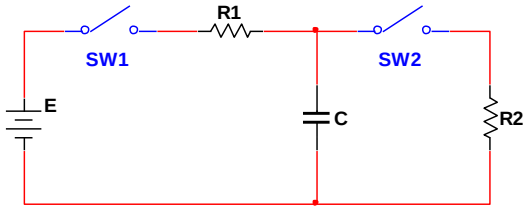
Capacitor Charging Featuring Thevenin's Theorem (32:42)

Capacitor Charging Circuit 1 (0:00 to 23:59)



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 Thevenin's equivalent circuit seen by the capacitor when both SW1 and SW2 simultaneously close at t=0.

Determine the time constant for capacitor charging circuit 1 when both SW1 and SW2 simultaneously close at t=0. Determine the time necessary for a full charge.

Determine the instantaneous values for V_C and I_C at the start of the charge process when both SW1 and SW2 simultaneously close at t=0. Assume the capacitor is initially uncharged.

Given SW1 and SW2 remain closed for 5 time constants determine the final values for V_C and I_C.

Derive the time variant expressions for current through the capacitor as a function of time, $i_c(t)$, and voltage across the capacitor as a function of time, $v_c(t)$, and plot these properties for a full charge when both SW1 and SW2 simultaneously close at t=0.

Determine the instantaneous values of I_C and V_C at t = 1ms.

Determine the time V_C has risen to 5V. At this same time determine the instantaneous value of I_C.

Determine the instantaneous values of I_1, V_1, I_2, and V_2 at t = 0 and 10ms.

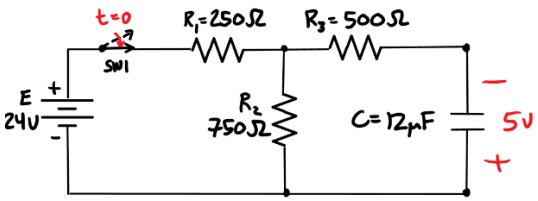
Determine the instantaneous values of I_1, V_1, I_2, and V_2 at t = 10ms.

Derive the time variant expressions for $i_1(t)$, $v_1(t)$, $i_2(t)$, and $v_2(t)$ and plot these properties for a full charge.

Determine the instantaneous values of I_1, V_1, I_2, and V_2 at t = 1ms.

Determine the instantaneous values of I_1, V_1, I_2, and V_2 at t = 1.963ms, and occasion in which V_C to be 5V and I_C to be 22.5mA.

Capacitor Charging Circuit 2 (23:59 to END)



Given capacitor charging circuit 2, determine the Thevenin's equivalent circuit seen by the capacitor with an initial voltage of -5V.

Determine the time constant for the charging process

Determine the initial and final conditions for I_C and V_C.

Determine the time variant expressions for vc(t) and ic(t) draw a plots of these properties for a full charge of 5 time constants.

Determine the instantaneous values of I_C and V_C at t = 10ms.

Determine the time V_C has risen to 0V. At this same time determine the instantaneous value of I_C.