Physics 334
Notes for Lab 7 – OpAmps II

February 18, 2009

Lab manual sections **9-1 a, 9-2, 9-3, 9-5, 9-6, 9-7**.

It is a good idea to follow the practices began in Lab 4 of using a single-point ground and adding bypass capacitors (0.1 μF) between the supply voltages and ground. Also, make all scope measurements with the 10x scope probes.

9-1. Do part ***a*** only. The "slew rate" is the maximum value of $\Delta V_{\rm out}/\Delta t$. Check your values for the maximum slew rates for the '741 and the '411 amps against the manufacturer's specs.

The OpAmps are pretty fast, so to see the slew, you'll need to crank up your timebase. You're looking for the slope of the "vertical" part of the square wave... And you'll only see it if you look at that part of the waveform closely.

For part (2), the Horowitz and Hill Text notes (p. 192) that "A sine wave of frequency f hertz and amplitude A volts requires a minimum slew rate of $2\pi Af$ volts per second. This lil' detail may help you with this part.

9-2. Do all parts. Hint on the calculation: a 2 volt peak to peak square wave has a value of 1 volt peak to ground. You'll understand the meaning of this remark when you make the calculation.

Note: If you neglect the 10MΩ feedback resistor, the input current $I_{\rm in}$ obeys

$$I_{\rm in} = \frac{V_{\rm in}}{R_{\rm in}} = -C\frac{dV_{\rm out}}{dt} \ .$$

9-3. Build the differentiator and try it out. What should the derivative of the 1kHz triangle wave be?

Note: Our generators do not have the diode circuit shown, but you may see some interesting glitches nevertheless. Draw what you see with a sine wave input.

9-5. Drive the active rectifier with a 100Hz sine wave of about 2 volts peak to peak. Draw pictures of what you see on both the terminal marked "out" and at the output of the op amp itself, and comment on why they look the way they do.

9-6. The op-amp does not have such large output swings into "saturation" with this circuit. What prevents them?

9-7. Vary the setting of the 50k pot, sketch the results, and discuss.

Be sure to have the scope input on "DC" for this exercise. The function generator also provides some DC bias to the input. What happens if this is removed? Put a 10μF capacitor (with the + terminal connected to the 3.3k resistor input), and then switch the scope to "AC" input, and see.