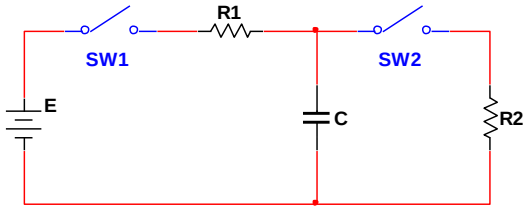
Capacitor Partial Charging and Discharging (31:31)

Capacitor Partial Charging and Partial Discharging Circuit 1 (0:00 to 14:05)



Given:

E = 12V
R_1 = 200Ω
C = 15µF
R_2 = 400Ω
V_C starts the charging process at 0V

Assume the following polarities:

positive I_1 travels in to out left to right
positive V_1 appears positive to negative left to right
positive I_C travels in to out top to bottom
positive V_C appears positive to negative top to bottom
positive I_2 travels in to out top to bottom
positive V_2 appears positive to negative top to bottom

Determine the instantaneous values of V_C, I_C, V_{R1}, and I_{R1} for a 6ms partial charge through SW1.

Draw a plot of electrical properties for a 6ms partial charge through SW1. Identify a quick means of drawing plots for a partial charge event.

Identify the beginning state for a discharge process preceded by a partial charge.

Derive the time variant expressions for $i_c(t)$, $v_c(t)$, $i_{R2}(t)$, and $v_{R2}(t)$, and plot these properties for discharge through SW2.

Determine the instantaneous values of V_C, I_C, V_{R2}, and I_{R2} for a 4ms partial discharge through SW2.

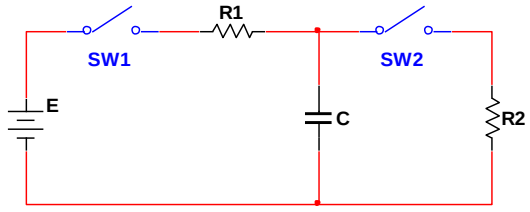
Draw a plot of electrical properties for a 4ms partial discharge through SW2. Identify a quick means of drawing plots for a partial discharge event.

Draw a plot of electrical properties for a 6ms partial charge through SW1 immediately followed by a 4ms partial discharge through SW2. (ie: back to back partial charge and partial discharge)

Describe the behavior of $v_c(t)$ for repeated partial charges immediately followed by partial discharges of less than 5 time constants.

Describe what defines a partial charge or partial discharge with respect to a circuit's time constant.

Capacitor Partial Charging and Partial Discharging Circuit 2 (14:05 to END)



Given:

E = 16V
R_1 = 200Ω
C = 20µF
R_2 = 100Ω
V_C starts the charging process at 2.1V

Assume the following polarities:

positive I_1 travels in to out left to right
positive V_1 appears positive to negative left to right
positive I_C travels in to out top to bottom
positive V_C appears positive to negative top to bottom
positive I_2 travels in to out top to bottom
positive V_2 appears positive to negative top to bottom

Determine the time constant for the charging process through SW1. Determine the time necessary for a full charge.

Determine the initial conditions for V_C, I_C, V_{R1}, and I_{R1}. Assume the capacitor has an initial voltage of 2.1V.

Derive the time variant expressions for $i_c(t)$, $v_c(t)$, $i_{R1}(t)$, and $v_{R1}(t)$ for the charge process.

Determine the instantaneous final values of V_C, I_C, V_{R1}, and I_{R1} for a 1ms partial charge through SW1.

Determine the time constant for the discharge process through SW2. Determine the time necessary for a full discharge.

Determine the initial conditions for V_C, I_C, V_{R2}, and I_{R2} at the start of the discharge process through SW2.

Derive the time variant expressions for $i_c(t)$, $v_c(t)$, $i_{R2}(t)$, and $v_{R2}(t)$ for the discharge process through SW2.

Determine the instantaneous final values of V_C, I_C, V_{R2}, and I_{R2} for a 1ms partial discharge through SW2.

Draw a plot of electrical properties for a 1ms partial charge through SW1 immediately followed by a 1ms partial discharge through SW2.