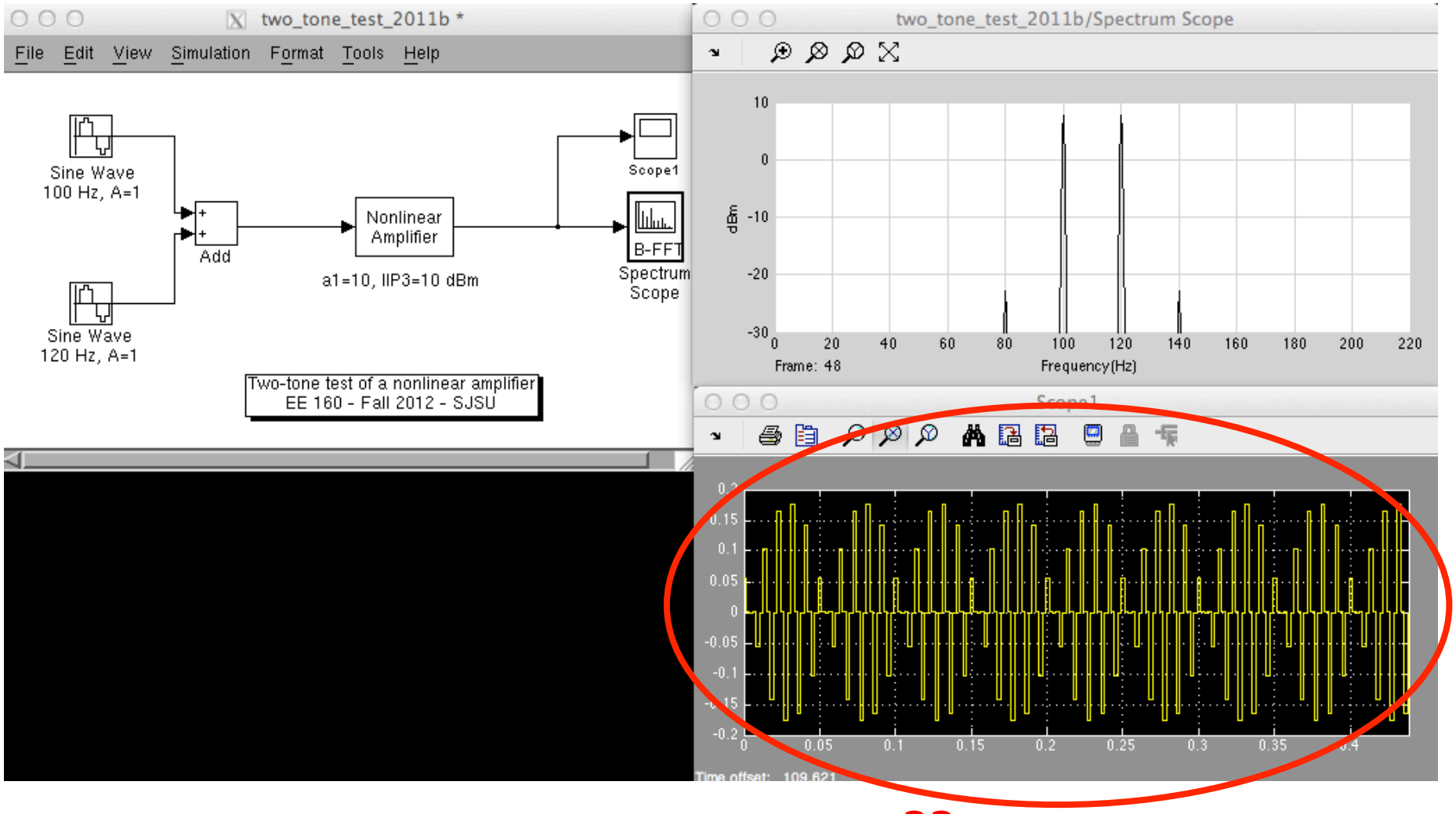
A note on the two-tone test

EE160: Principles of Communication Systems

San Jose State University

MATLAB Simulink model



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Two-tone signal

- The two-tone signal is given by

$$v(t) = A\cos(2\pi f_1 t) + A\cos(2\pi f_2 t), \quad f_1 < f_2$$

- Let $f_c = \dfrac{f_1 + f_2}{2}$, and $\Delta f = f_2 - f_1$. Then

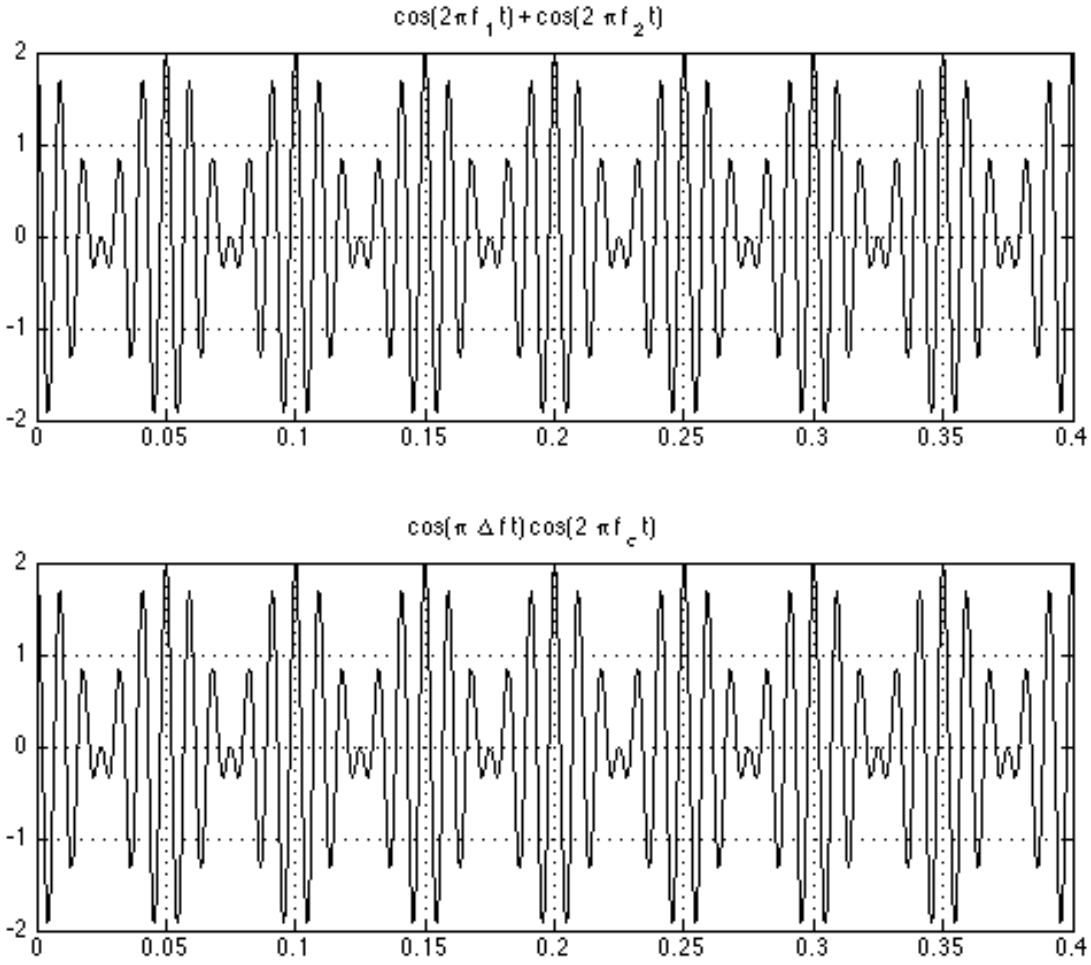
$$f_1 = f_c - \Delta f / 2, \quad f_2 = f_c + \Delta f / 2.$$

- A well-known trigonometric identity gives

$$\boxed{v(t) = 2A\cos(\pi \Delta f\, t)\cos(2\pi f_c t)}$$

which is an ***amplitude modulated (AM) waveform***!

Comparing the two waveforms



Matlab script for the plot

```
% Plot of a two-tone signal
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clear all

t=0:1/10000:0.4;

% Two-tone waveform
f1=100; f2=120;
v = cos(2*pi*f1*t) + cos(2*pi*f2*t);

subplot(2,1,1), plot(t, v, '-k'), grid on
title('cos(2\pi f_1 t) + cos(2\pi f_2 t)')

% AM modulated version
fc=(f1+f2)/2; deltaf=f2-f1;
vp = 2 * cos(pi*deltaf*t) .* cos(2*pi*fc*t);

subplot(2,1,2), plot(t, vp, '-k'), grid on
title('cos(\pi \Delta f t) cos(2\pi f_c t)')
```

Lab result (Fall 2018) !!