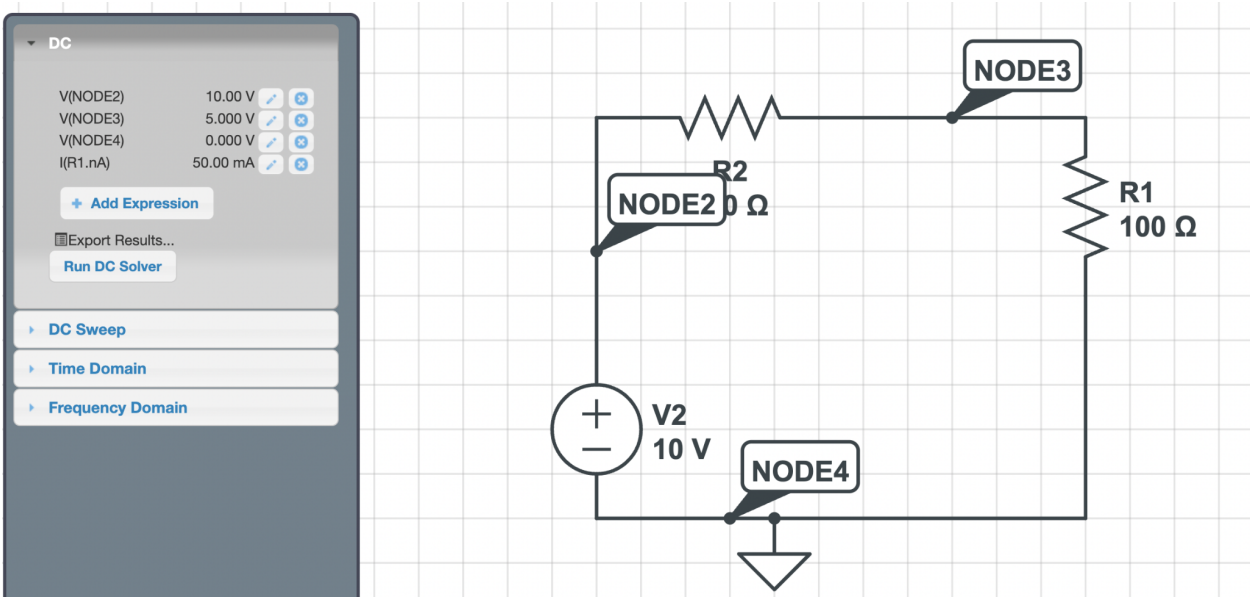
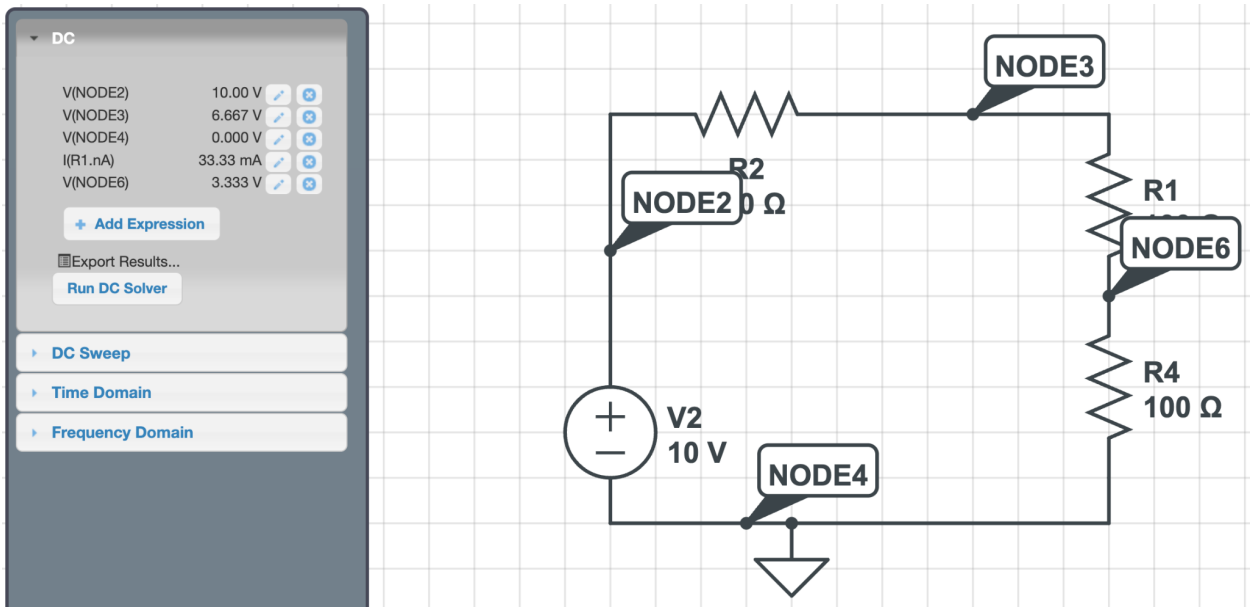
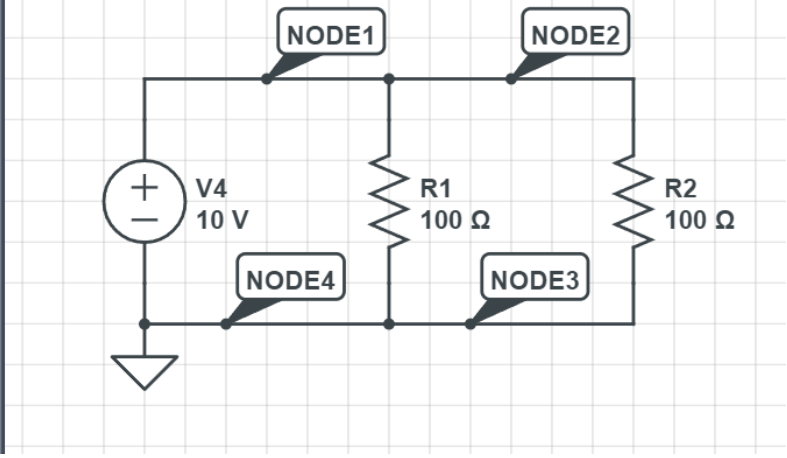
1. Resistor in Series

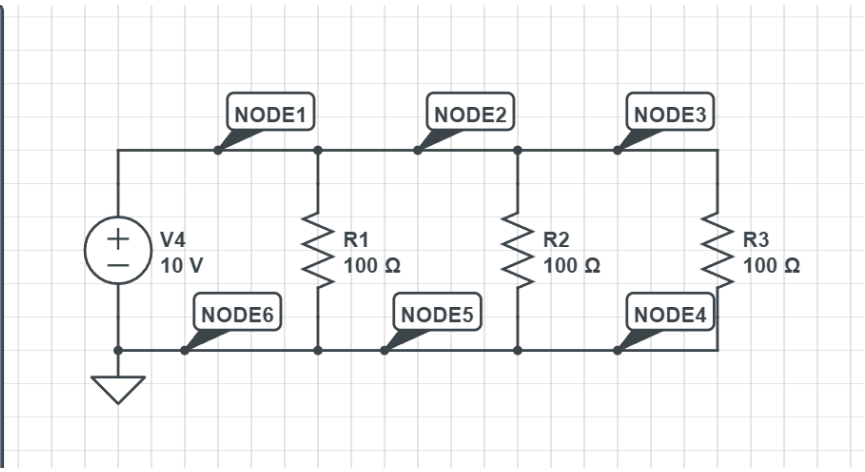




With the resistors all at the same value, the voltage drops halfway after each resistor in the two resistor cases. For the three resistor case, the voltage drops a third after each resistor. The current drops from 50 mA to 33.3 mA from the two resistor case to the three resistor case.

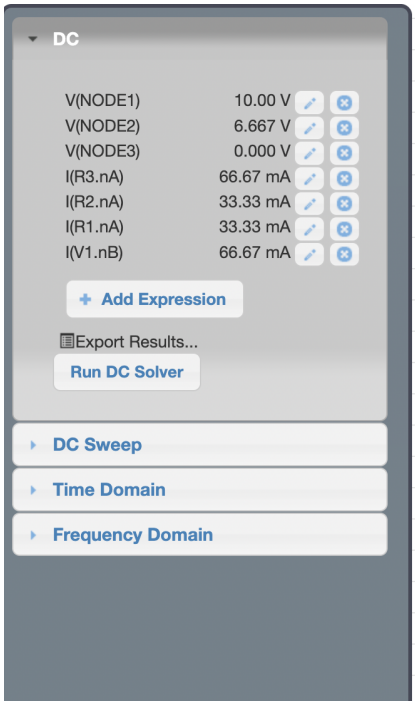
2. Resistors in Parallel

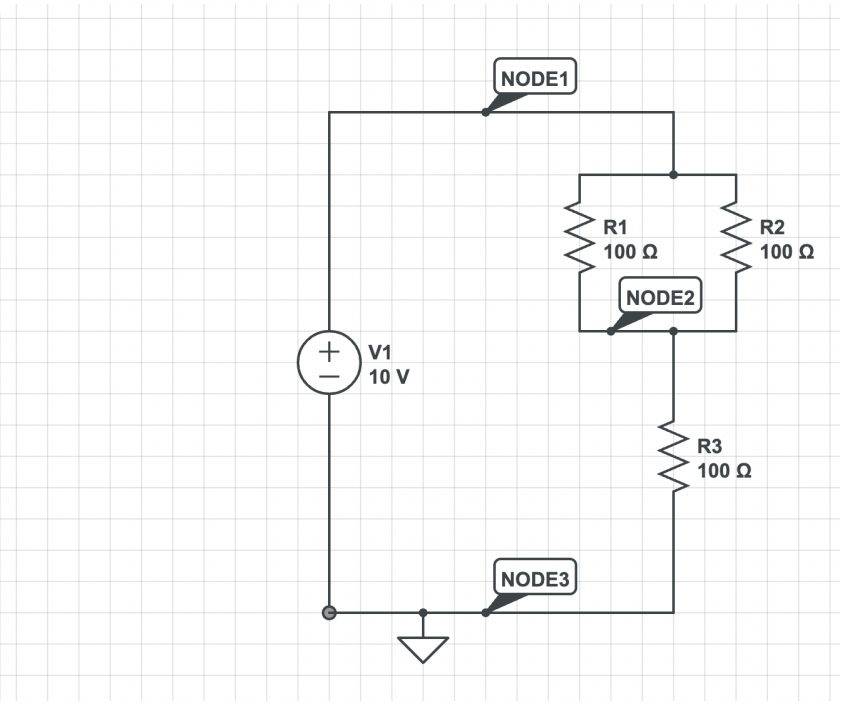




For the resistors in parallel, all the nodes before the resistor have a voltage of 10V. The current however increases from 200mA to 300mA, as the current before the resistors all remain consistent at 100mA.

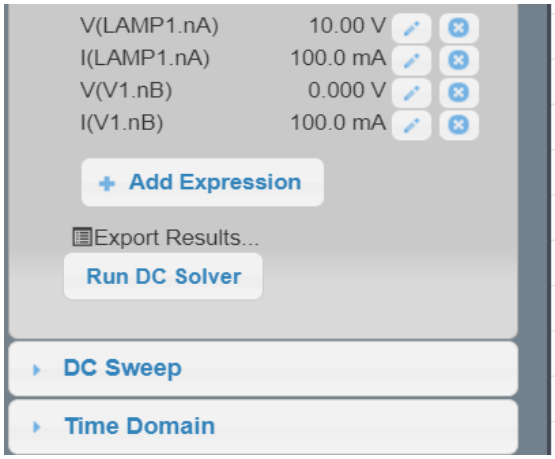
3. Resistor in Series and Parallel

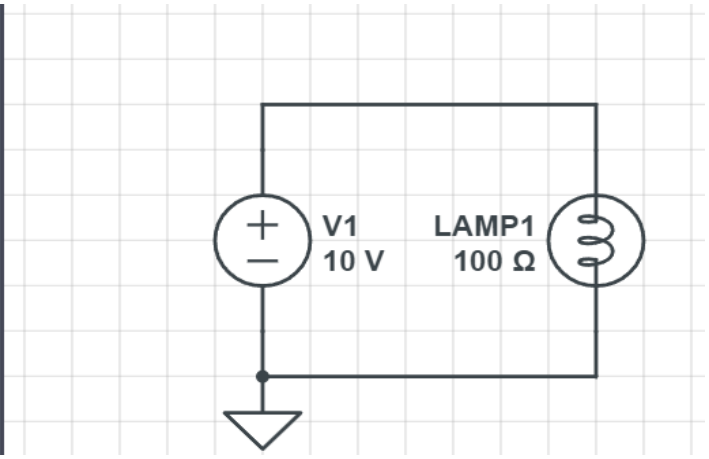




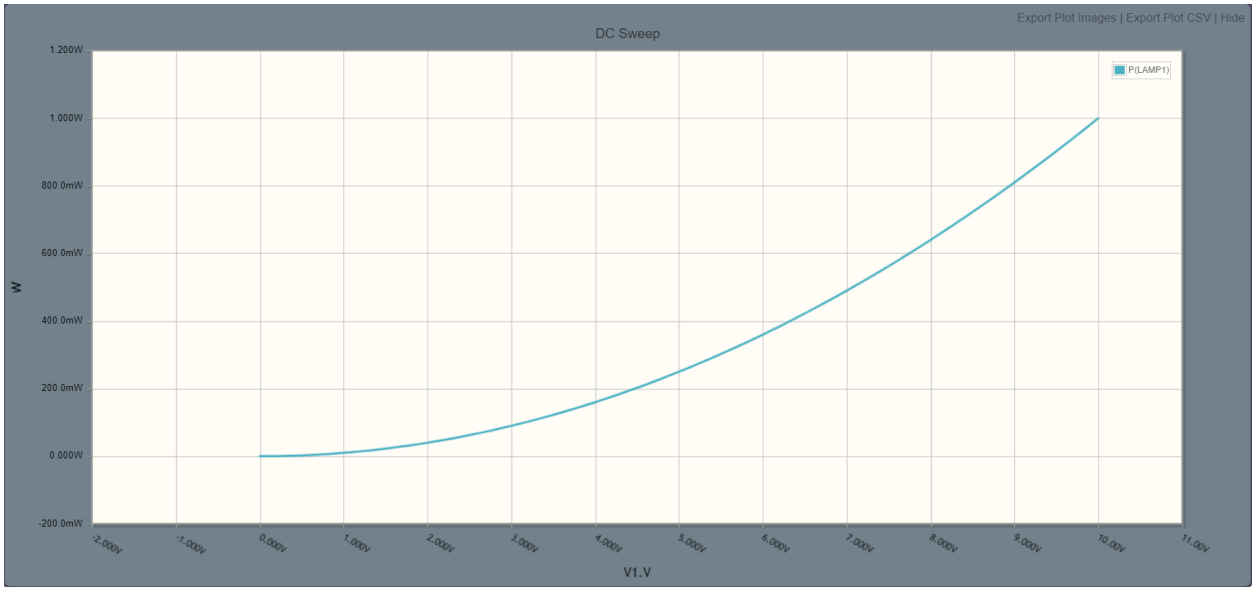
The voltage drop across the resistors in parallel is a third of the total voltage drop and the voltage drop across the resistor in series makes up the rest of the two-thirds. The total current is 66.7 mA while the current through the resistors in parallel is half that.

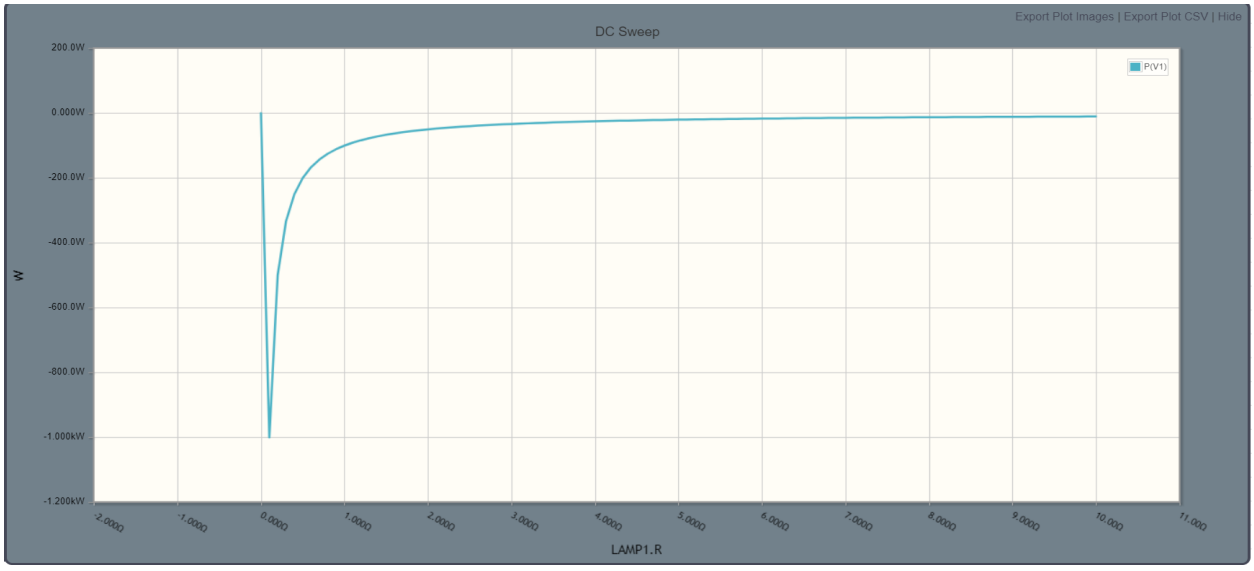
4. Powering Light Bulbs



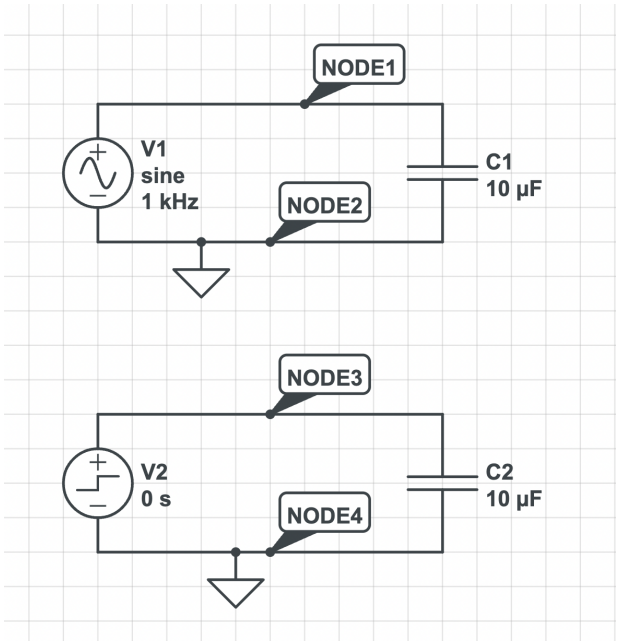


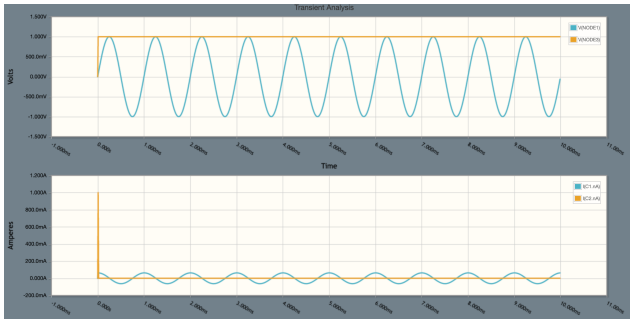
The power output for the light bulb is 1W



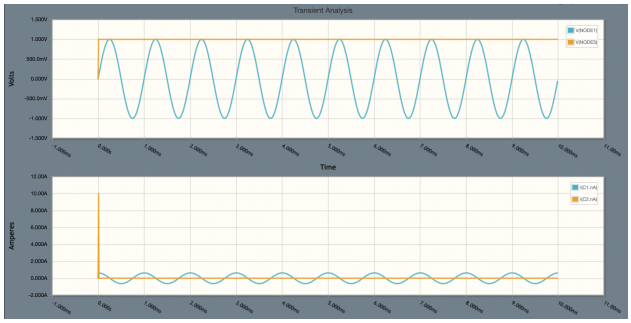


5. Capacitor Circuit

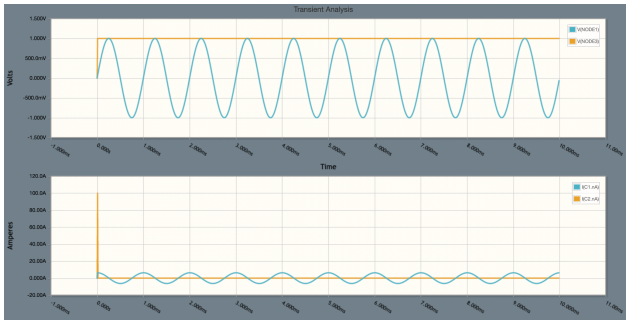




For 10uF Capacitor



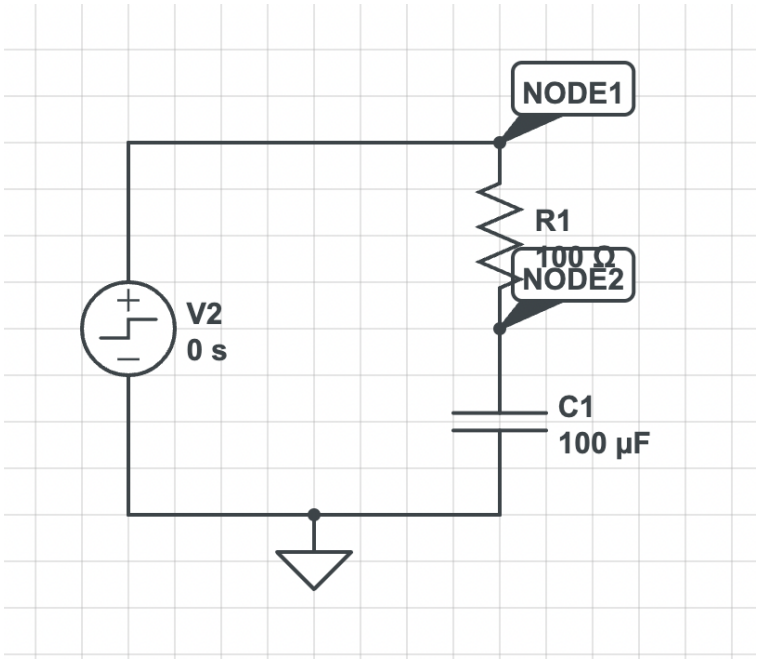
For 100uF Capacitor

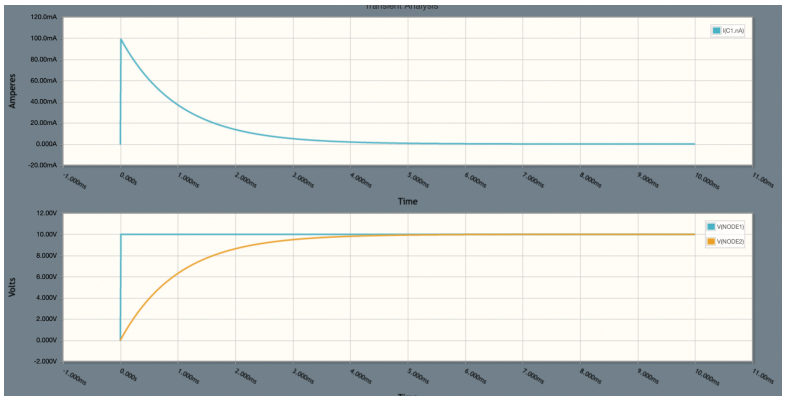


For 1mF Capacitor

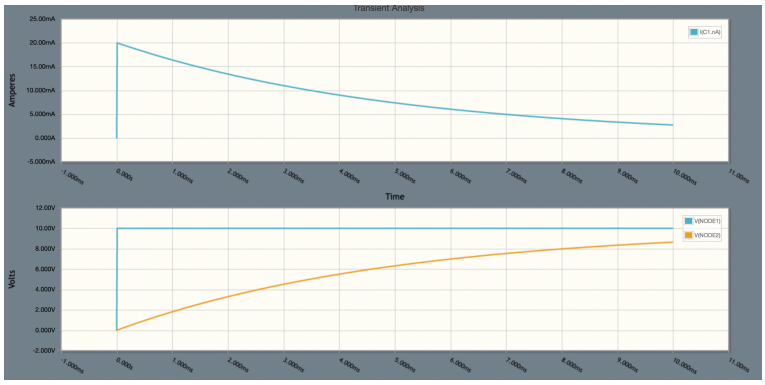
Does not change the voltage or current response for changes in capacitance

6. RC Circuit

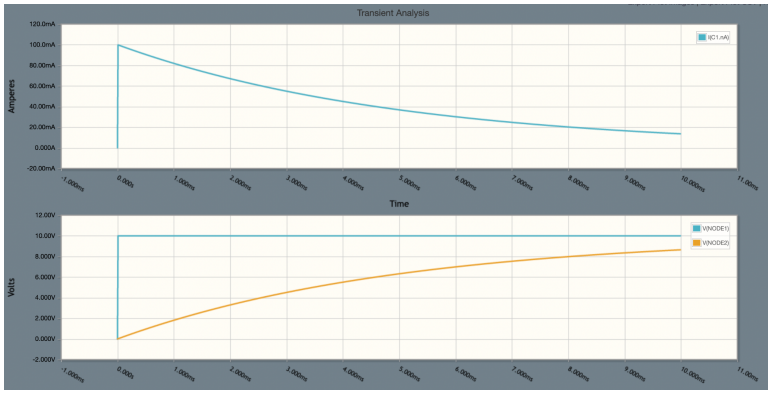




With a 100-ohm resistor and 10uF Capacitor

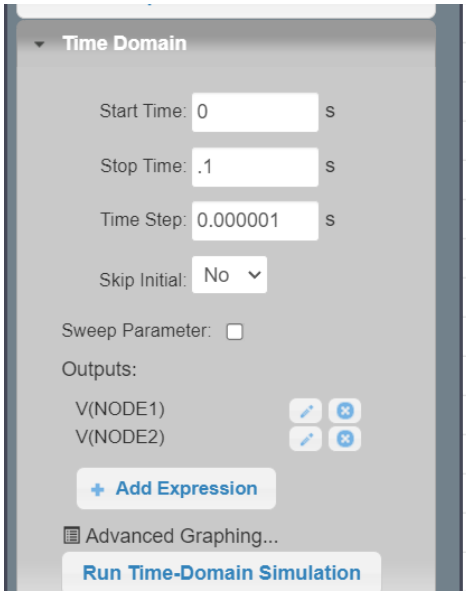


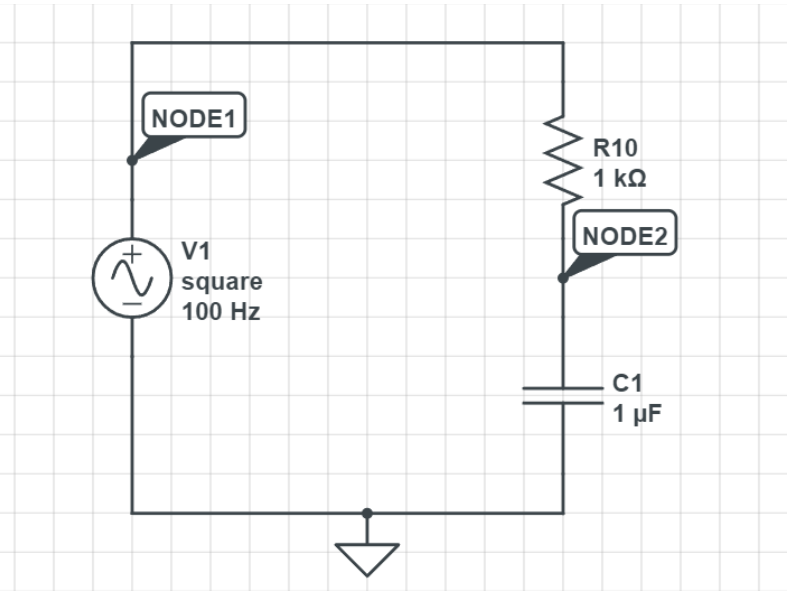
Increasing resistance to 500 ohms while keeping capacitance at 10uF

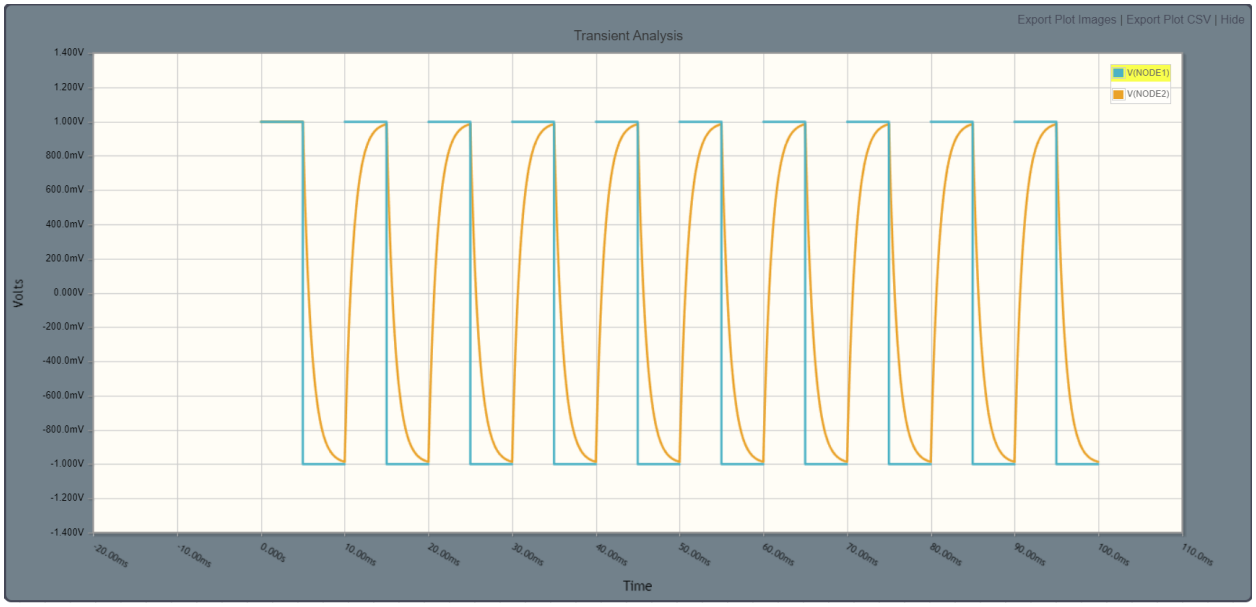


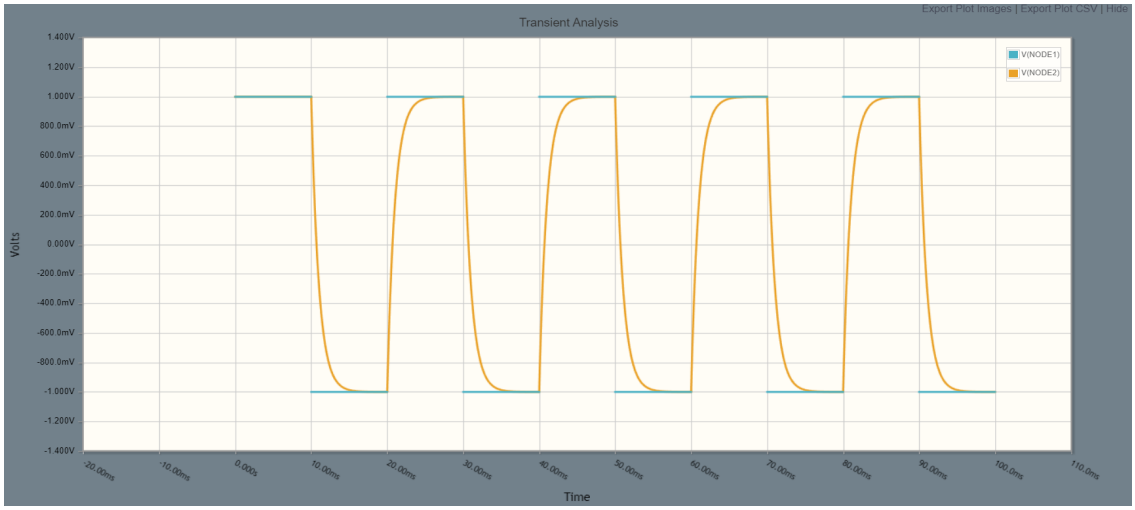
Increasing capacitance to 50 uF while keeping resistance at 100 ohms
We don’t see a difference between the graphs for 500ohm, 10uF, and 100ohm, 50uF because the product of those values is the same. The time constant is a function of R*C. We also see that the current and voltage reached a steady state faster in the first case (both low resistance and capacitance) because the time constant is small if the product of the resistance and the capacitance is small.

7. RC Filter

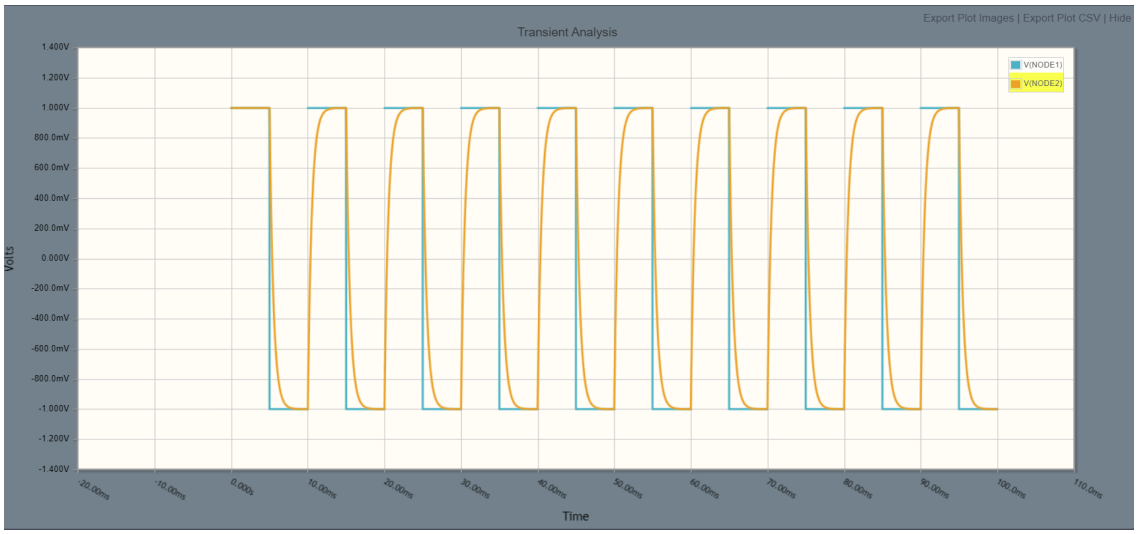

Time Domain
Start Time: 0 s
Stop Time: .1 s
Time Step: 0.000001 s
Skip Initial: No
Sweep Parameter:
Outputs:
V(NODE1)
V(NODE2)
Add Expression
Advanced Graphing...
Run Time-Domain Simulation


NODE1
R10
1 kΩ
NODE2
V1
square
100 Hz
C1
1 µF

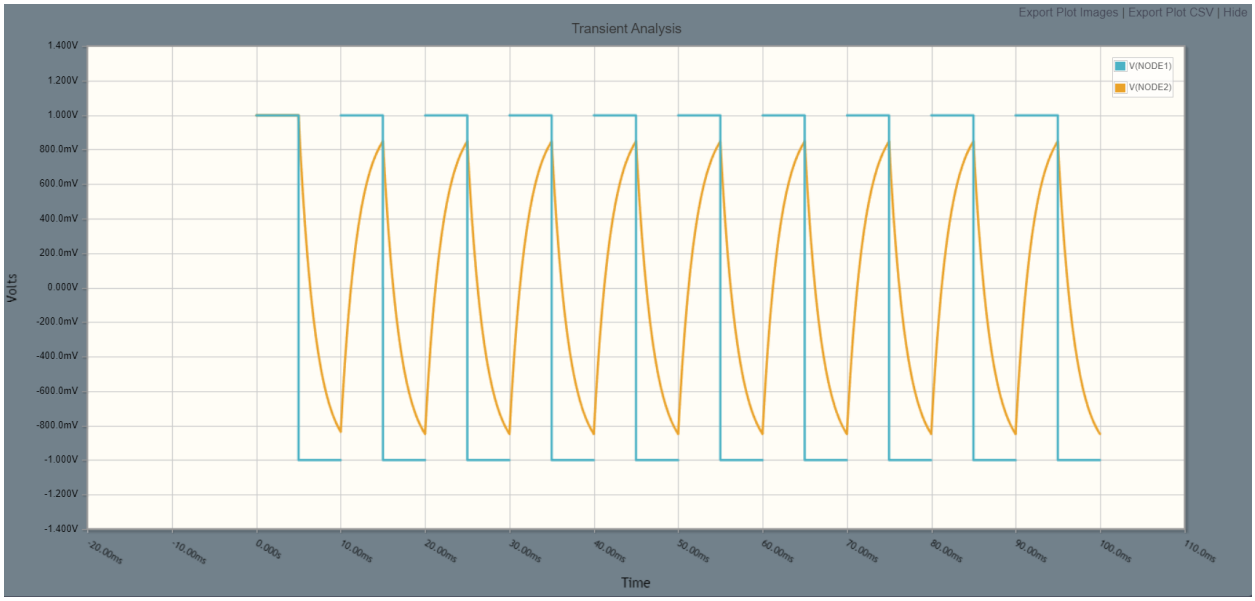

Export Plot Images | Export Plot CSV | Hide
Transient Analysis
V(NODE1)
V(NODE2)
Volts
Time



By dropping the frequency by half we see that the sawtooth wave is able to reach the step voltage before it changes.



With only the resistance at half its original value, we see that the output voltage meets the input voltage faster than it did with the original values.



Increasing the capacitor by 2x, we see the output voltage approaches the input voltage at a slower rate than the original values.