

# Principles of Communications

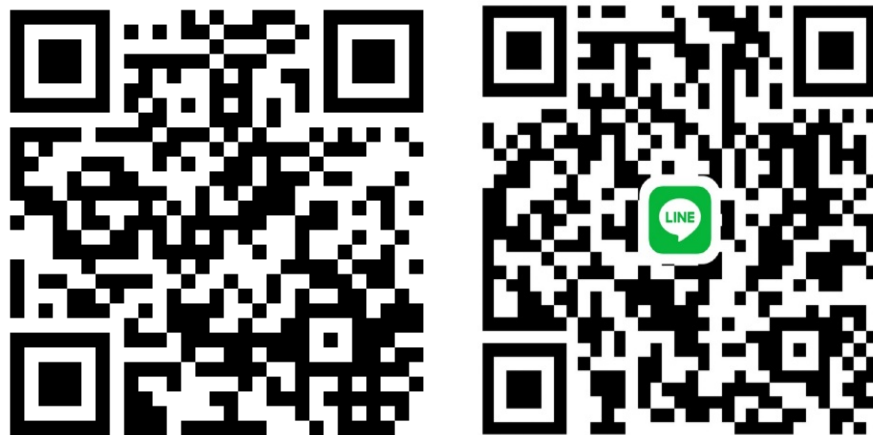
## EES 351

**Asst. Prof. Dr. Prapun Sukksompong**

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### 4. Amplitude Modulation



**Office Hours:**

Check Google Calendar on the course website.

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6th floor of Sirindhralai building,  
BKD

# Principles of Communications

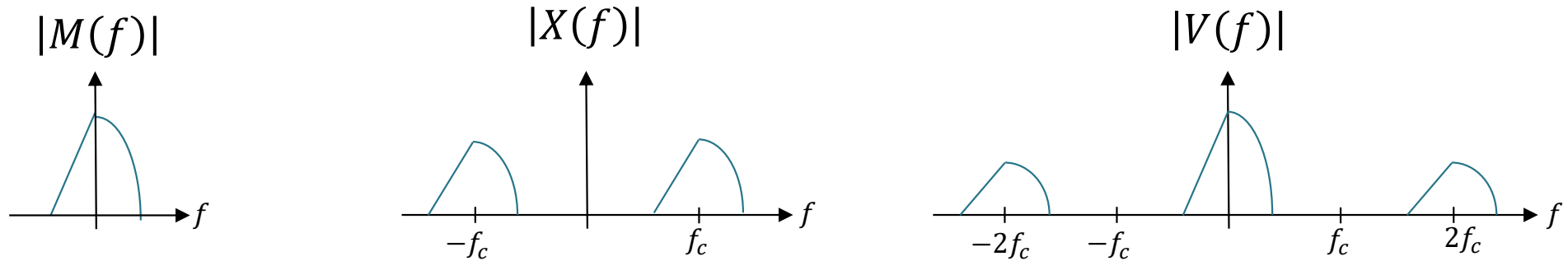
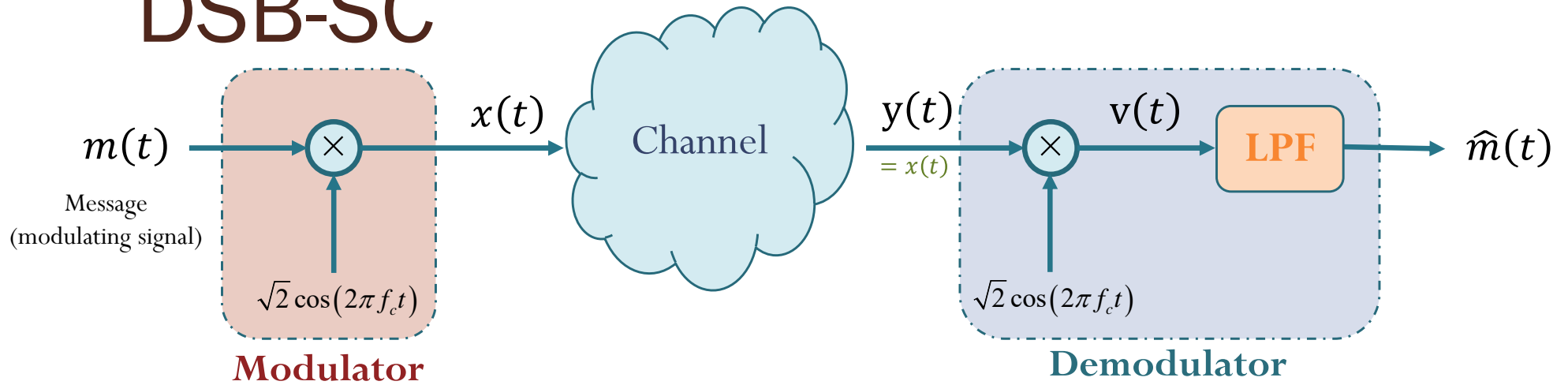
## EES 351

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**4.1 DSB-SC**

# DSB-SC



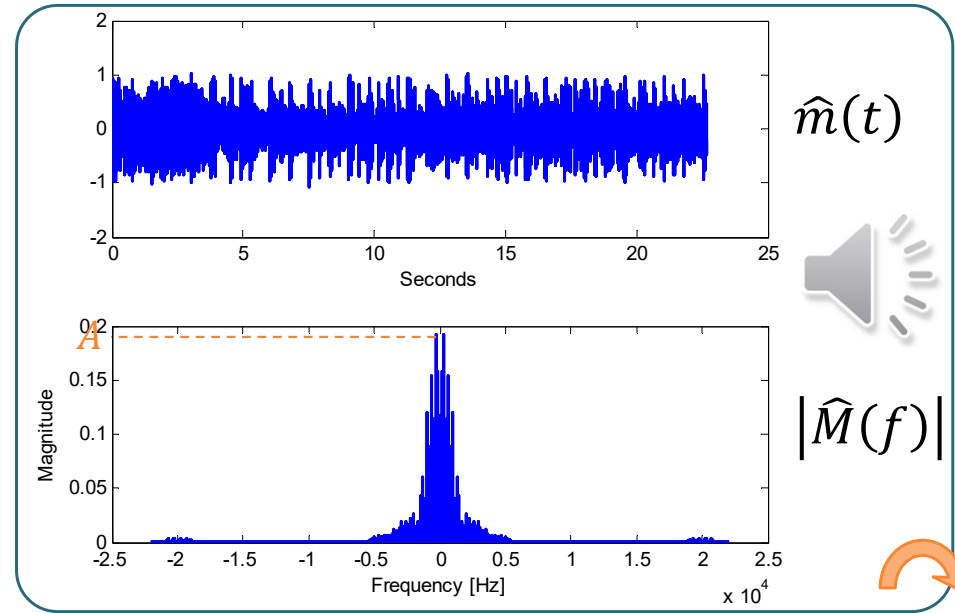
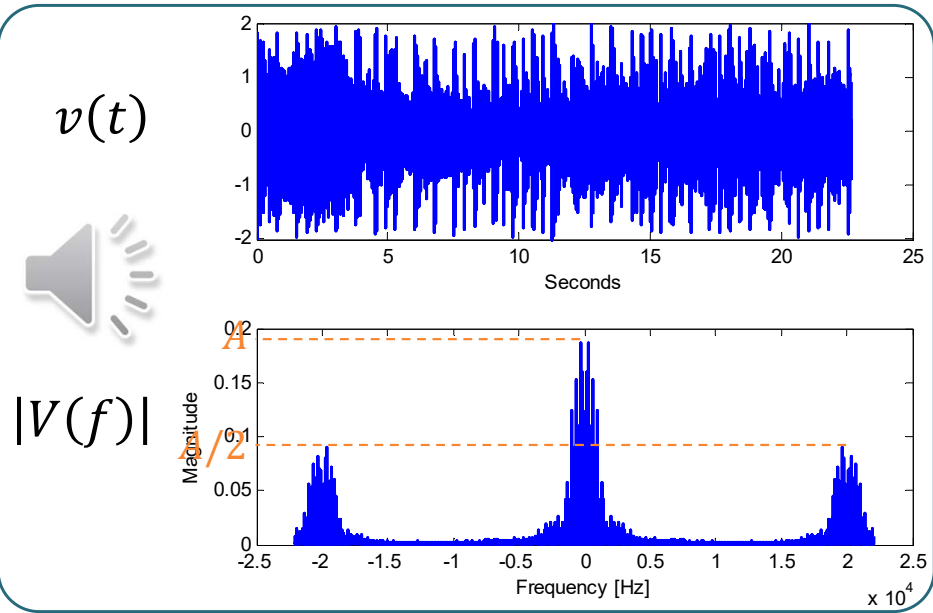
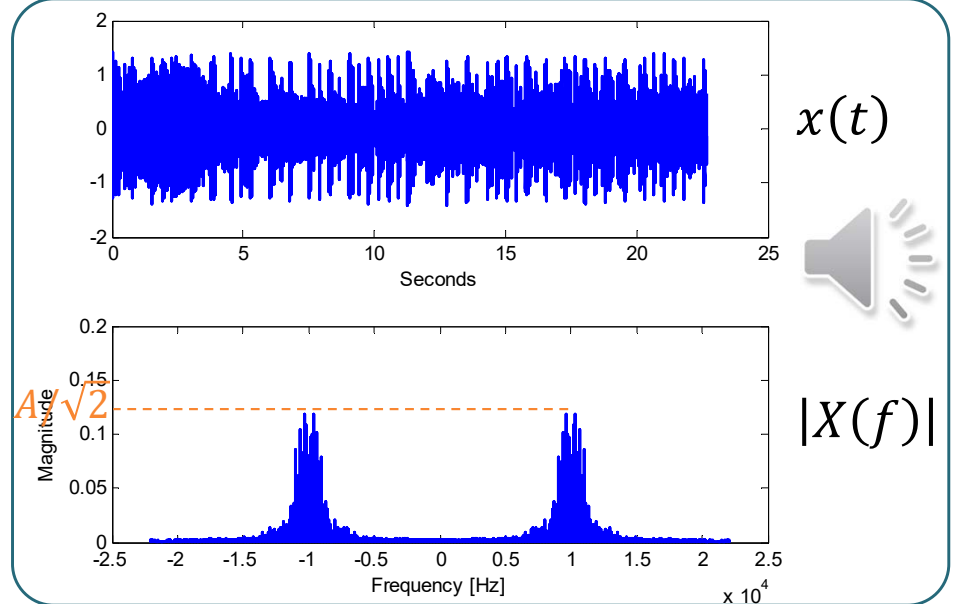
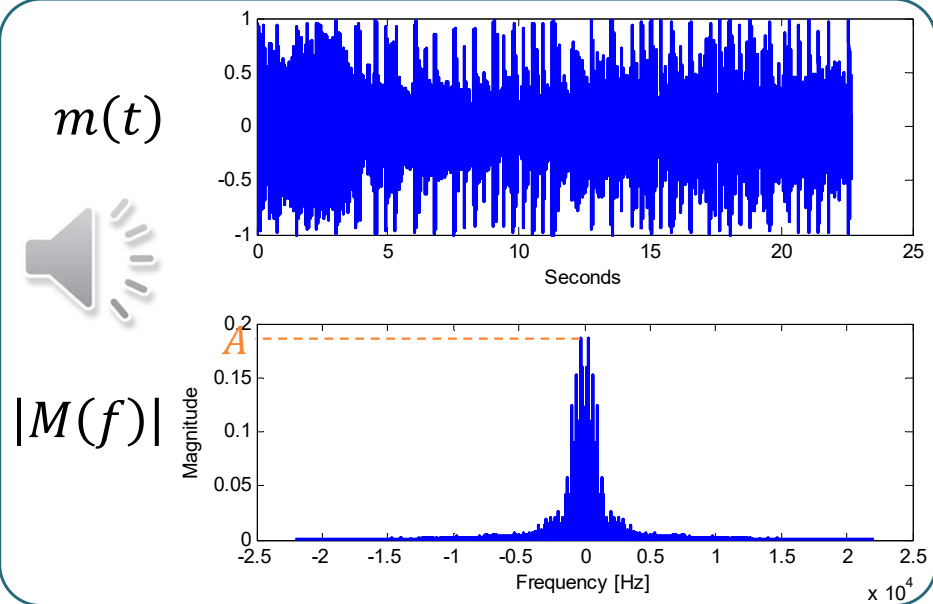
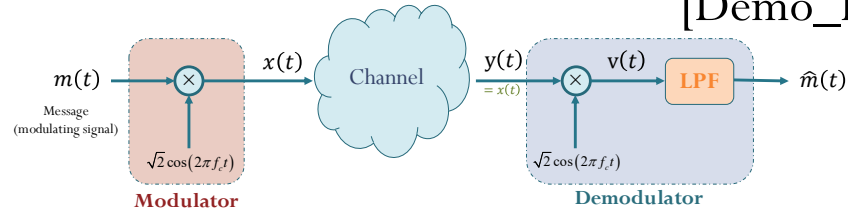
Key equation:

$$\text{LPF} \left\{ \underbrace{\left( m(t) \times \sqrt{2} \cos(2\pi f_c t) \right)}_{x(t)} \times \underbrace{\left( \sqrt{2} \cos(2\pi f_c t) \right)}_{v(t)} \right\} = m(t)$$

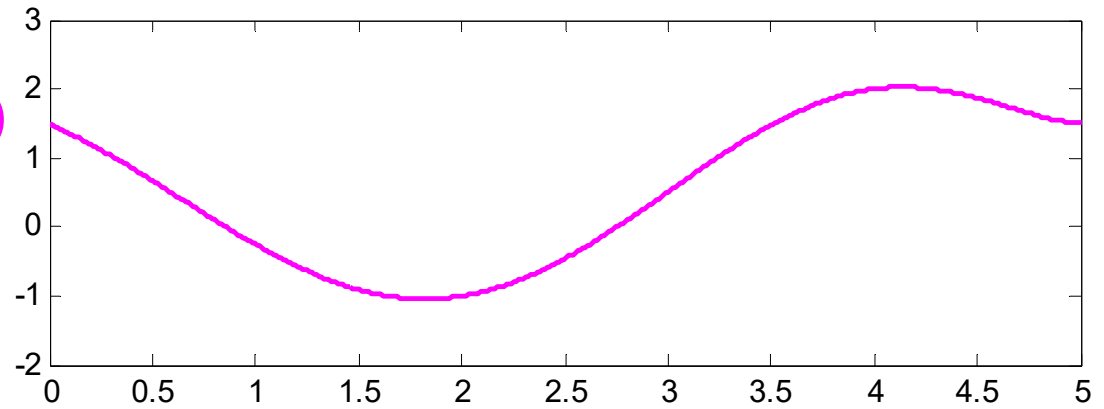


# DSB-SC

[Demo\_DSBSC\_Sound\_ReadWAV.m]

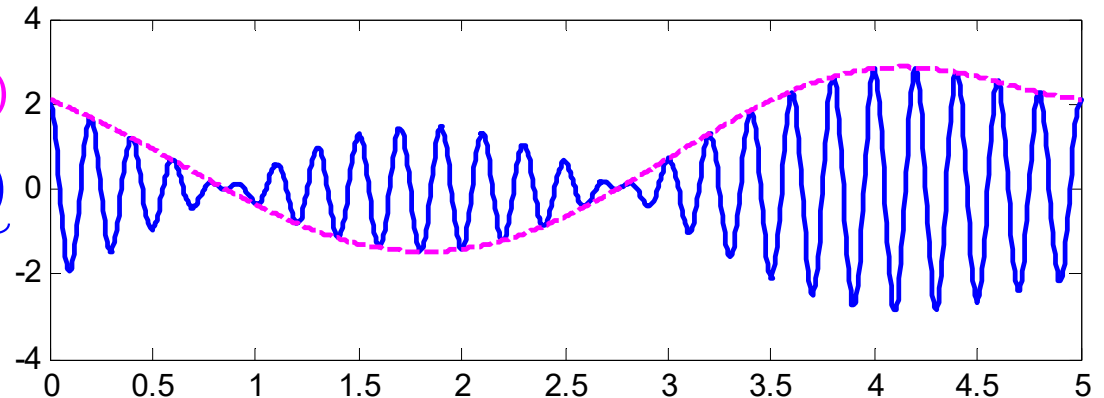


# In the time domain...



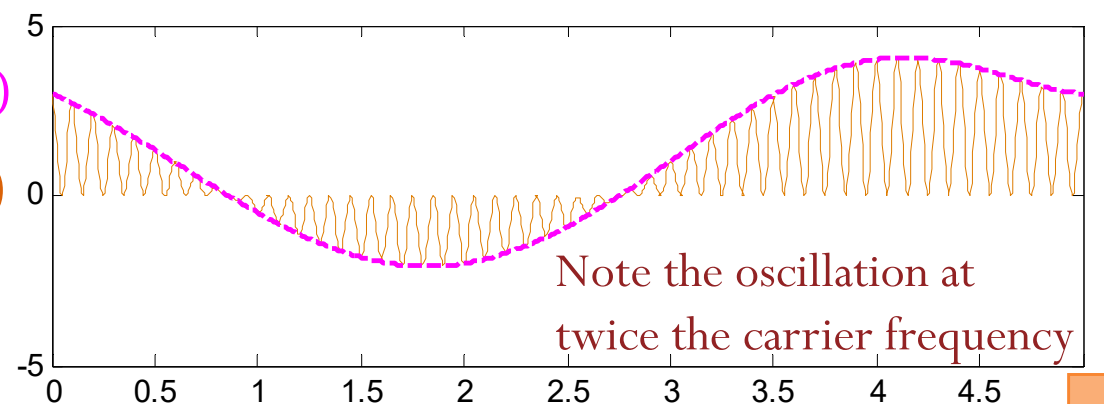
$m(t)$

$$m(t) \times \sqrt{2} \cos(2\pi f_c t) = x(t)$$



$\sqrt{2}m(t)$

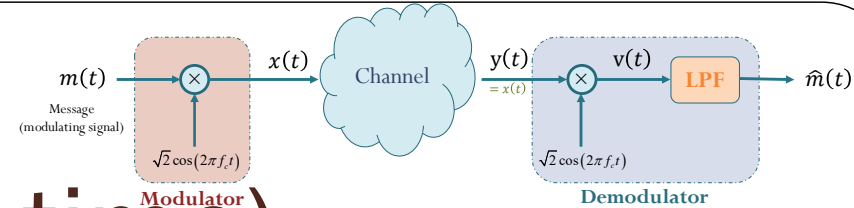
$$x(t) \times \sqrt{2} \cos(2\pi f_c t) = v(t)$$



$2m(t)$

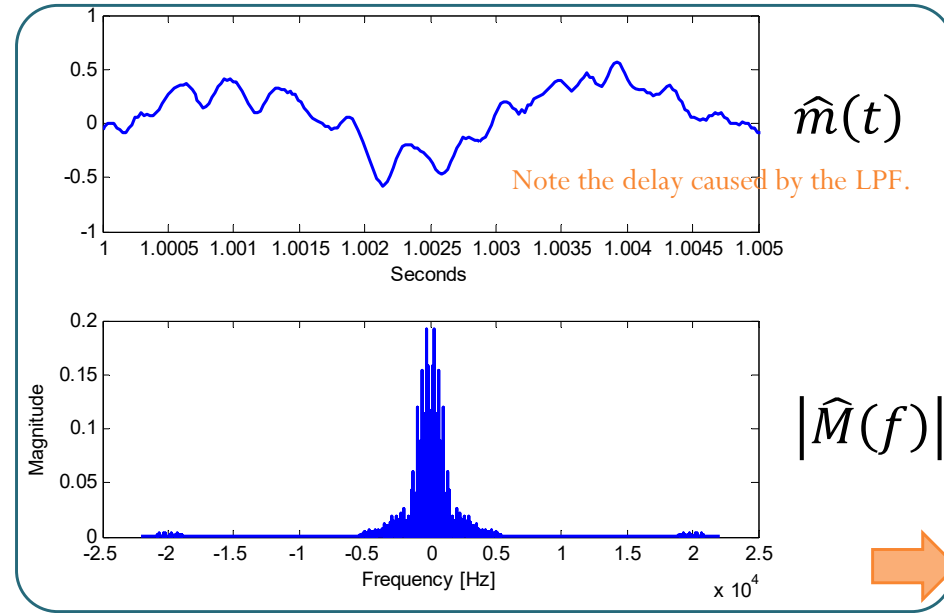
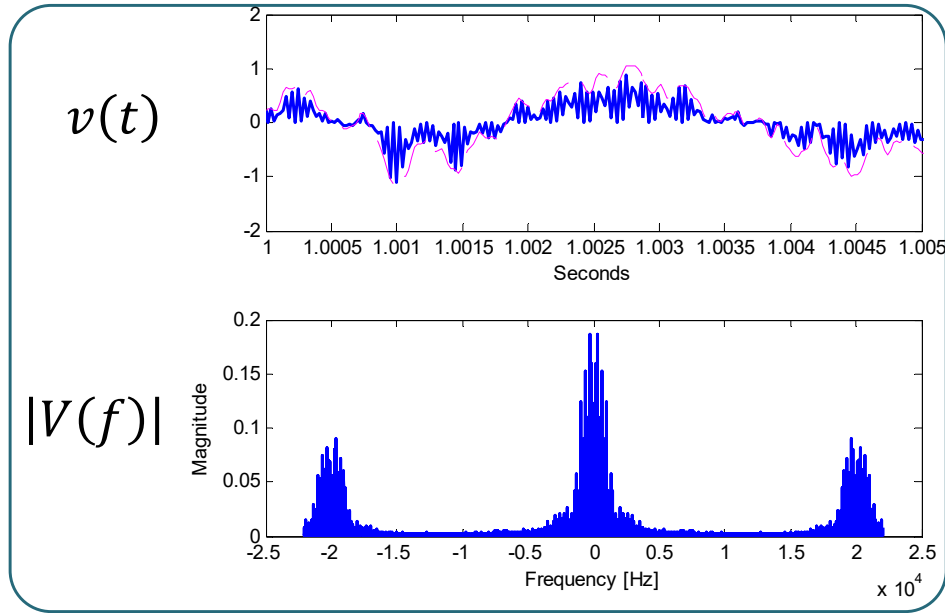
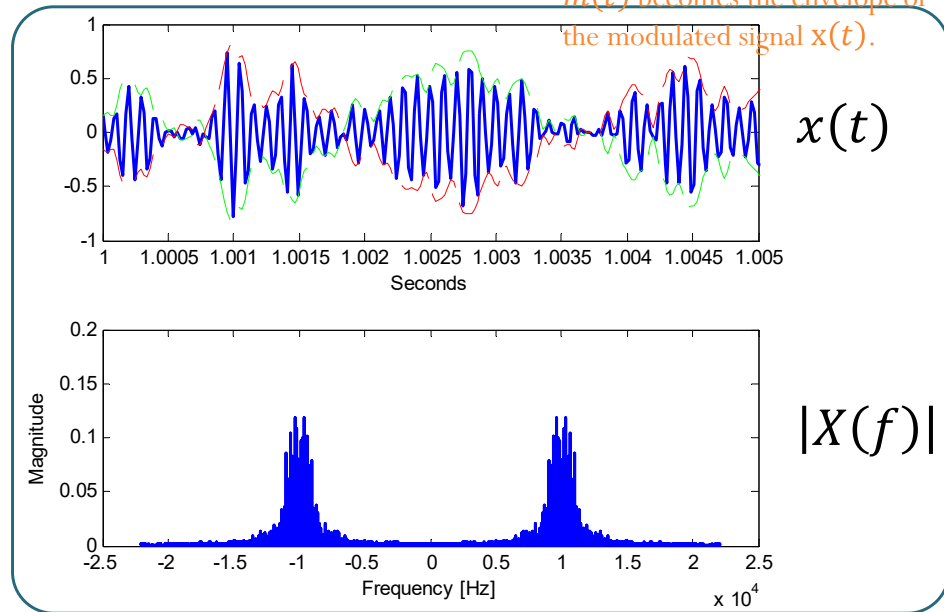
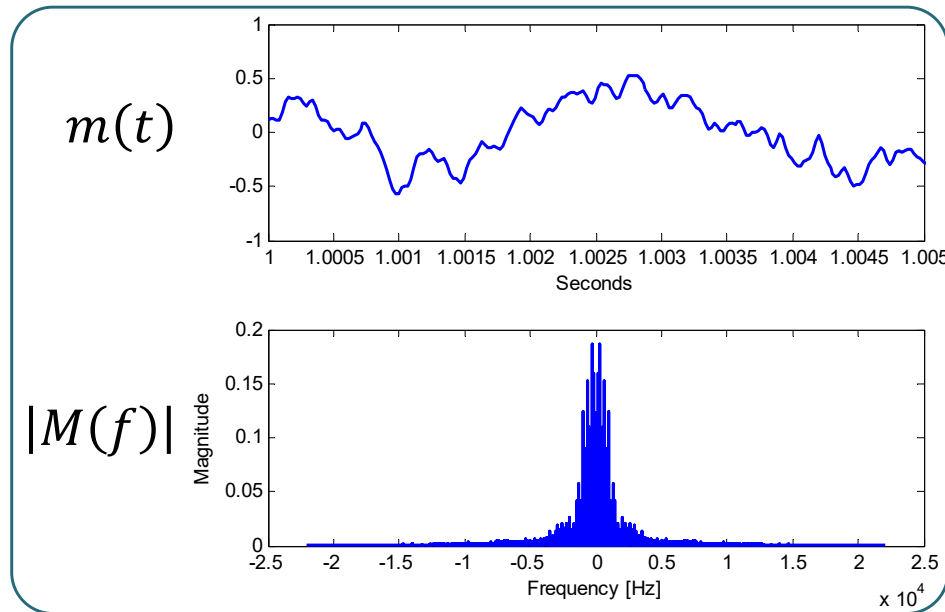
Note the oscillation at twice the carrier frequency

Seconds



# DSB-SC (Zoomed in time)

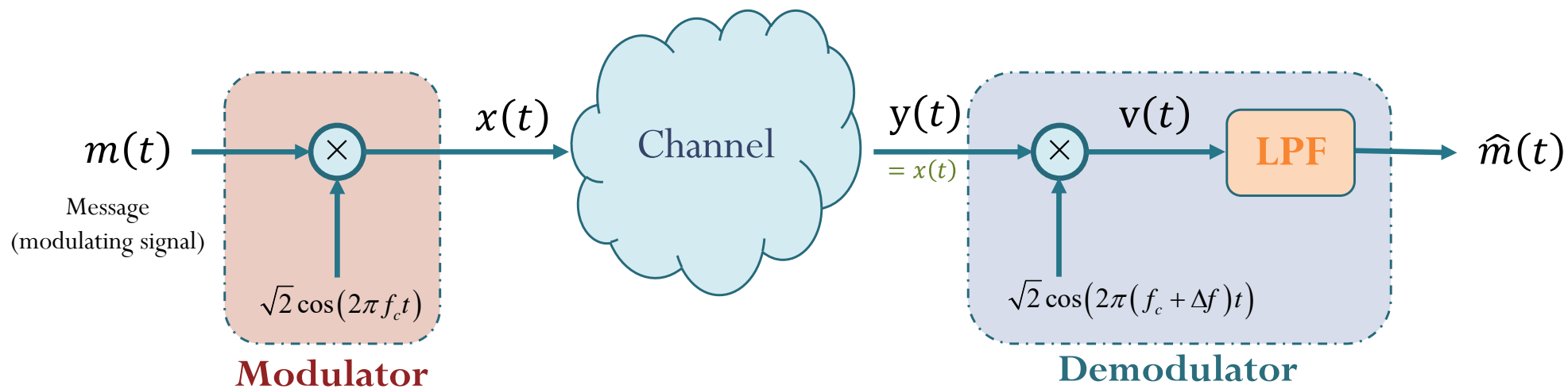
Note how the baseband signal  $m(t)$  becomes the envelope of the modulated signal  $x(t)$ .

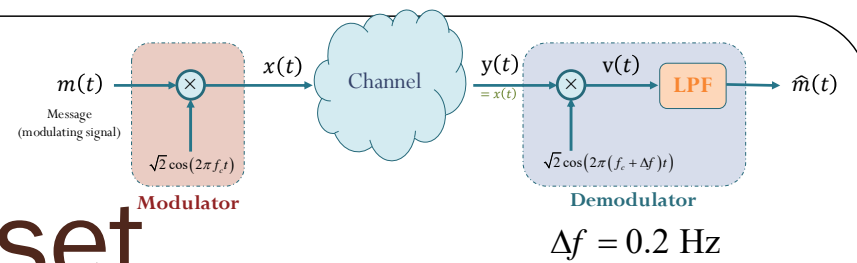


Note the delay caused by the LPF.

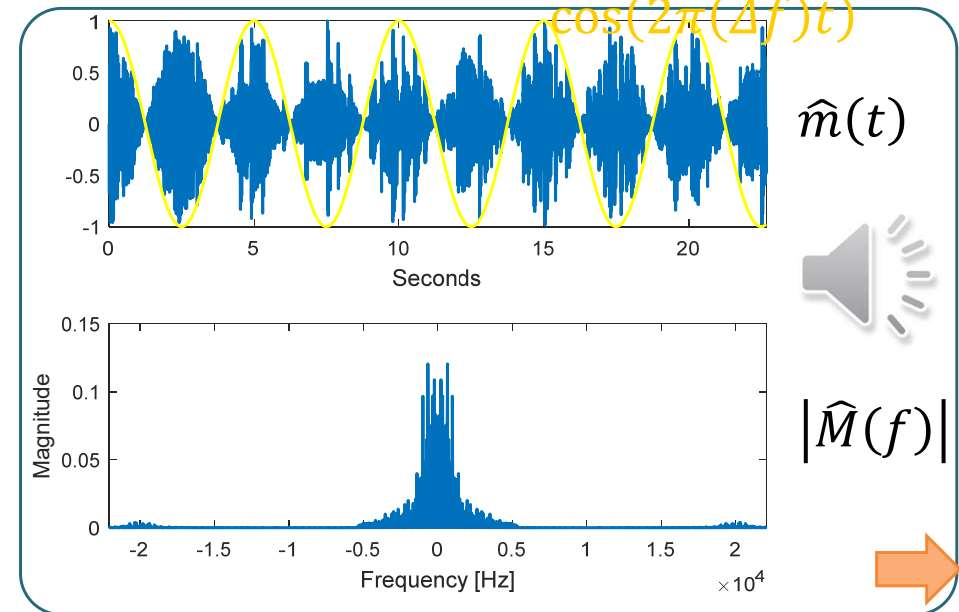
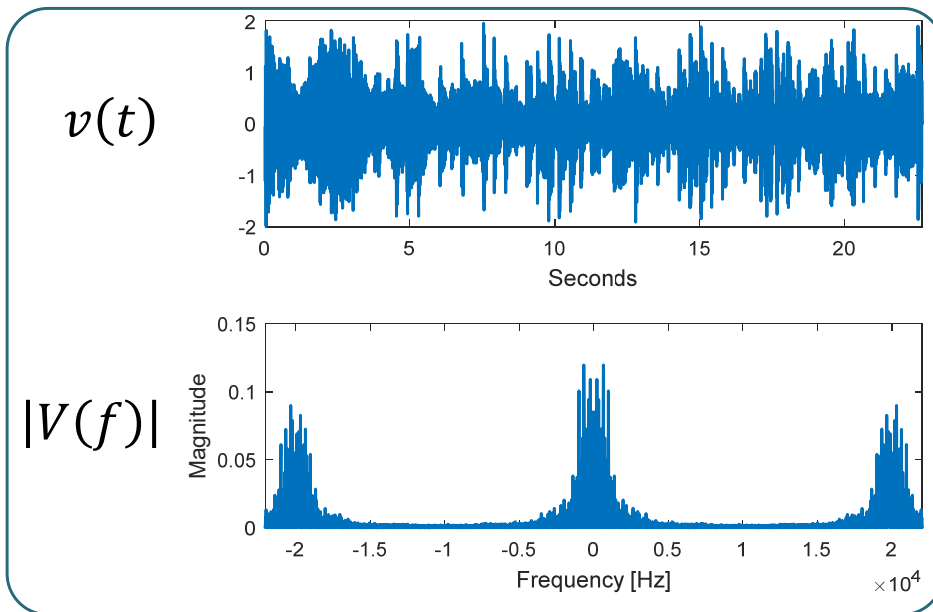
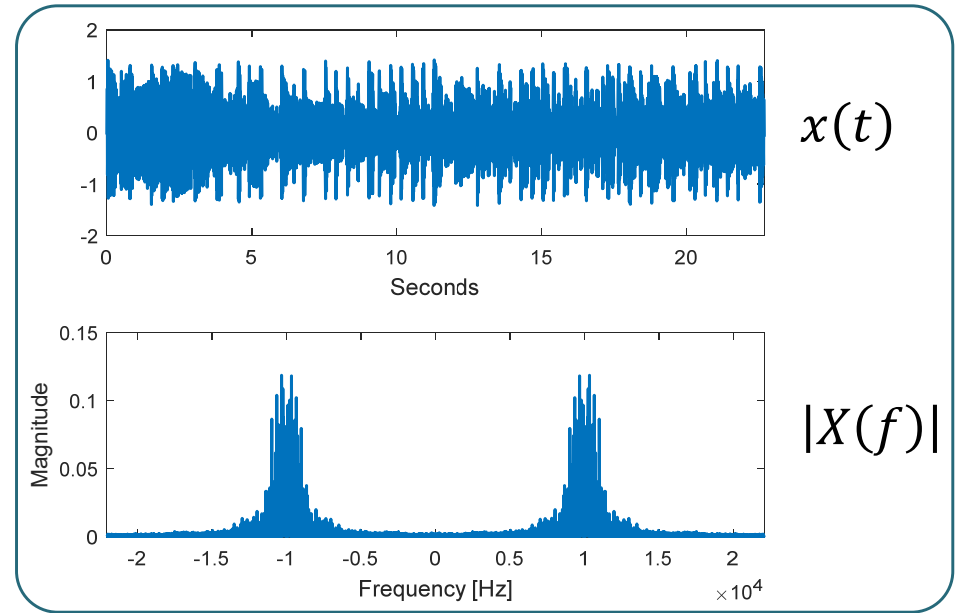
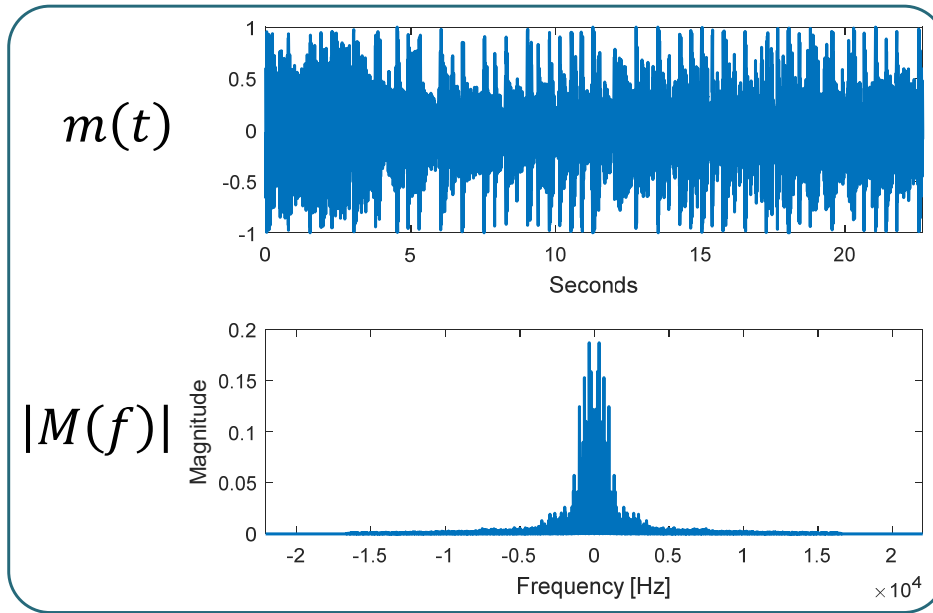


# DSB-SC w/ Freq. Offset





# DSB-SC w/ Freq. Offset





# DSB-SC w/ Freq. Offset

