

3.1 - Capacitor Filtering

About capacitor filters

Filter circuits are most often installed in-line between a potential input and the circuit that will use the potential. Filter circuits modify the potential of circuits in different ways based on two factors: the arrangement of the resistor and capacitor in the filter (an R-C circuit), and the relationship of their combined time constant to the time period of the input wave. Filters are commonly found in circuits that utilize AC signal sources.

Capacitor filter activity

1. Install capacitor C1 into your CHRP circuit board. **Note: C1 is a polarized capacitor. Be sure to observe the correct polarity during installation!**

Teacher Check

2. Examine the CHRP schematic diagram. How is LED1 connected to the filter circuit (series or parallel)? Explain how you know.

3. Since LED1 is connected directly to the filter capacitor, it is reasonable to assume that the amount of potential in the capacitor can be inferred from observing the LED brightness.

Assuming this to be true, plug the AC adapter into the CHRP board observing the LED as you do this. How long does it take to charge C1?

4. Unplug the AC adapter from the CHRP board, again observing the LED as you do so. How long does it take to discharge C1?

5. Why is there a difference between C1's charge and discharge times? (Hint: How does the circuit change between charging and discharging?)

Teacher Check

- Obtain an AC output wall adapter. Record the AC output voltage of the adapter first, and then measure the filtered DC output voltage of the capacitor using a multimeter.

$V_{AC} =$

$V_{C1} =$

- Using an oscilloscope, measure the filtered DC output voltage at C1. Trace the wave and record the oscilloscope settings.

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- Next, switch the oscilloscope to measure AC, and increase the sensitivity to measure the AC ripple in the filtered DC output. Trace the wave and record the oscilloscope settings.

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Teacher Check

Filter analysis

- What is AC ripple? How does the ripple frequency compare to the input source frequency?
- Calculate the maximum ripple as a percentage of the filtered DC output.