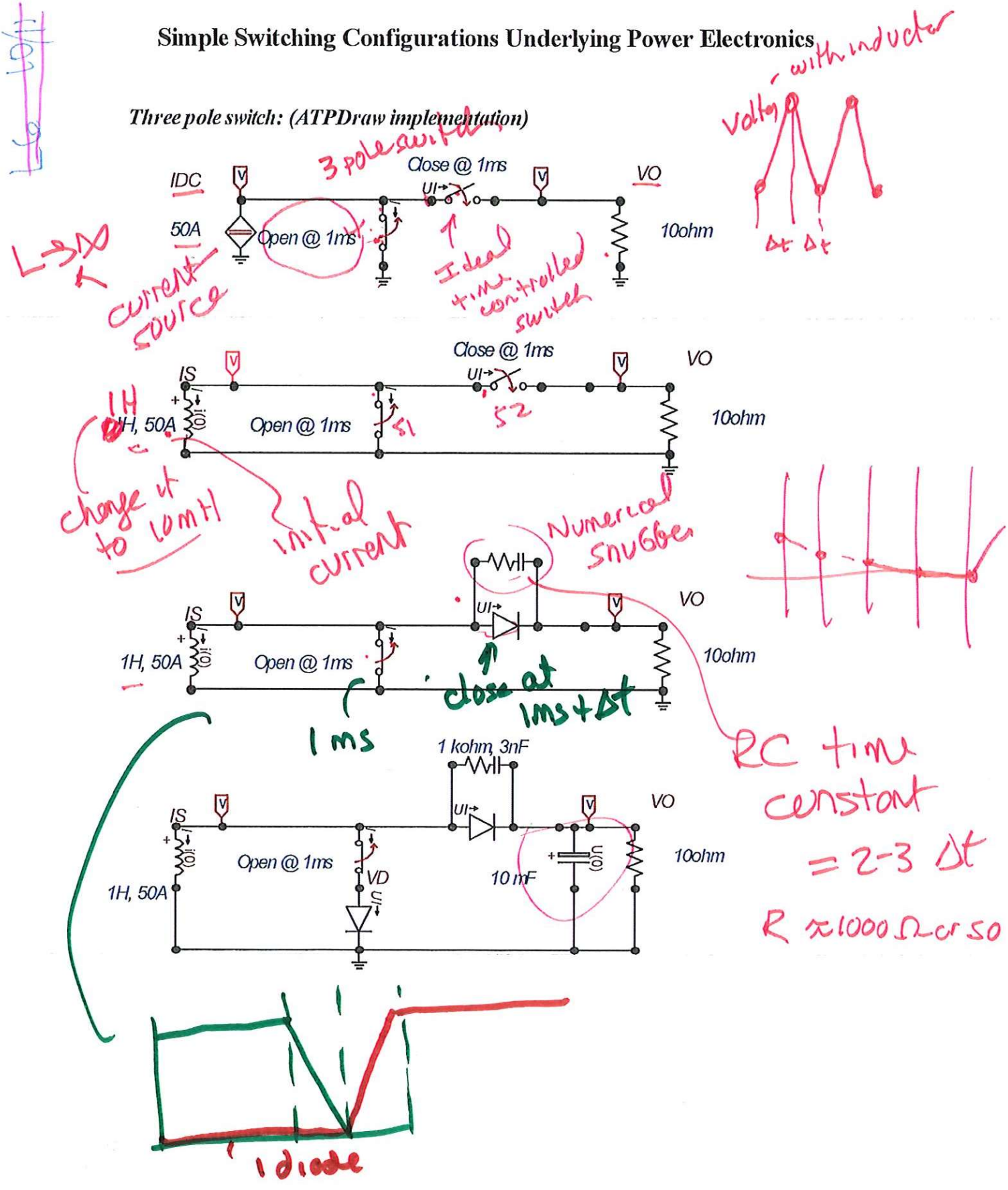
University of Idaho

ECE 529
Utility Applications of Power Electronics

Session 7

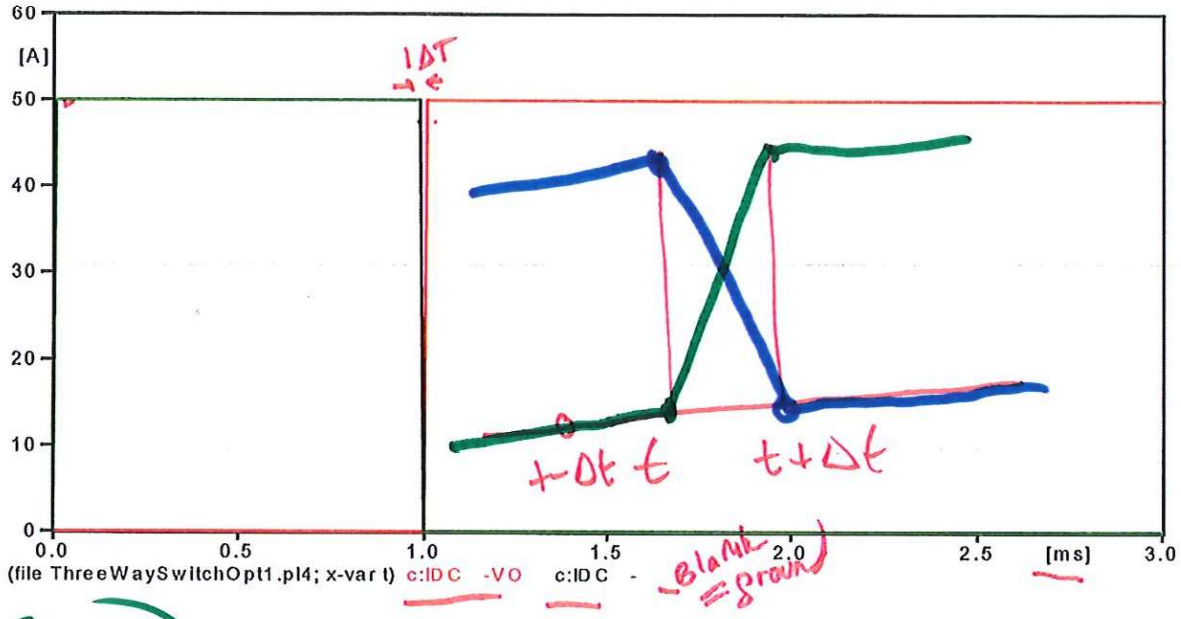
Simple Switching Configurations Underlying Power Electronics

Three pole switch: (ATPDraw implementation)

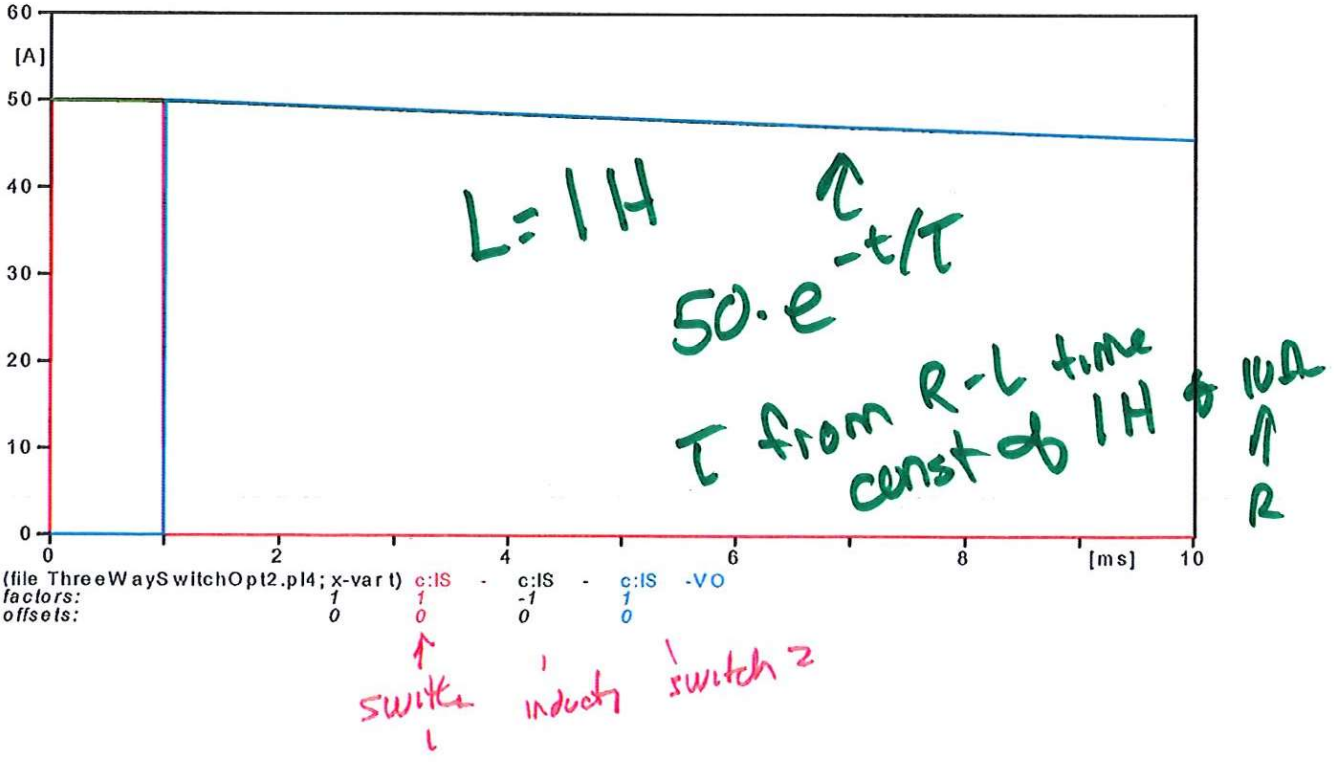


Simulation Results:

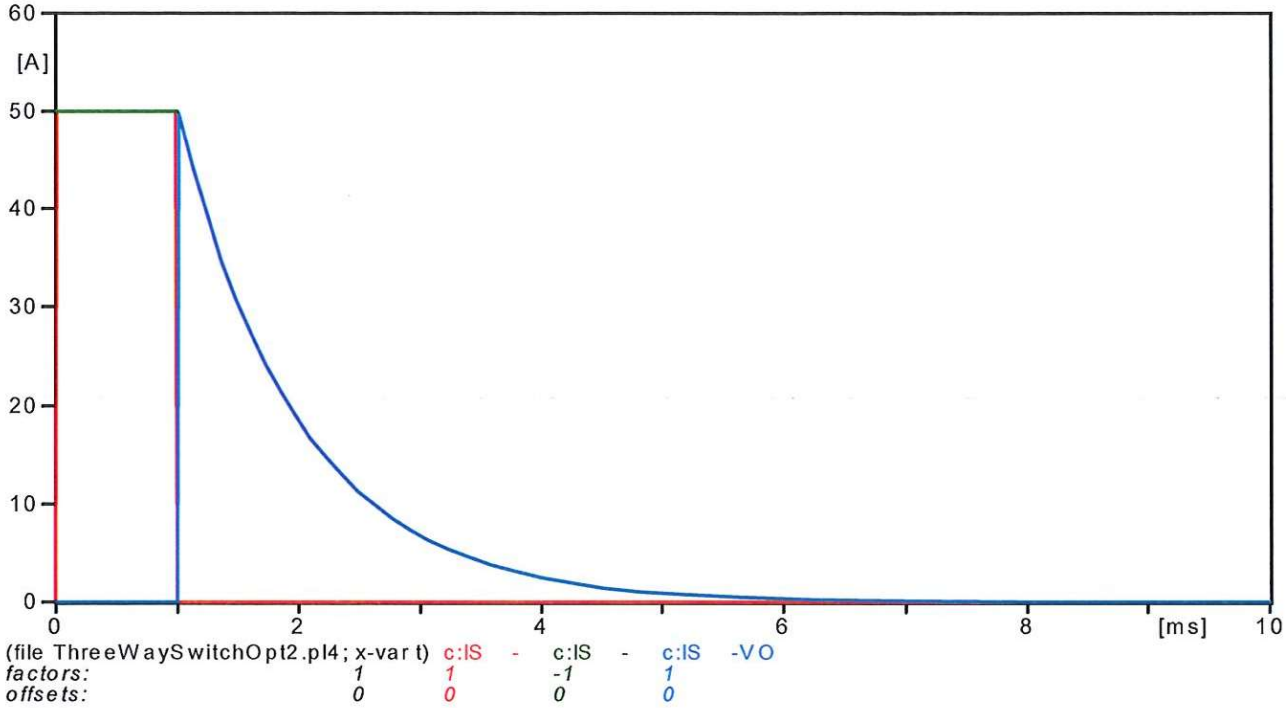
- Circuit 1: Transition from current in switch to ground (green) to switch to load (red). Note the 1 time step transition time



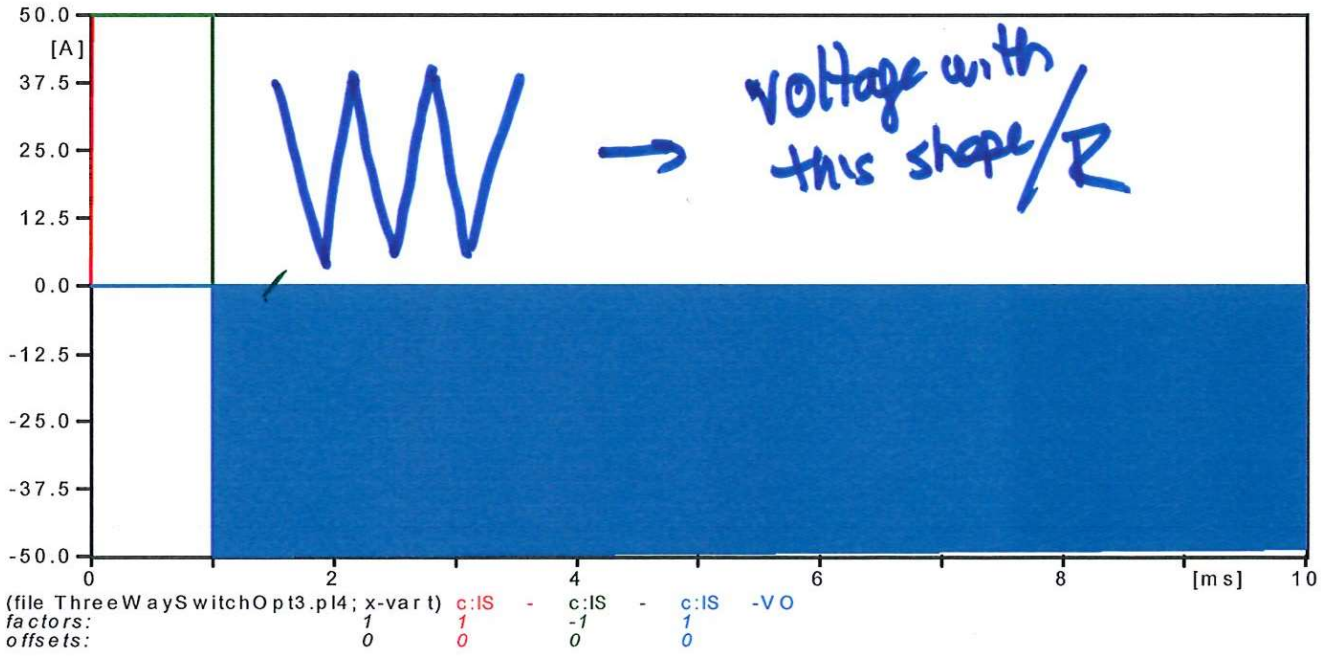
- Circuit 2: Inductor current (green line - multiplied by -1), current in switch to ground (red line), and current through switch to the load (blue line). Note the R-L decay in the current to the load resistor.



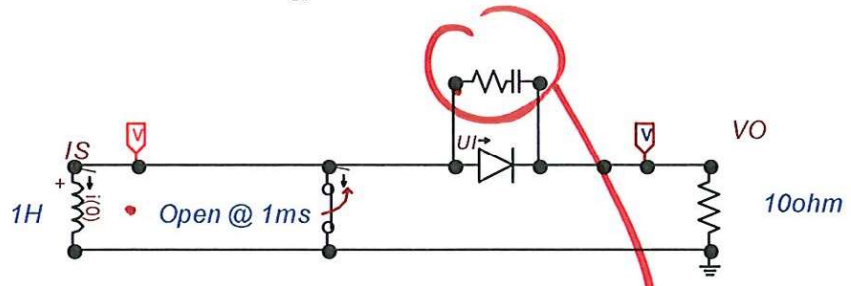
- Repeat case 2, with inductor of 10 mH instead of 1H.



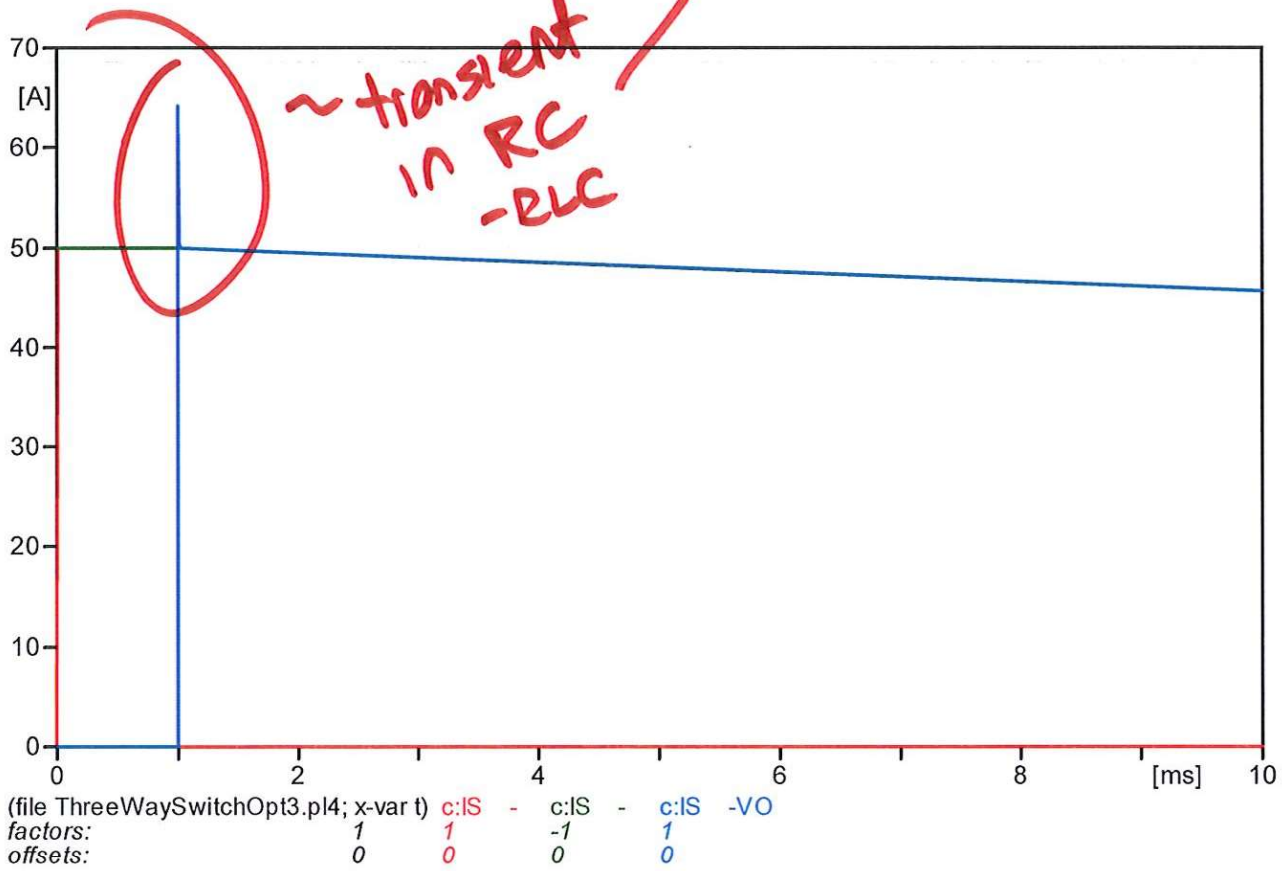
- Circuit 3, without RC snubber



- Circuit 3 with RC snubber added across the diode (R = 1000 ohm, C = 0.003 uF, so R*C = 3*Δt (three times the simualtion time step)



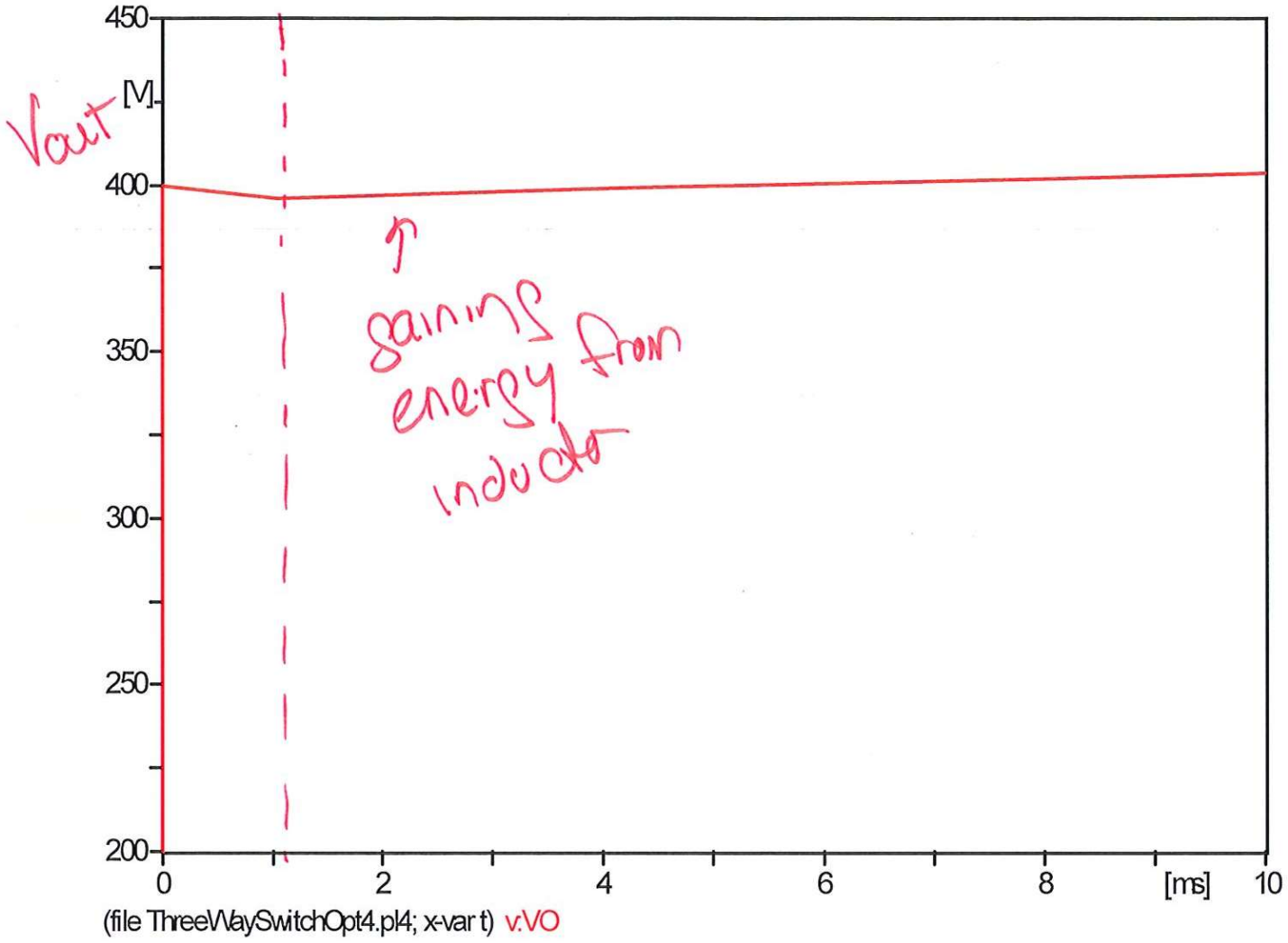
- Simulation result:



- The diode current shows jump (largely numerical error response)

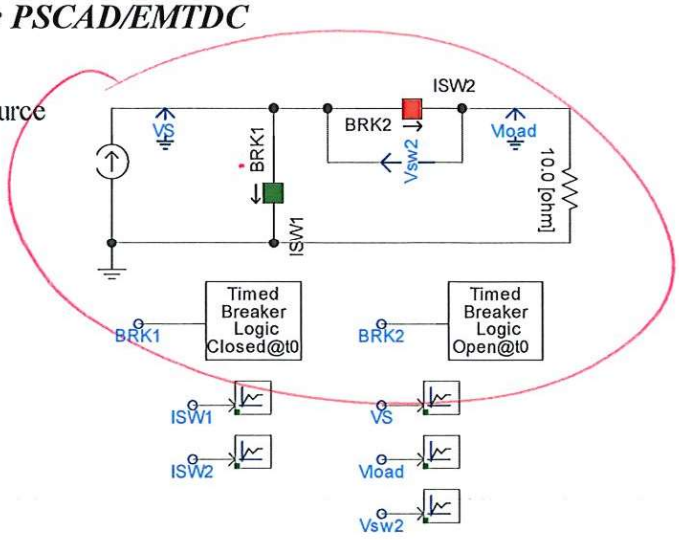
- Circuit 4: Now add 10,000 uF capacitor with initial charge of 200 V (resulting in 400V pole to ground voltage).

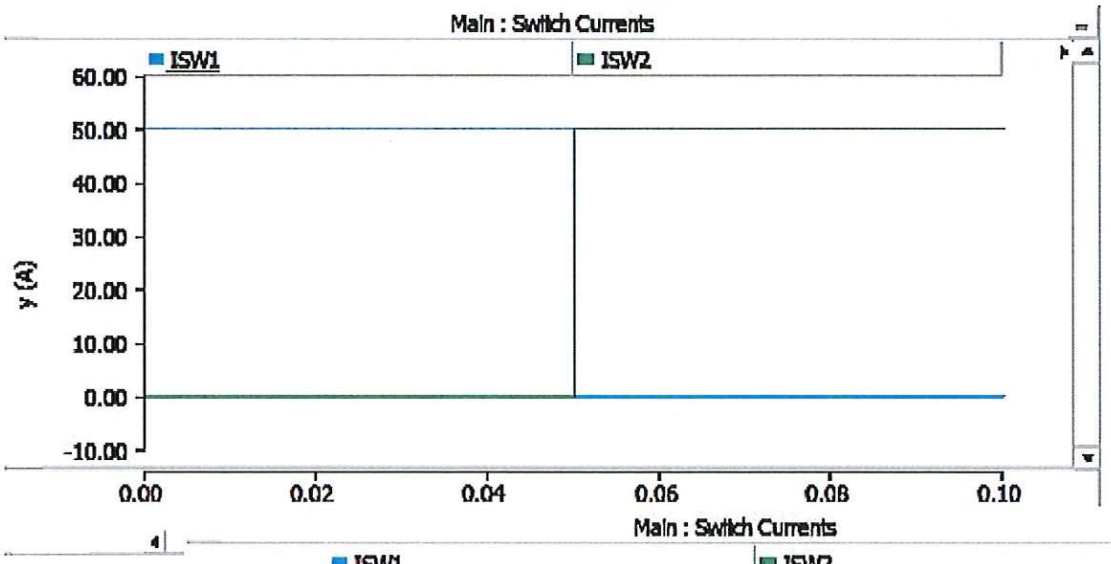
Output voltage: Note that it starts at 400V due to charge on capacitor. Then it falls as capacitor discharges into 10 ohm resistor. The voltage starts to rise when the diode begins to conduct and provides energy from the inductor.



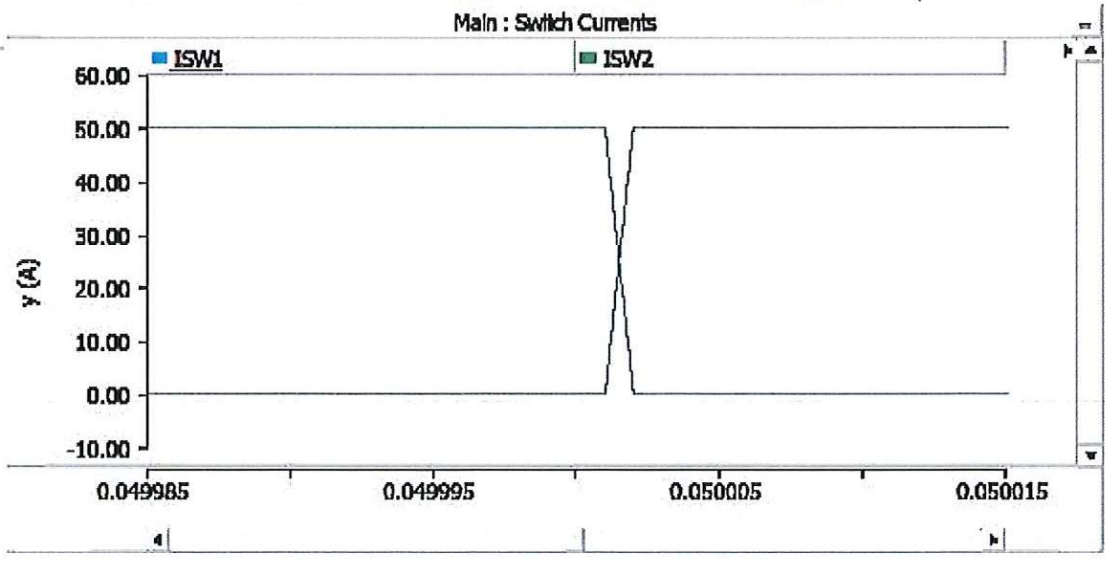
Three pole switch: PSCAD/EMTDC

Circuit 1: ideal current source



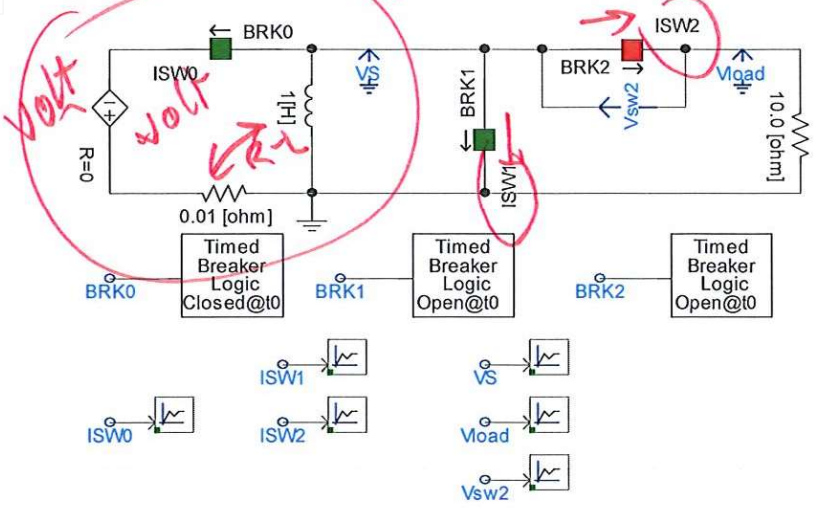


Zoomed currents:



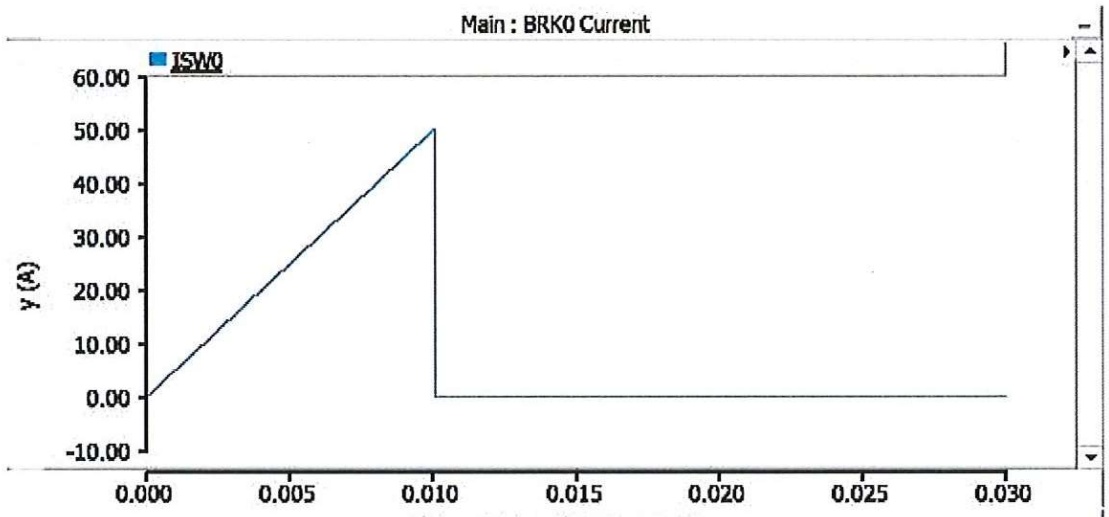
precharge inductor current

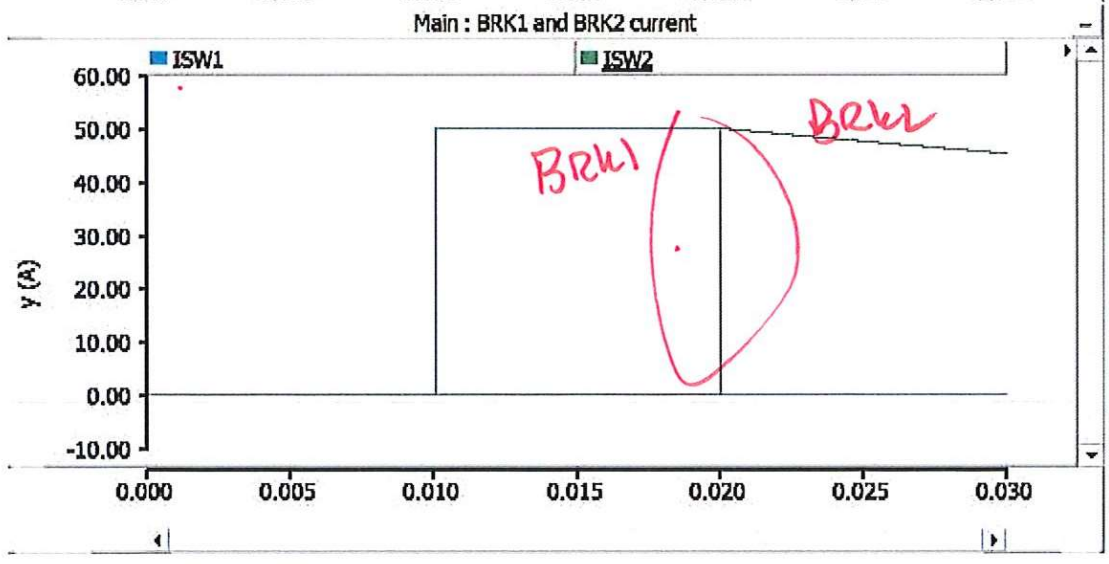
Circuit 2: inductor as the current source. Note the use of the circuit to initialize the inductor current



volt volt

- cant have inductor current pre initialized in SS.





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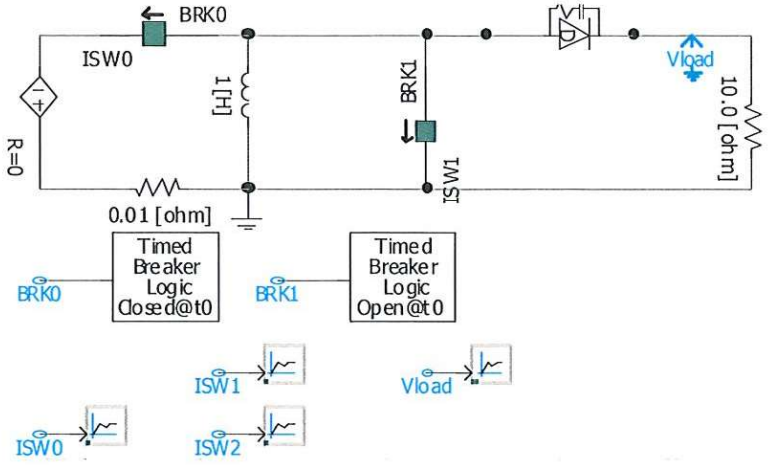
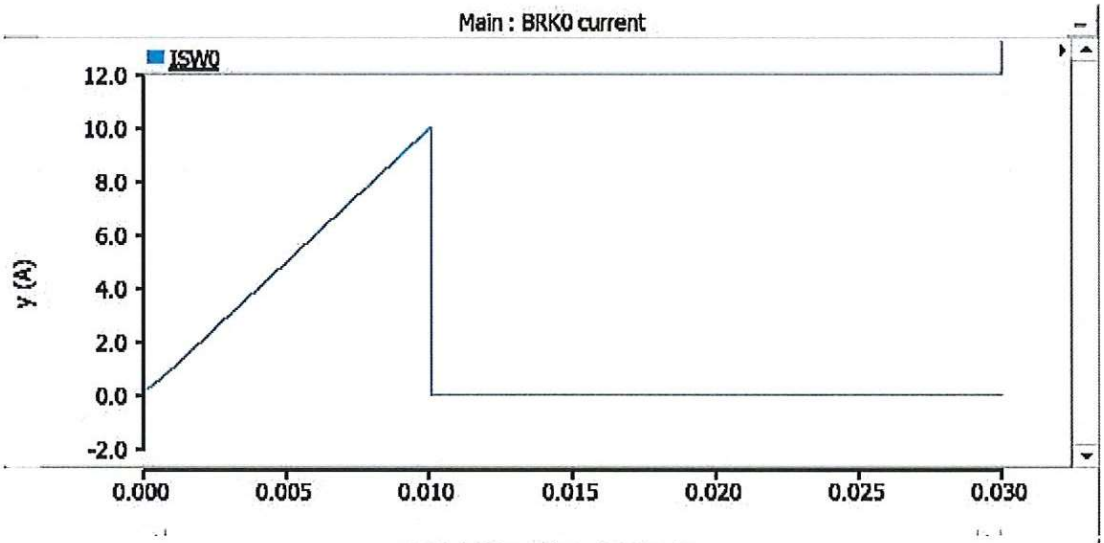
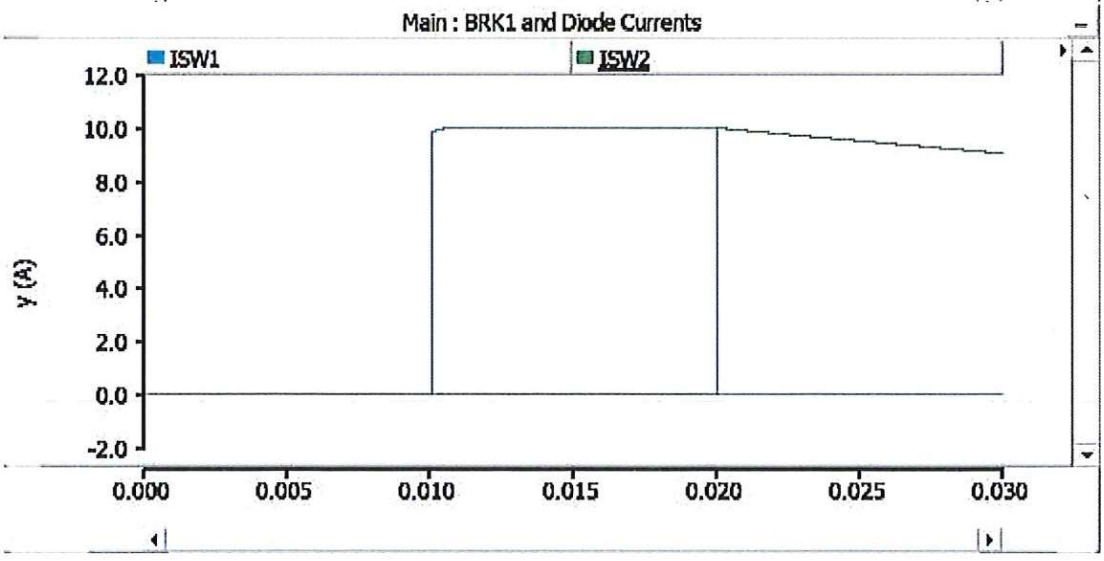
Circuit 3: Replace switch 2 with a diode:







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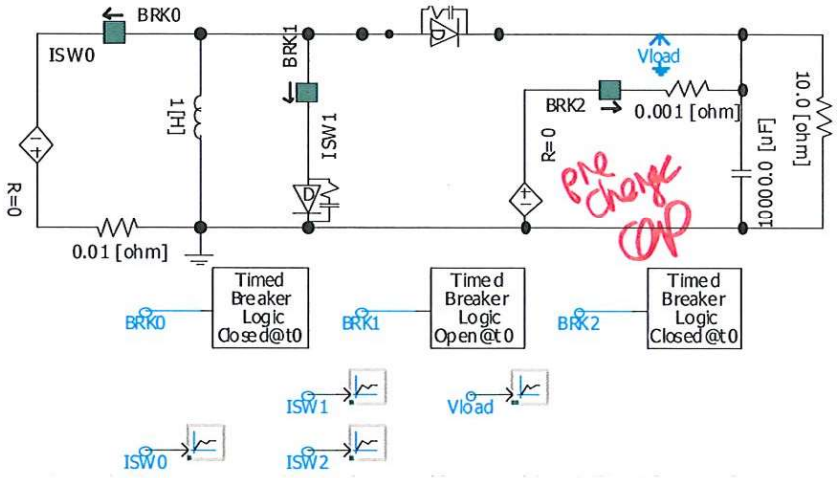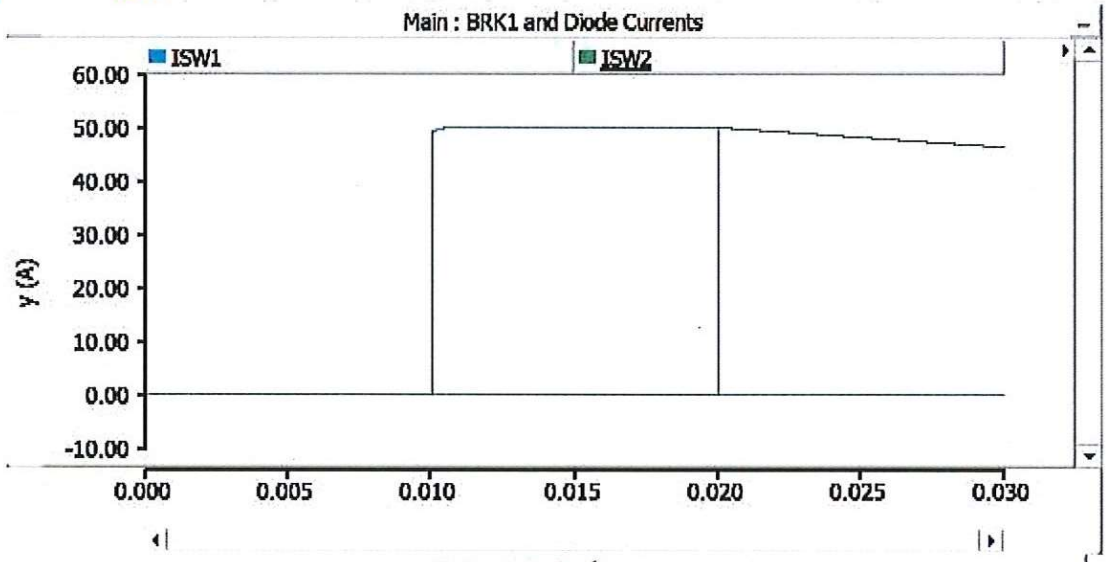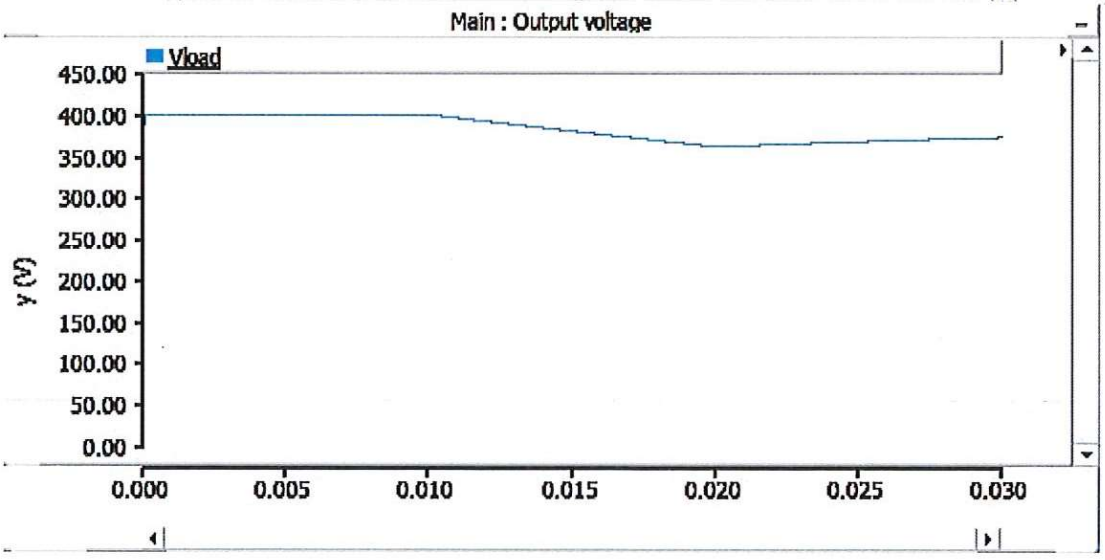
Circuit 4: Replace switch 2 with a diode and add capacitor on output precharged to 400 V: