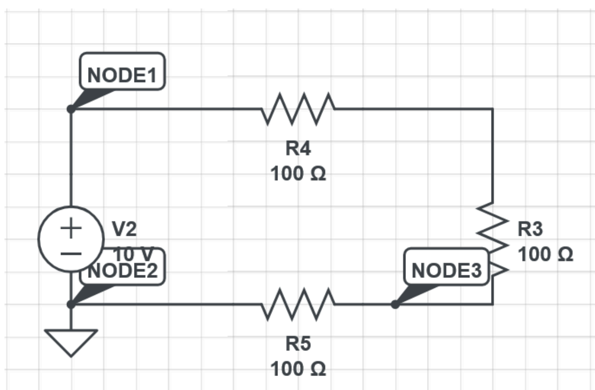
Resistors in Series

Examine the voltage values at each node and the current for the system

- Node 1 - 10V
- Node 2 - 0V
- Current - 50 mA

Add a third resistor and an additional node and make not of how this changes the voltage at each node and the current in the system

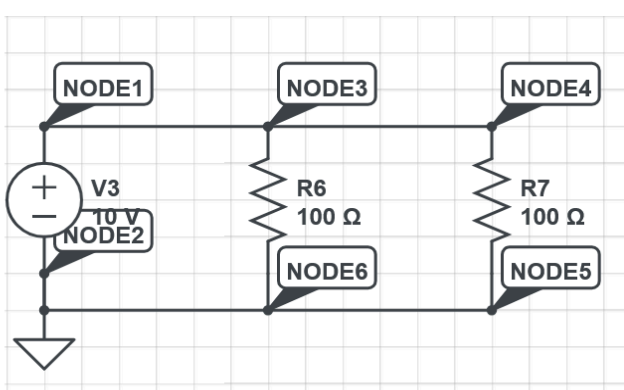
- Node 1 - 10V
- Node 2 - 0V
- Node 3 - 3.333V
- Current - 33.33mA



Resistors in Parallel

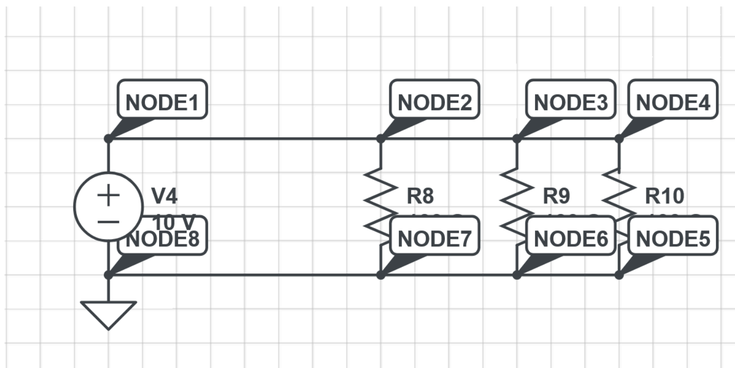
Examine the voltage values at each node and the current across the voltage source and each resistor

- Current at power source - -200mA
- Current split between R6 and R7 - 100mA
- Node 1 - 10V
- Node 2 - 0V
- Node 3 - 10V
- Node 4 - 10V
- Node 5 - 0V
- Node 6 - 0V



Add a third resistor in parallel and additional nodes. Make note of how this changes the voltage at each node and the current across each resistor.

- Current at power source - -300mA
- Current is split between R8, R9, and R10 - 100mA
- Node 1 - 10V
- Node 2 - 10V
- Node 3 - 10V
- Node 4 - 10V
- Node 5 - 0V
- Node 6 - 0V
- Node 7 - 0V
- Node 8 - 0V



Resistors in Series and Parallel

Examine the voltage value at each node and the current across the voltage source and each resistor. Make note of how this compares to either the case of resistors only in parallel or only in series.

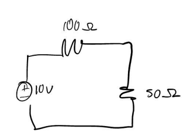
- Current over R11 - -66.67
- Current between R12 and R13 - -33.33
- Node 1 - 10V
- Node 2 - 3.333V
- Node 3 - 0V
- Node 4 - 0V
- Node 5 - 0V

This compares to the case of resistors only in parallel because the total current decreases significantly since there is a resistor in series in the circuit as well. The math to the right explains this:

$V=10$

$$R = \frac{1}{\frac{1}{R_1} + \frac{1}{R_2}}$$

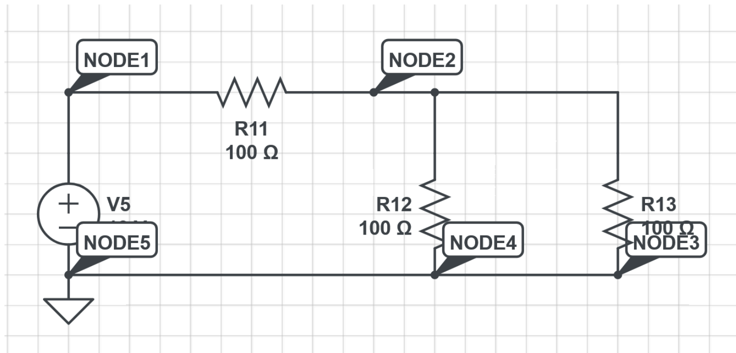
$$R = \frac{1}{\frac{1}{100} + \frac{1}{100}} = \frac{1}{\frac{2}{100}}$$



$$\frac{100}{2} = 50$$

$$R_T = 100 + 50 = 150\Omega$$

$$V = IR$$
$$10 = I(150)$$
$$I_T = \frac{10}{150} = \frac{1}{15}$$



Powering Light Bulbs

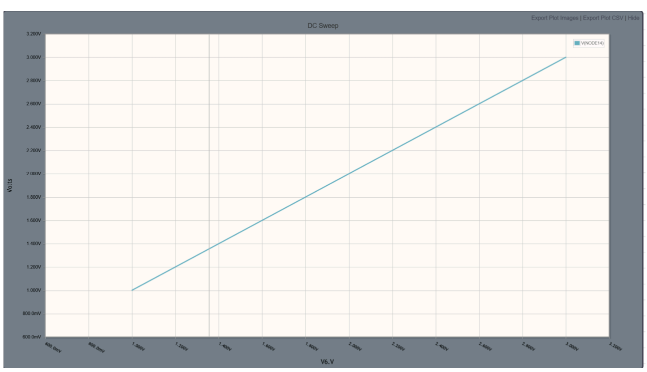
P = IV → I = V/R → P = V^2/R → P = 10^2 / 100 → P = 1
The power output for this lightbulb will be 1 Watt.

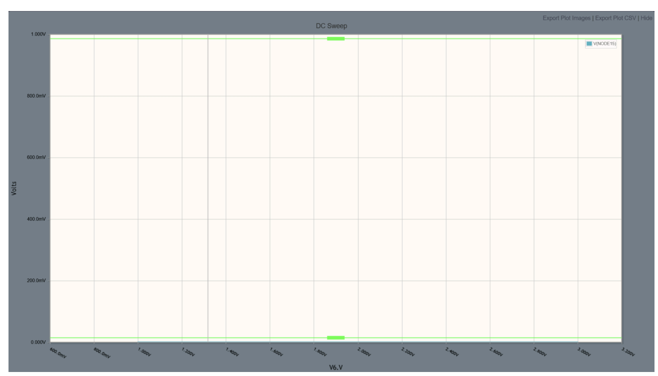
The lightbulb power varies with the voltage of the battery because it would increase according to the equation P = IV. I, V, and P have a proportional relationship.

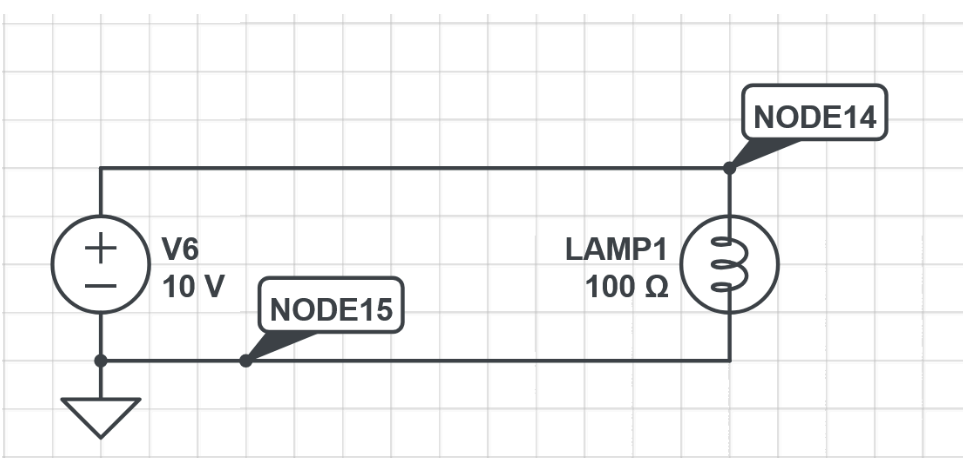
The lightbulb power varies with the internal resistance of the lightbulb because power is inversely proportional to the square of resistance.

Node 14:

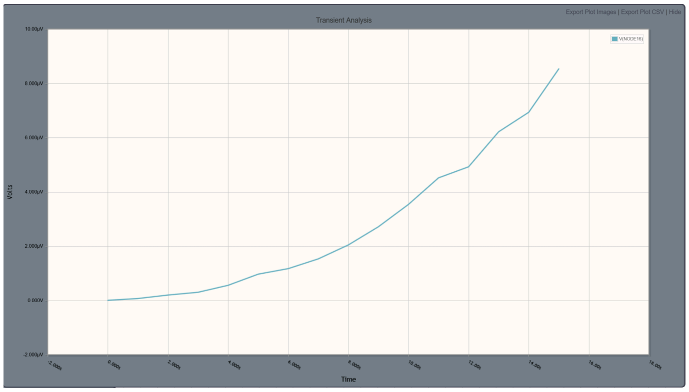
Node 15: There is a faint line at 0

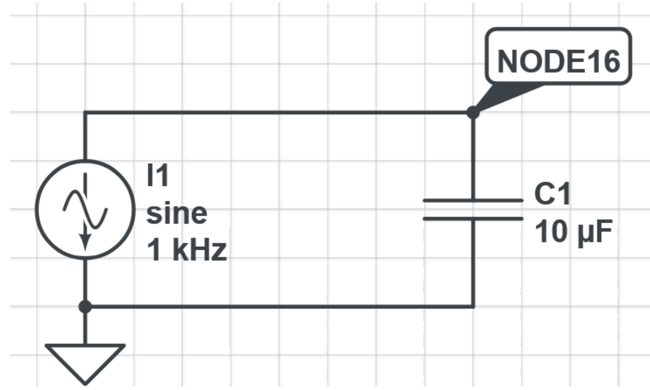


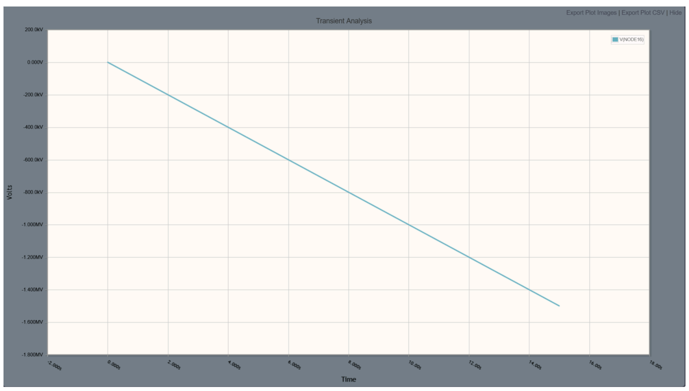


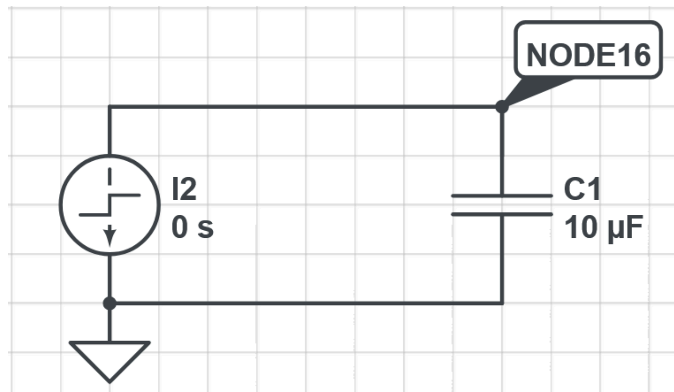


Capacitor Circuit



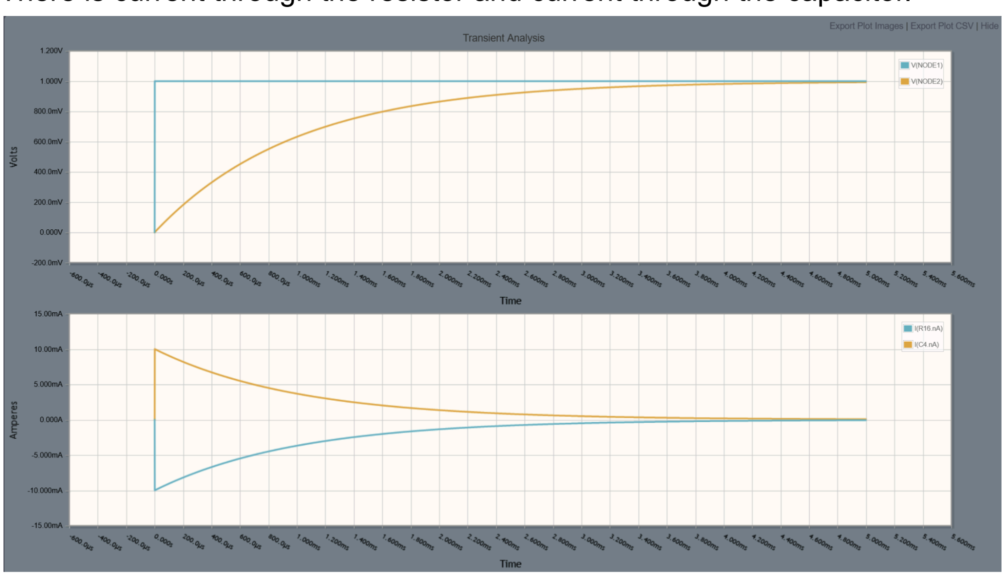


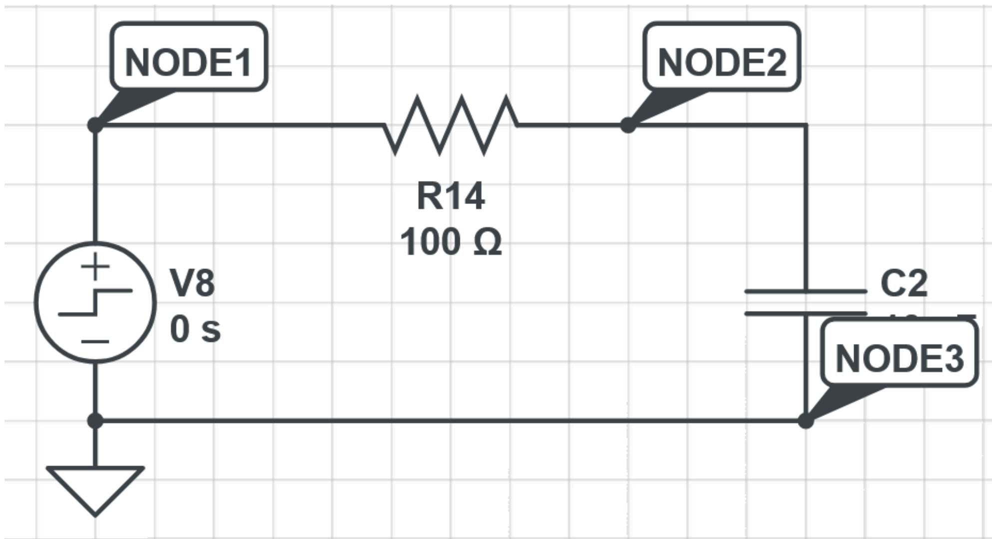




RC Circuit

Voltage vs Time (Top), Current vs Time (bottom) - Node 1, Node 2, Node 3:
There is current through the resistor and current through the capacitor.

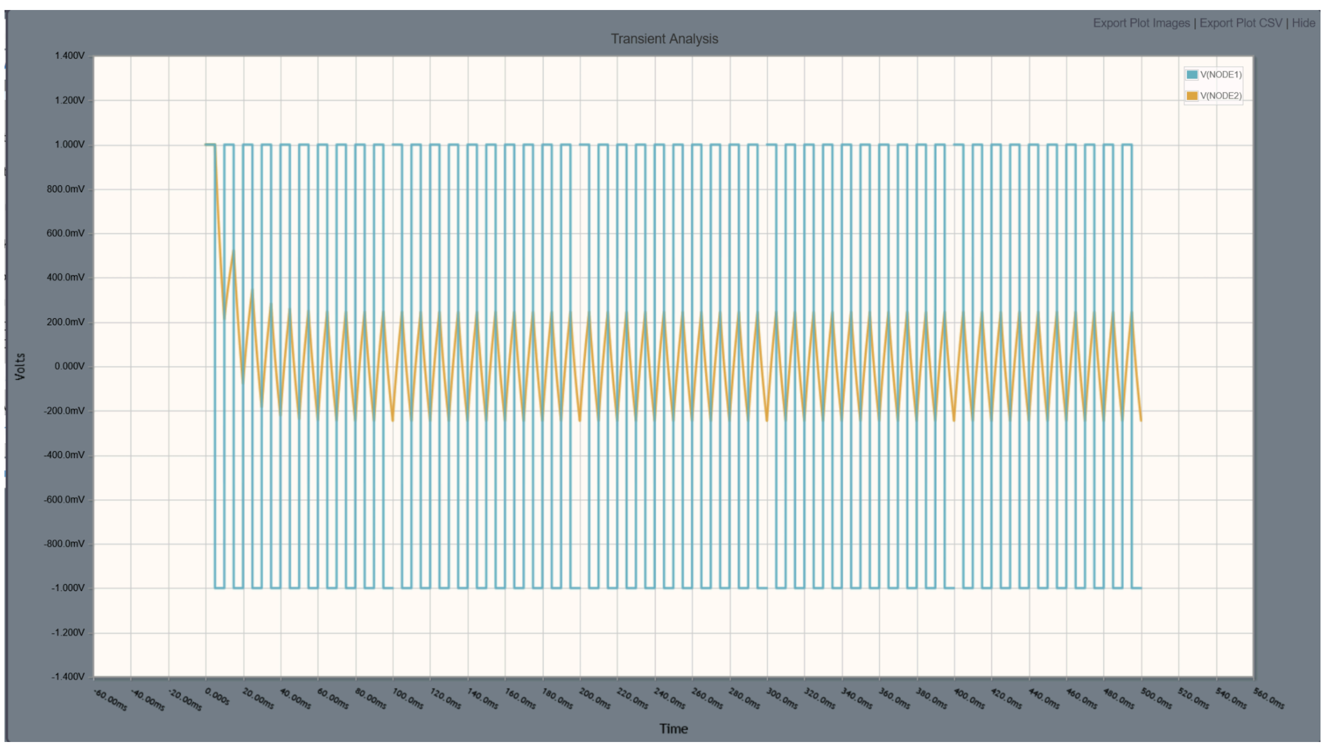




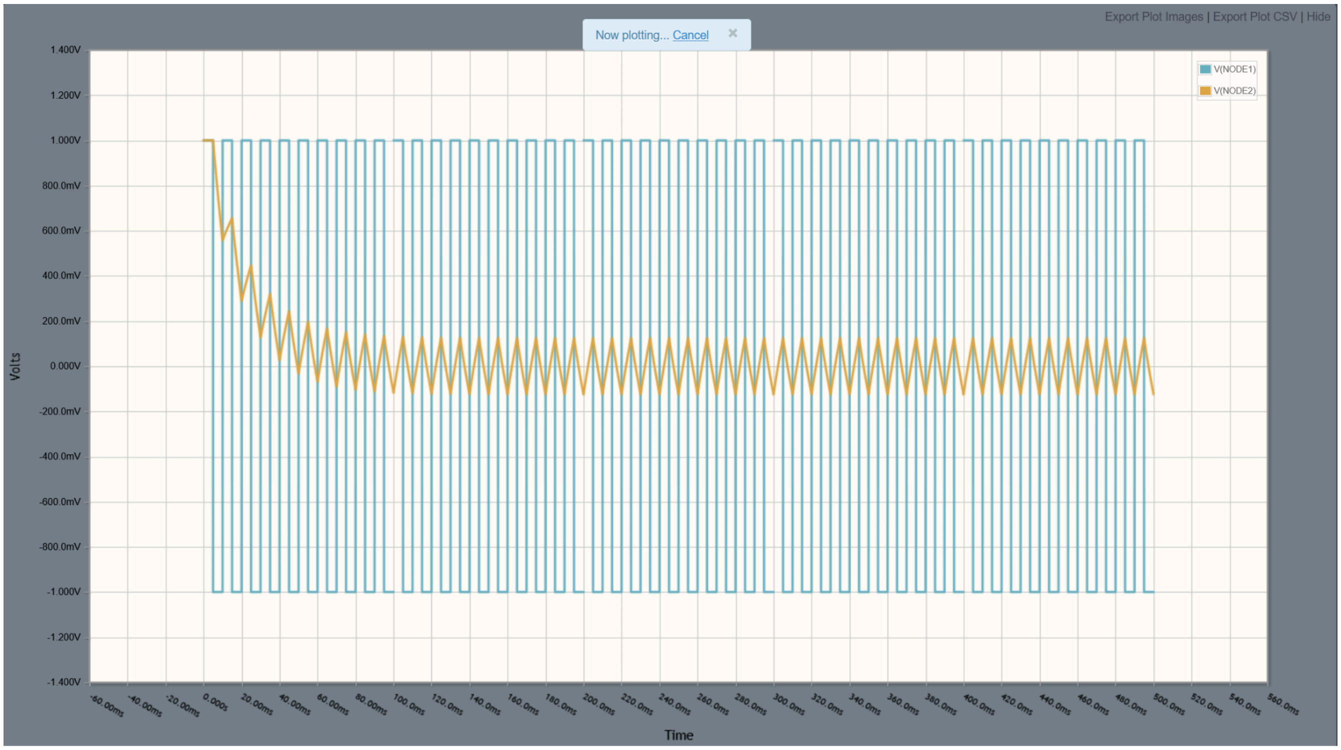
The time dependence of the system changes as you vary the resistance and capacitance of the system because resistance and capacitance are proportional to the RC time constant. Therefore, an increase in resistance will increase the time constant and an increase in capacitance will also increase the time constant.

RC Filter

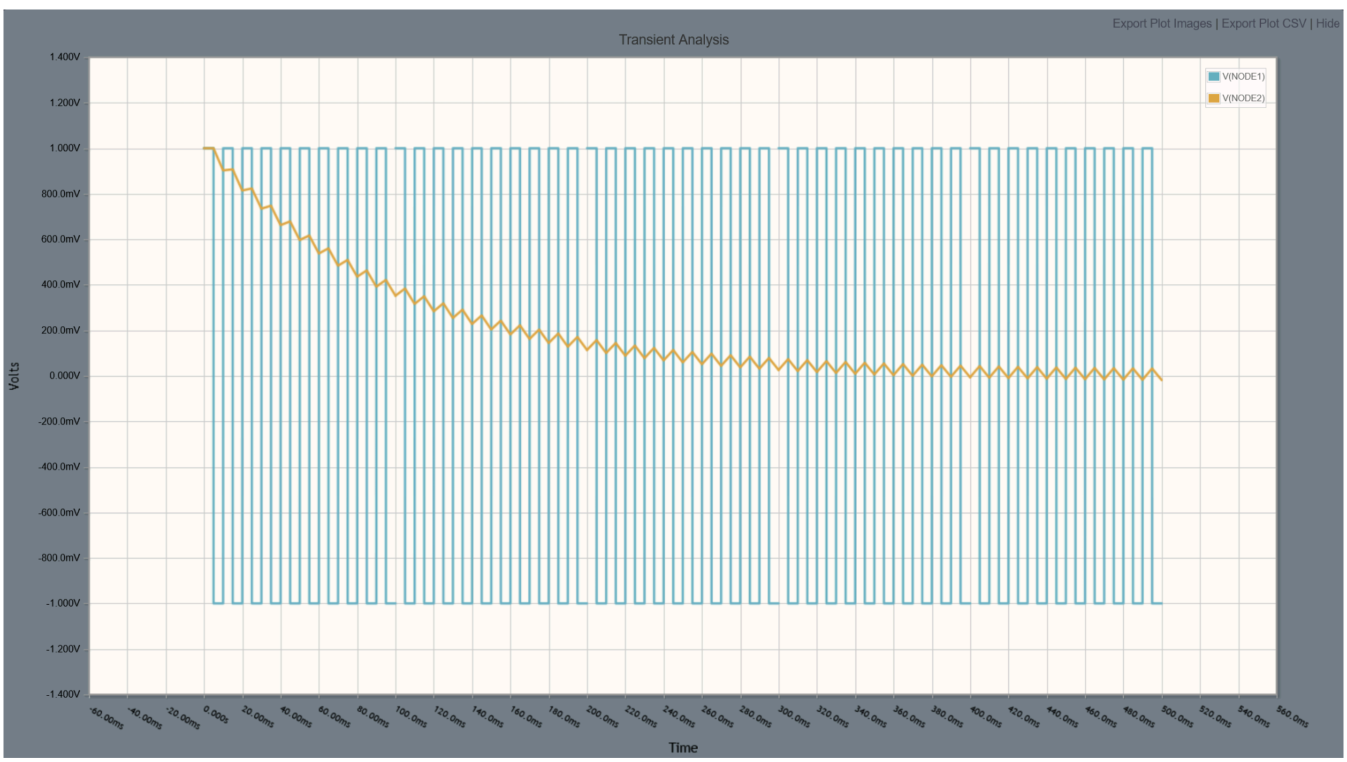
R = 10 kO, C = 1uF



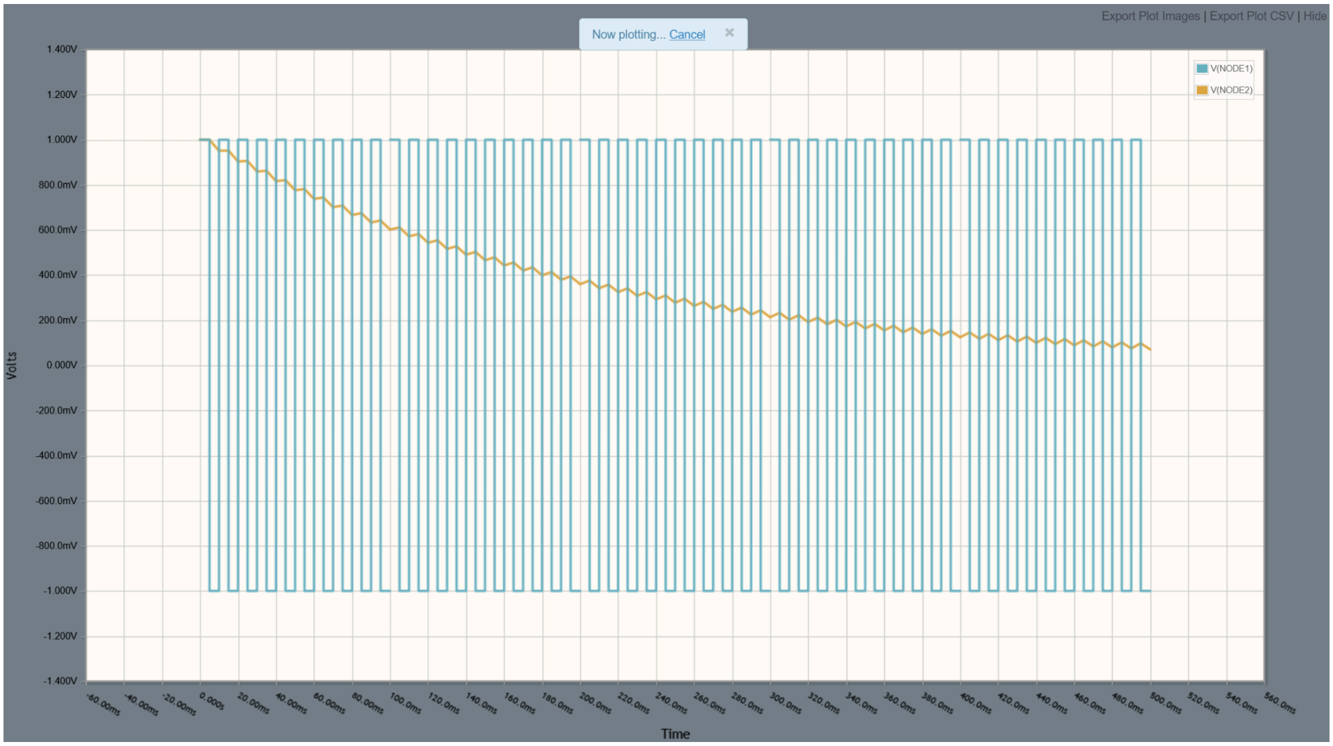
R = 20 kO, C = 1uF



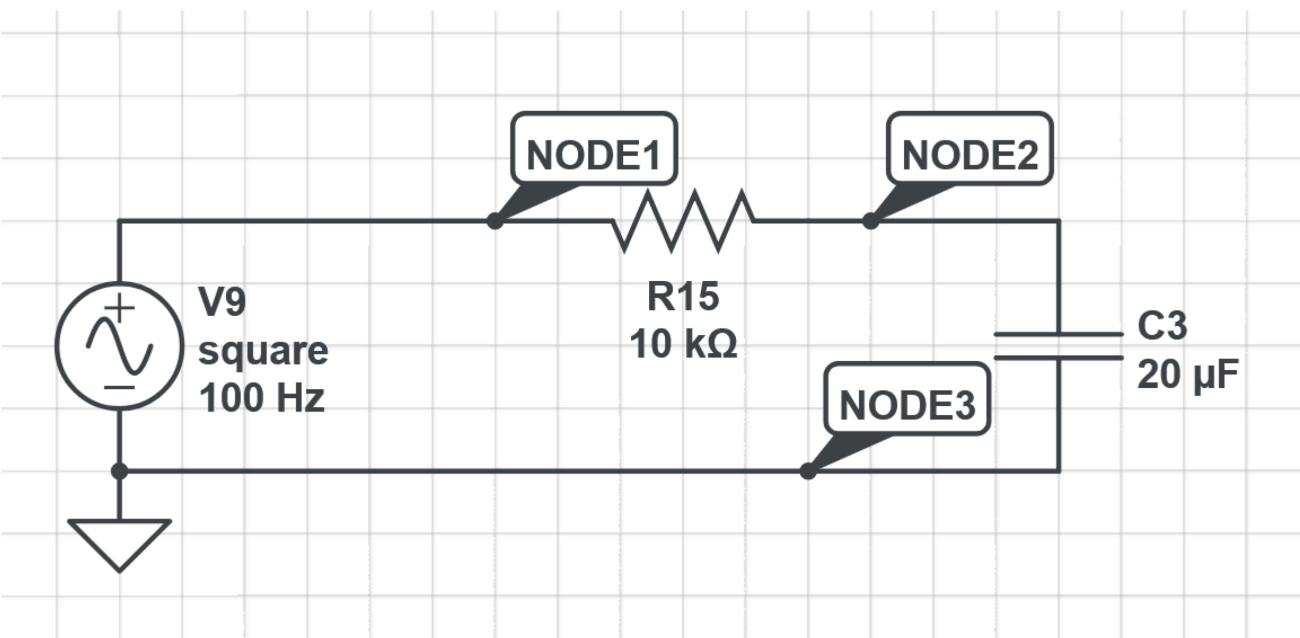
R = 10 kO, C = 10uF



R = 10 kO, C = 20uF



Export Plot Images | Export Plot CSV | Hide
Now plotting... Cancel
V(NODE1)
V(NODE2)
Volts
Time



NODE1
NODE2
NODE3
V9
square
100 Hz
R15
10 kΩ
C3
20 µF