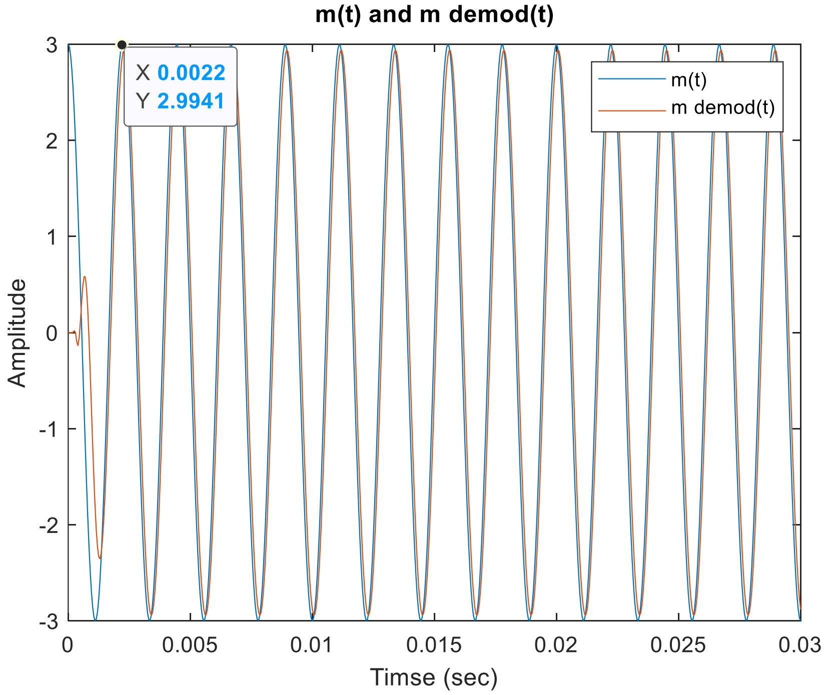


Figure 4

We obtain almost the same signal from demodulating s(t). There is just a little phase and amplitude difference because of nonideal filter.



Comments
2.1f
%We see that filter with greater order filters much better than the filter
%which has lesser order. Also, the lower side band signal passed through the
%filter at the second graph but not at the third graph. Because greater order
%generates more ideal like filter.

2.2a
%s_usb2 which has order greater that 20 is more likely desired modulated
%signal. That is why I have chosen s_usb2.

2.2b
%Our cutoff frequency is supposed to be between fm and 2fc-fm that is why I
%have chosen cutoff as 1000Hz with order of 2 because we desire least order
%as possible and more original message like modulated signal. I obtain
%those with 2nd order 1000Hz cutoff filter.

2.2d
%When we multiply s with local oscillator, we obtain the signal with 1/4
%times message signal. Thus, I have chosen 4 as amplitude of local
%oscillator. Thanks to this, we almost obtain the original message signal.
%There are peaks at 450Hz because our message signal is a cosine with 450Hz
%frequency. Also, at V(f) we see peak at 2fc-fm because of product
%modulator.

2.2e
%We obtain almost the same with demodulating s(t). There is just a little
%phase and amplitude difference because of nonideal filter.