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02/12/2016 Lab 1

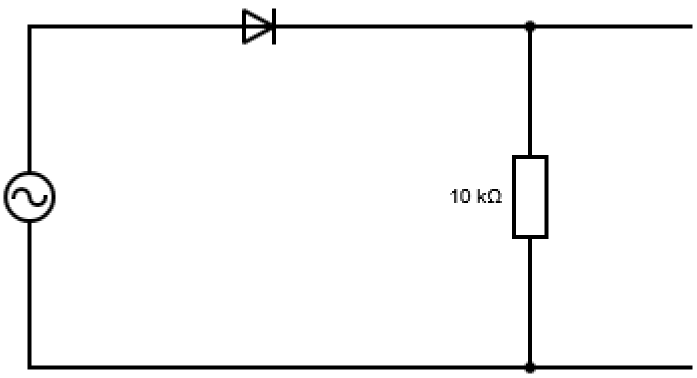
Electrotechnology lab 3 report:

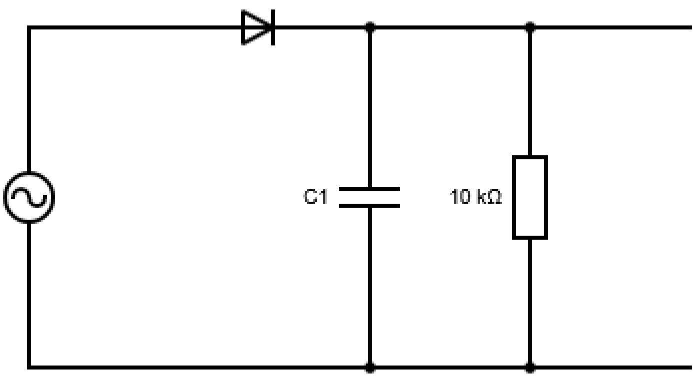
Objective:

For our third lab, we want to connect a capacitor to our circuit and understand the output given by the oscilloscope.

Method:

We made the two following circuit:





Note: This is an electrolytic capacitor, its positive side is the top plate and the negative side the bottom plate.

The AC power supply is set to 2V peak to peak. For the second circuit we took multiple measurements with different settings. We changed both the electrolytic capacitor and the frequency of the generator. We plotted the input/output for a 1μF capacitor at 200Hz and 2KHz frequency. And repeated the same process with a 10μF capacitor.

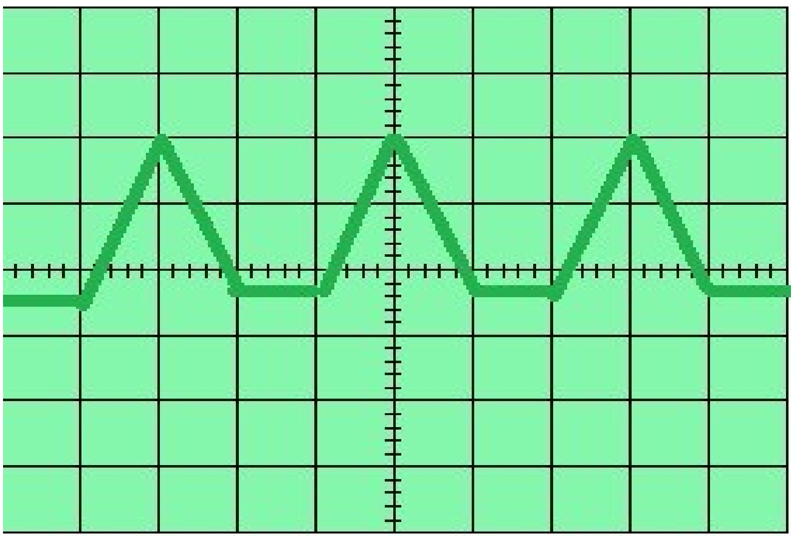
For the first circuit, the diode is in forward bias, we can expect to only read positive values on the oscilloscope because of this. As the current in reverse bias won't pass through the diode besides some leakage as it is not a perfect diode.

For the second circuit, the capacitor will charge and discharge, changing the output signal. Again we should read positive voltage in forward bias. But when the power supply reaches a peak, the capacitor will discharge all the current it stored.

Data:

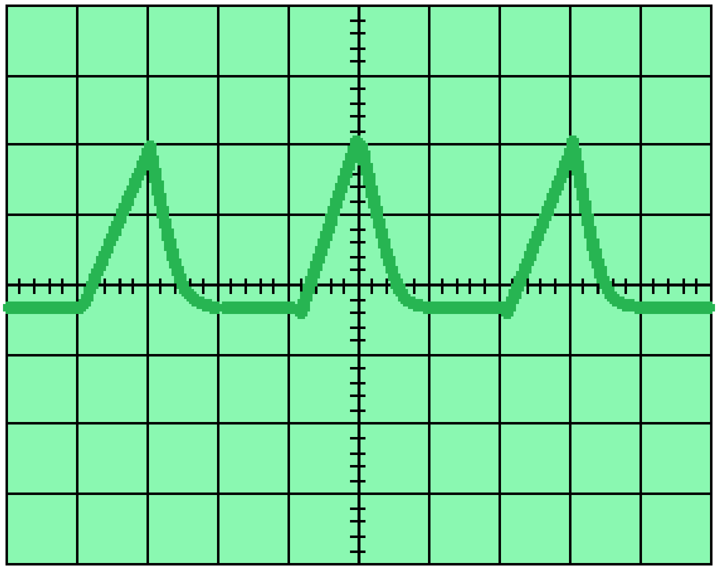
Note: The oscilloscope was set on 0.5V/div so each division, each square from the grid, is 0.5 volts.

-For the first circuit, we got the following graph:

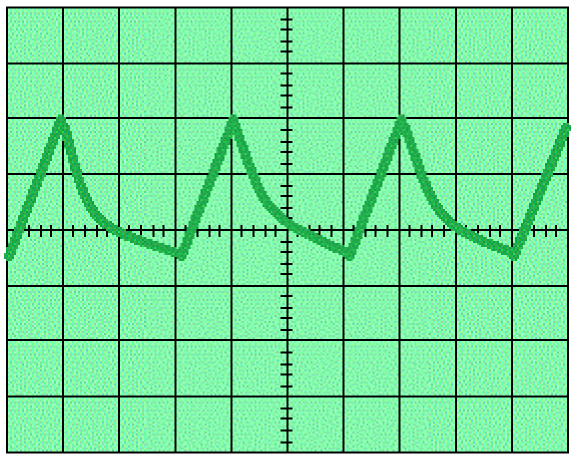


For the second circuit, we first had:

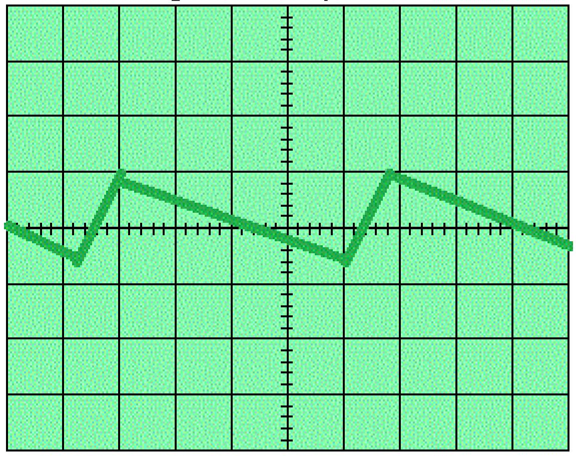
-Power supply at 200Hz and capacitor 1μF



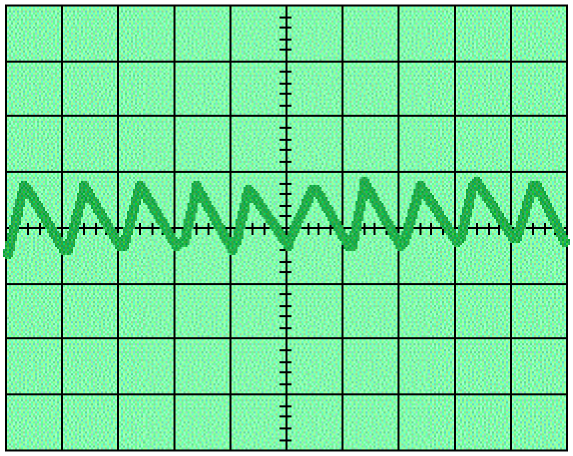
-Power supply at 2KHz and capacitor 1μF (lower sweep time / div)



-Power supply 200Hz and capacitor 10μF



-Power supply 2KHz and capacitor 10μF



Data Analysis:

For the first graph, of the first experiment, we only have a positive voltage coming through, showing the circuit is working accordingly. The diode is blocking the flow of current in reverse bias since it is in forward bias itself. Although we can read negative voltage, which is little enough to be due to the current leakage from the diode not being a perfect insulator in reverse bias.

After this, we had a capacitor that is charging and discharging. First difference we notice from the second part of the experiment is that the graph get "curvy" after reaching peak voltage in forward bias. The capacitor is charging when the voltage is increasing, once the voltage is at peak value, the capacitor will start discharging and deliver current in the circuit. That is why is the graph gets "curvy" and the voltage output isn't immediately equal to zero. The extra current coming from the capacitor means there is still current flowing through the circuit even in reverse bias and so the oscilloscope is still reading a voltage difference. The graph for 2KHz is basically the same, since we changed the time/div value. If we let it the same we would have more peaks on the screen. A higher frequency means a shorter wave length and therefore more peaks.

Graph 4 and 5 were made using a 10μF capacitor. A capacitor with a higher capacitance will store more current. We read lower voltages, which makes sense since there is less current, V=I*R shows that voltage is proportional to the current. If it can store more current it can discharge more as well, which is why the voltage is slowly dropping down, the capacitor can supply the circuit for a long moment, especially because the current is small. The last graph is with the same capacitor but at 2KHz.

We see the same voltages but just a lower wavelength on the oscilloscope due to the higher frequency once again.

Conclusion:

The experiment was a success, the capacitor was working properly and we got the result expected.