

6.002 Demo# 13

First Order Sinusoidal Steady State

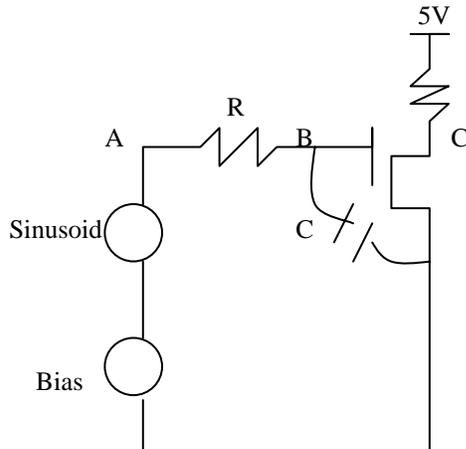
Lecture 16

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Purpose: This demo examines first order sinusoidal steady state responses of the inverting amplifier and an RC circuit. For low frequency sinusoids, the input-output behavior of the MOSFET amplifier is predictable. When the frequency is increased, the output dies away. This is explained with the source resistance (the demo uses a 100K resistor at the gate) and gate capacitance acting as a low-pass filter. The sinusoidal steady state response also introduces frequency responses and Bode plots.

Steps:

1. Start the input at a low frequency (2 kHz). Note the amplitudes of the input sinusoid, the gate voltage and resulting output.
2. Sweeping through frequency up to about 20 kHz, note the changes in amplitude and phase of each voltage shown. This can be related to the RC model using differential equations. Derive the equations for amplitude and phase.
3. Using the dynamic signal analyzer, plot the magnitude and phase of the RC response. This can also be played through a speaker, so the magnitude of the response can be heard. Note: the ear has its own response! It is not flat, so frequencies at the same amplitude will be perceived differently. (For that matter, the speaker has a non-flat response...)



As the frequency is increased, the capacitance at the gate acts more as a short. Thus the MOSFET has a smaller input, resulting in a smaller output.

Description: First Order SSS
(Using Gate Capacitance Demo board)

For this demo we use KH signal Generator instead of HP on the cart. Get the one with a serial #140 and use external trigger from KH Sig. Gen. , connect it on AUX of the new scope.

Set offset @ 1.17 v.

Frequency range from 2 KHZ to 20 KHZ, starting @ 10 KHZ and sweep the frequency, observe CH1, CH2 and CH4.

RG/short and RL/short switches should be down (Off position). If Prof. wants to short either gate or load resistors he will tell you!

Note: for schematic diagram and pins output, see next page Fig 1 for more detail.

With this demo we use demo #12-B “ an old demo ”, using Dynamic Signal Analyzer , amplifier and speaker to show the bode plot!

See schematic next page Fig 2

Oscilloscope Setup

CH	V/DIV	OFFSET	MODE	FUNC	MATH	VERTICAL	HORIZONTAL
1	on	100mv	-199.5mv	AC	on		
2	on	100mv	1.5mv	AC	on		
3	off				off		
4	on	1 v	2.0 V	AC	on		
Horizontal: 200 us/Div		Acquisition: 156.20			Trigger: AUX 1.535		

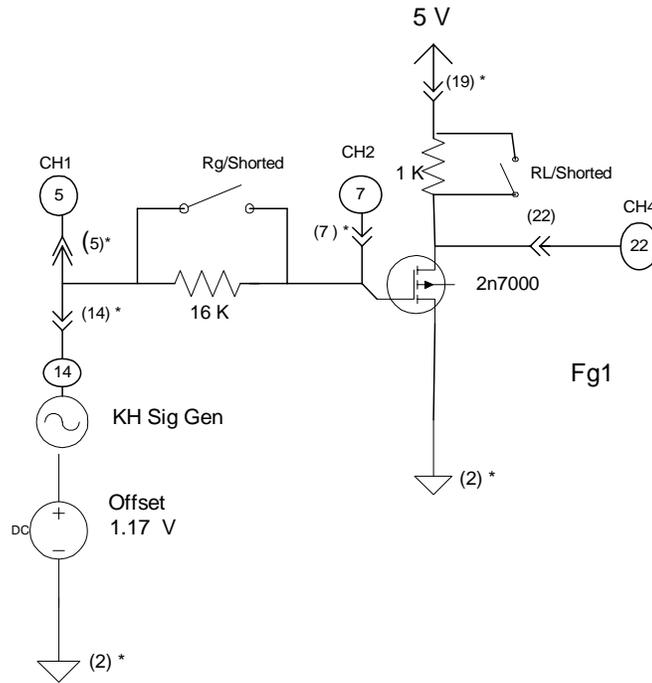
Waveform Generator Setup

Power Supply Setup

UNIT	WAVE	AMP	OFFSET	FREQ	+6	+25	-25	OUTPUT
KH	Sine		1.17	2 to 20 KHZ	5			on

Note: Use ext trig from KH gen to AUX trig in of the scope!

First Order SSS



Demo#12-B using Dynamic Signal Analyzer an old demo!

