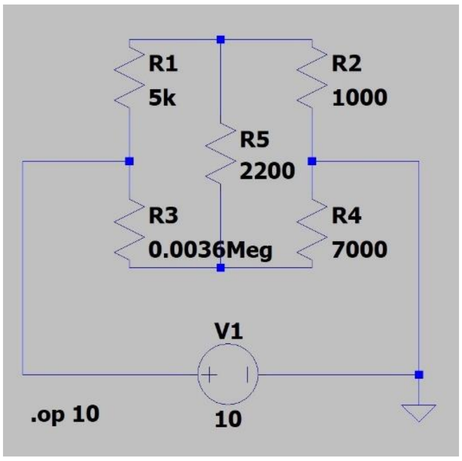
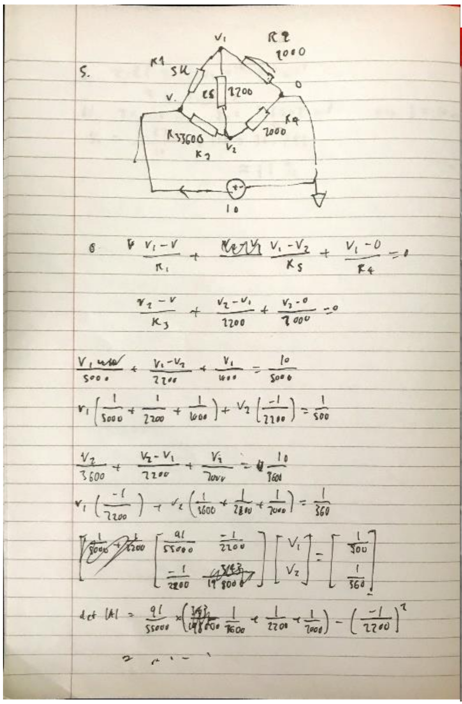
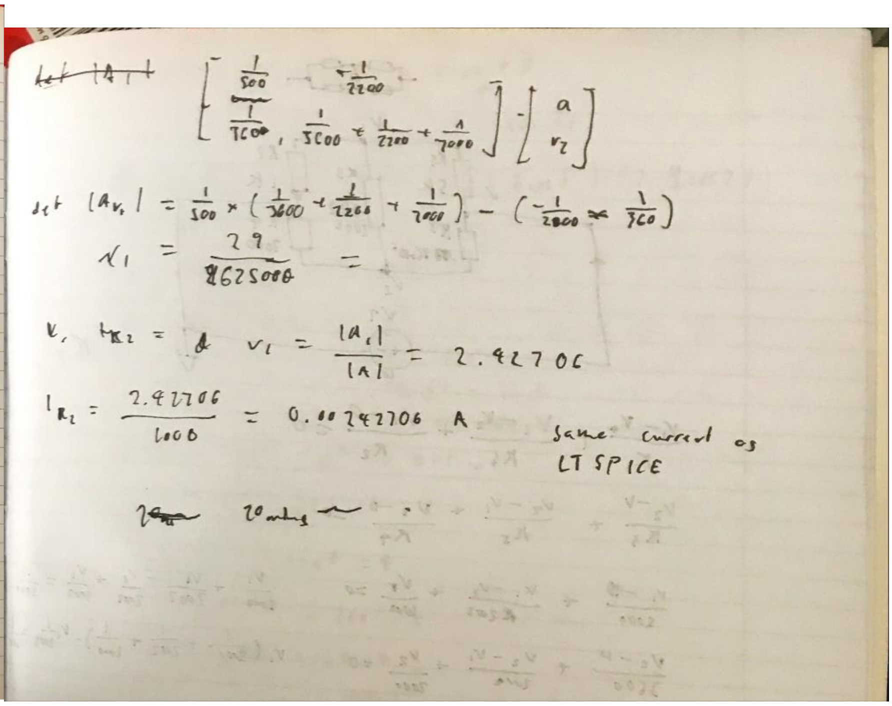
EEEN203 Lab 1 - SPICE

4. Schematic Entry



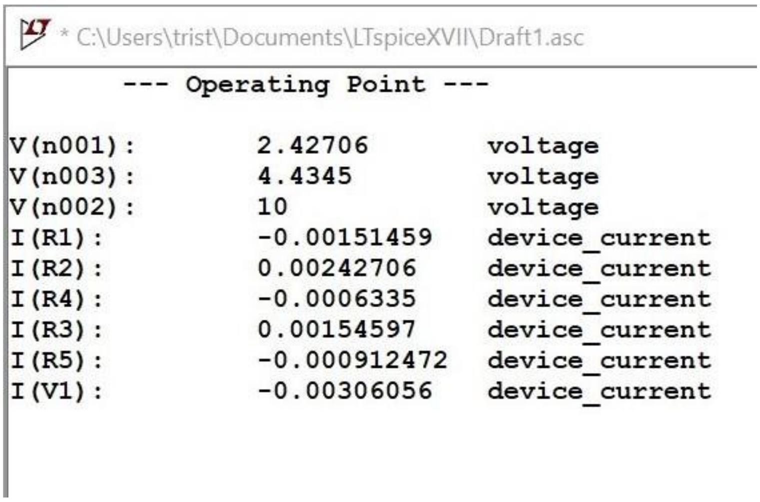
5. Manual Calculations





If illegible: time to manually complete took roughly 20 mins

6. Simulation

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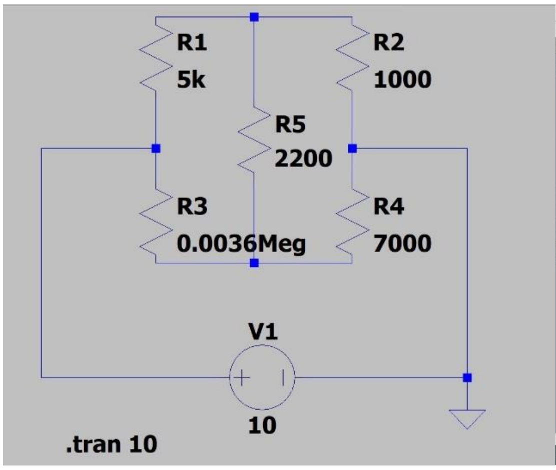
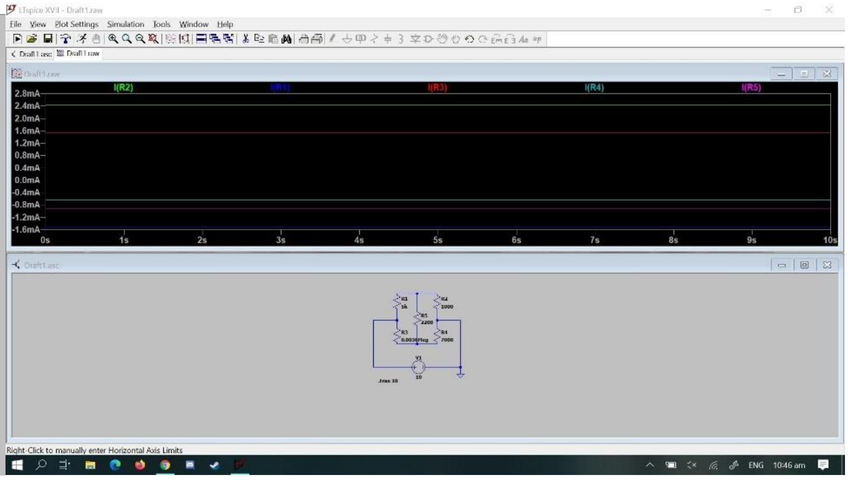
       --- Operating Point ---

V(n001):        2.42706         voltage
V(n003):        4.4345          voltage
V(n002):        10              voltage
I(R1):          -0.00151459     device_current
I(R2):          0.00242706      device_current
I(R4):          -0.0006335      device_current
I(R3):          0.00154597      device_current
I(R5):          -0.000912472    device_current
I(V1):          -0.00306056     device_current
```

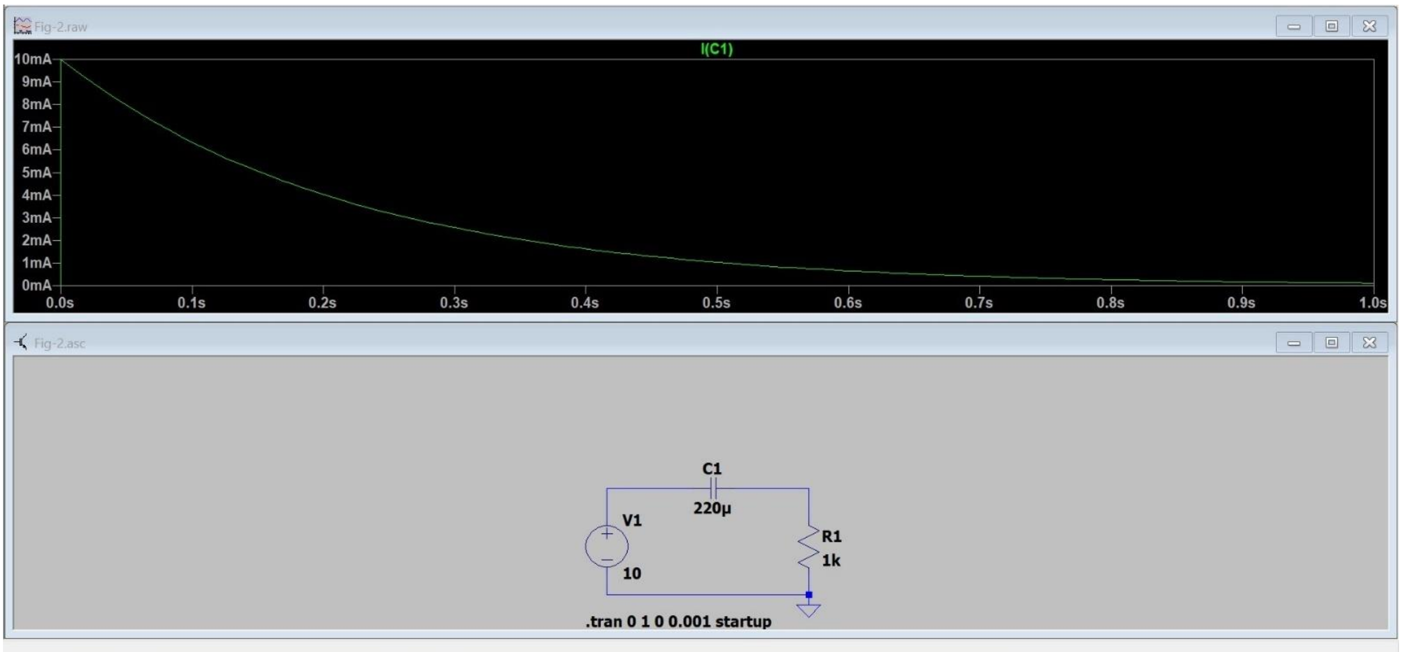
Simulation has the same current through R2 as my manual working out, but was probably twice as fast even considering the time it takes to create the simulation (and the fact it was my first time using the program).

7. More Simulation





8. More on Transients

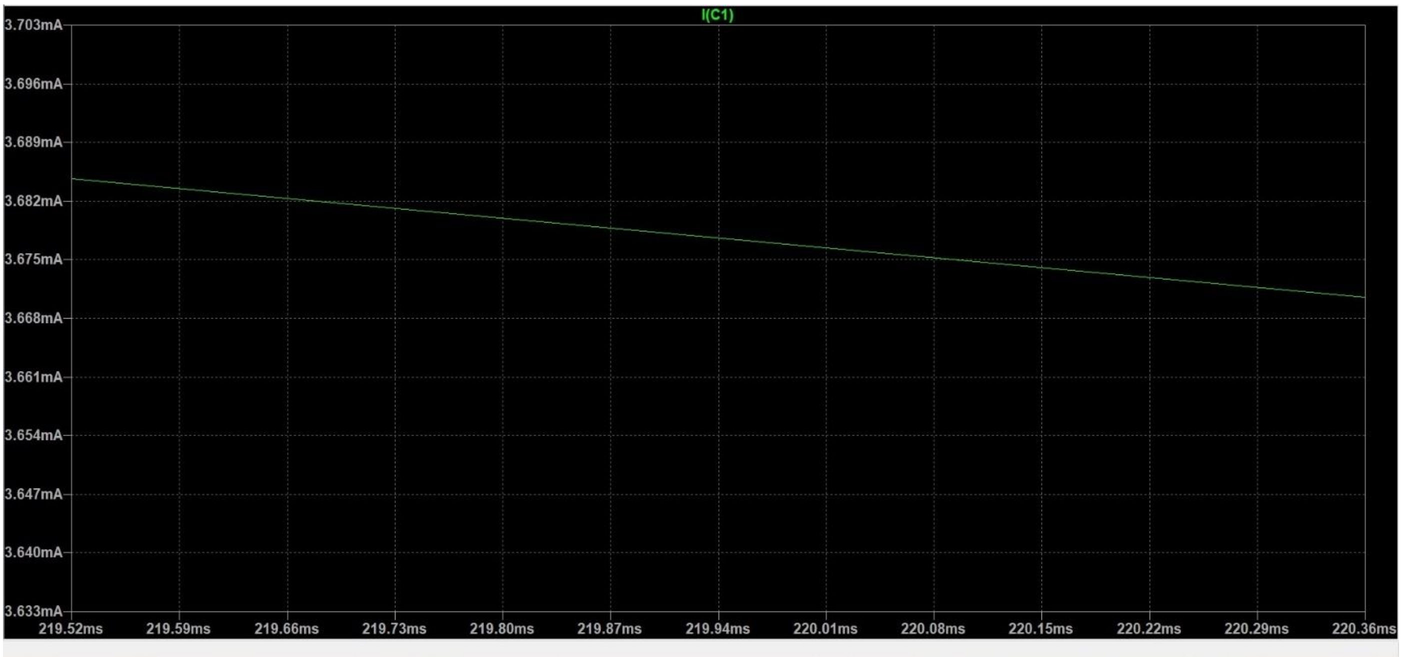


$$C = 220\,\mu F \qquad V = 10\,V \qquad R = 1000$$
$$\tau = RC = 220 \times 10^{-6} \times 1000 = 220\,ms \qquad I = 10 \div 1000 = 10\,mA$$
$$At\ \tau = 220\,ms, \quad I_\tau \approx 3.676\,mA$$
$$\%\ at\ \tau, \quad \frac{3.676}{10} \times 100 = 37\%$$

Mathematical derivation of said percent

Formula for the current over time in a capacitor: $i(t) = I_0 e^{-\frac{t}{\tau}}$

$$i(\tau) = I_0 e^{-\frac{\tau}{\tau}} = I_0 e^{-1}$$
$$at\ t = \tau, \quad i(\tau) = I_0 \frac{1}{e} \approx 0.368 I_0$$
$$i.e.\ \ 37\%\ of\ I_0$$


I(C1)
3.703mA
3.696mA
3.689mA
3.682mA
3.675mA
3.668mA
3.661mA
3.654mA
3.647mA
3.640mA
3.633mA
219.52ms
219.59ms
219.66ms
219.73ms
219.80ms
219.87ms
219.94ms
220.01ms
220.08ms
220.15ms
220.22ms
220.29ms
220.36ms