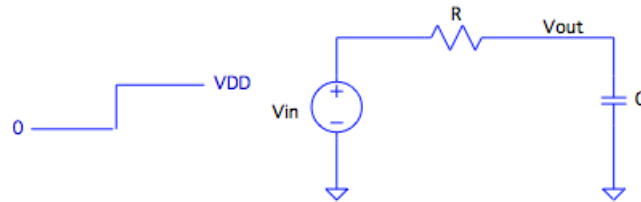


Problem Set

Problem

Given an RC circuit which input is a voltage step from 0 to VDD, and which output is the voltage on the capacitor, derive the circuit delay time (defined as the time it takes the output voltage to reach the 50% of its final value), and of the circuit rise time (defined as the time it takes the output voltage to go from the 10% to the 90% of its final value).

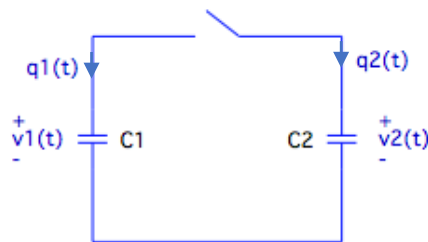


Verify the correctness of your results using 1) MATLAB and 2) SPICE

Problem

Consider two capacitors connected through a switch. Prior to switch closure ($t < 0$) the two capacitors C1 and C2 have respectively initial charge Q1 and Q2.

1. What is the voltage across the capacitors after the switch closes ($t \geq 0$).
2. What is the charge on the capacitors after the switch closes.
3. What is the total energy stored between the two capacitors before the switch is closed?
4. What is the total energy after the switch is closed?
5. While charge is conserved during the closure of the switch, it is interesting to note that energy is not. Where does the lost energy goes?



Problem: "Charge Trapping"

Find the response variables for the circuit in figure.

1. What is the value of $v_x(t)$, $v_y(t)$, $v(t)$, and $i(t)$ before the switches open ($t < 0$)
2. What is the value of $v_x(t)$, $v_y(t)$, $v(t)$, and $i(t)$ after the switches open ($t \geq 0$)
3. What is the value of v_x and v_y as $t \rightarrow \infty$
4. If any, what is the charge stored on the top and bottom capacitors as $t \rightarrow \infty$
5. What is the total energy $w(0^-)$ before the switches flip
6. What is the total energy as $t \rightarrow \infty$

