

Capacitor in a DC circuit

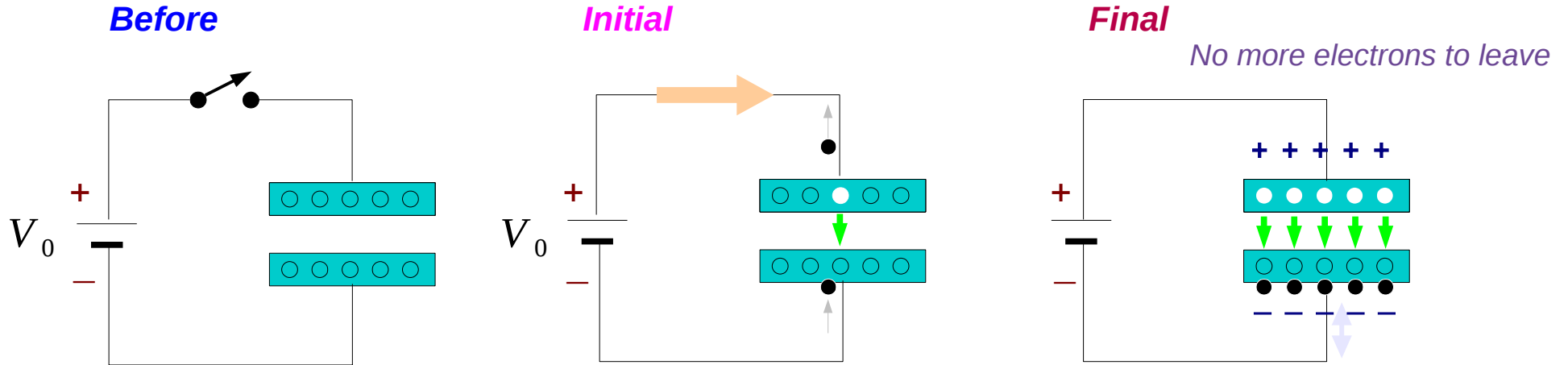
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Charge



$$i_c = C \cdot \frac{dv_c}{dt}$$

$$v_c(0^-) = v_c(0^+) \quad \text{unyielding voltage}$$

$$i_c(0^-) \neq i_c(0^+) \quad \text{current jump}$$

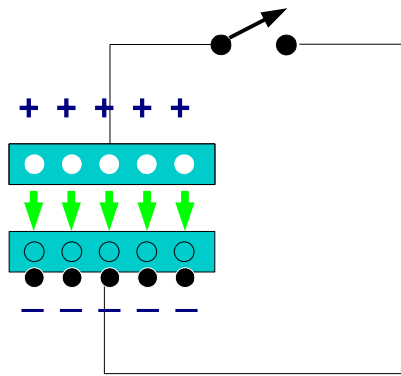
crowded electrons prevent other electrons from arriving

Energy stored in Electric Field

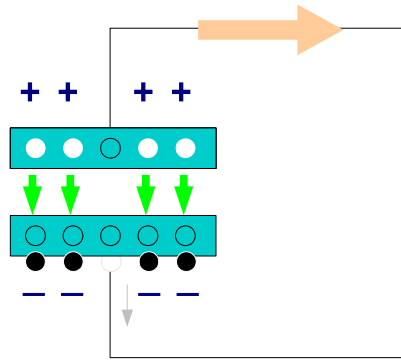
$$v_c(\infty) = V_0$$

$$i_c(\infty) = 0$$

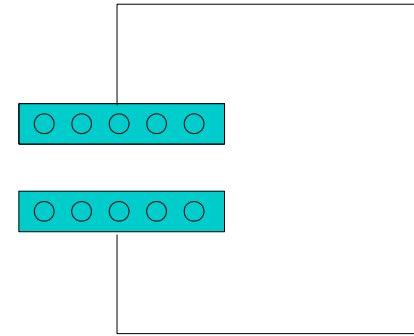
Discharge



Initial



Final



No more electrons moving

$$i_c = C \cdot \frac{dv_c}{dt}$$

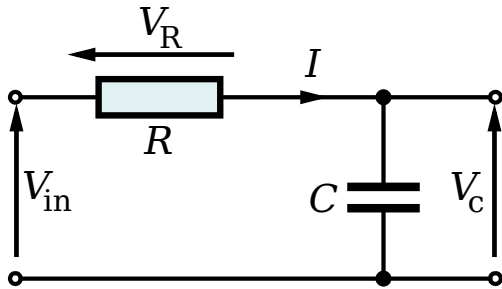
$$v_c(0^-) = v_c(0^+) \quad \text{unyielding voltage}$$

$$i_c(0^-) \neq i_c(0^+) \quad \text{current jump}$$

$$v_c(\infty) = 0$$

$$i_c(\infty) = 0$$

Charge

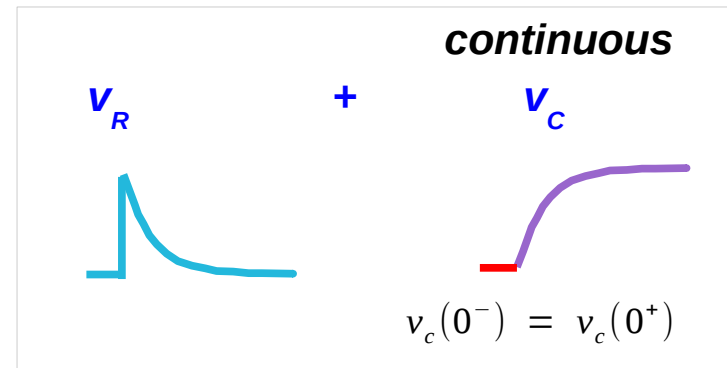
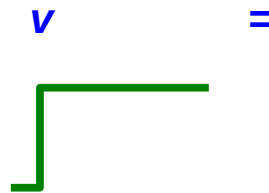


$$i_c = C \cdot \frac{d v_c}{d t}$$

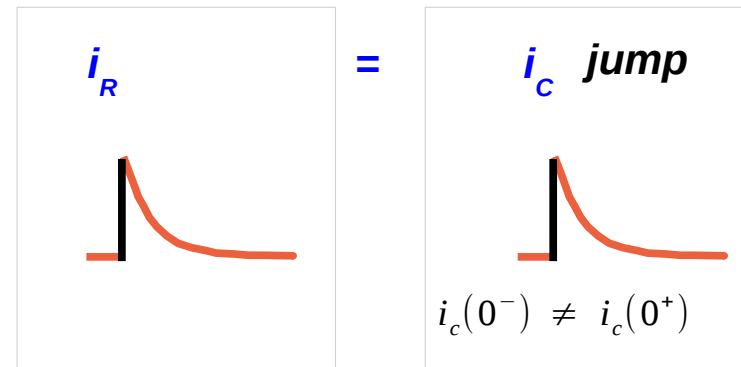
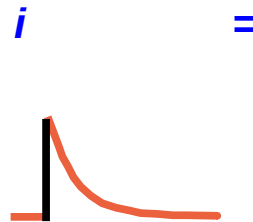
unyielding voltage

current jump

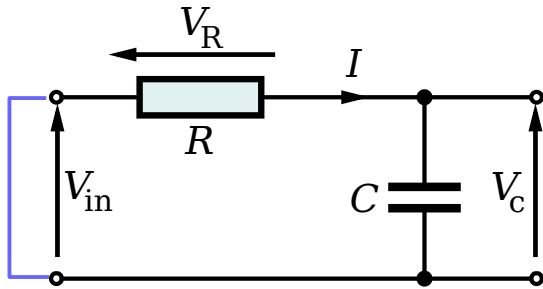
the capacitor voltage slowly follows the shape of the applied step input voltage



the capacitor current changes abruptly by the applied step input voltage and then slowly becomes zero



Discharge

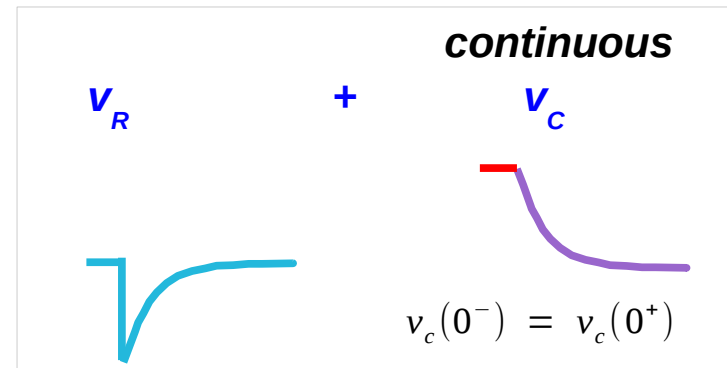
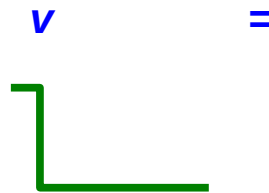


$$i_c = C \cdot \frac{d v_c}{d t}$$

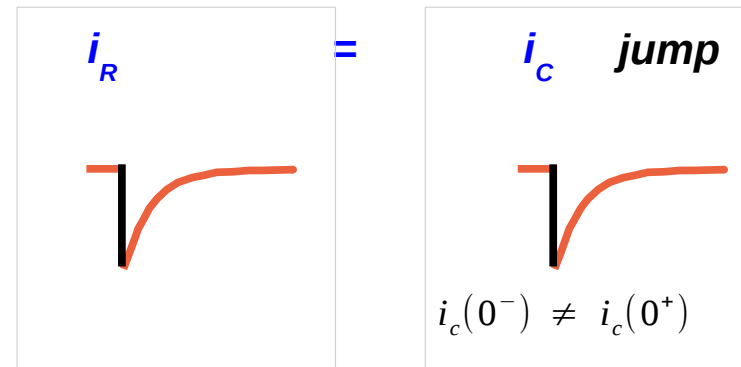
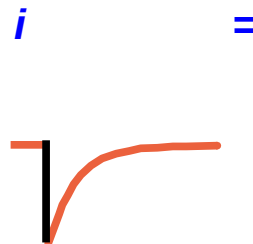
unyielding voltage

current jump

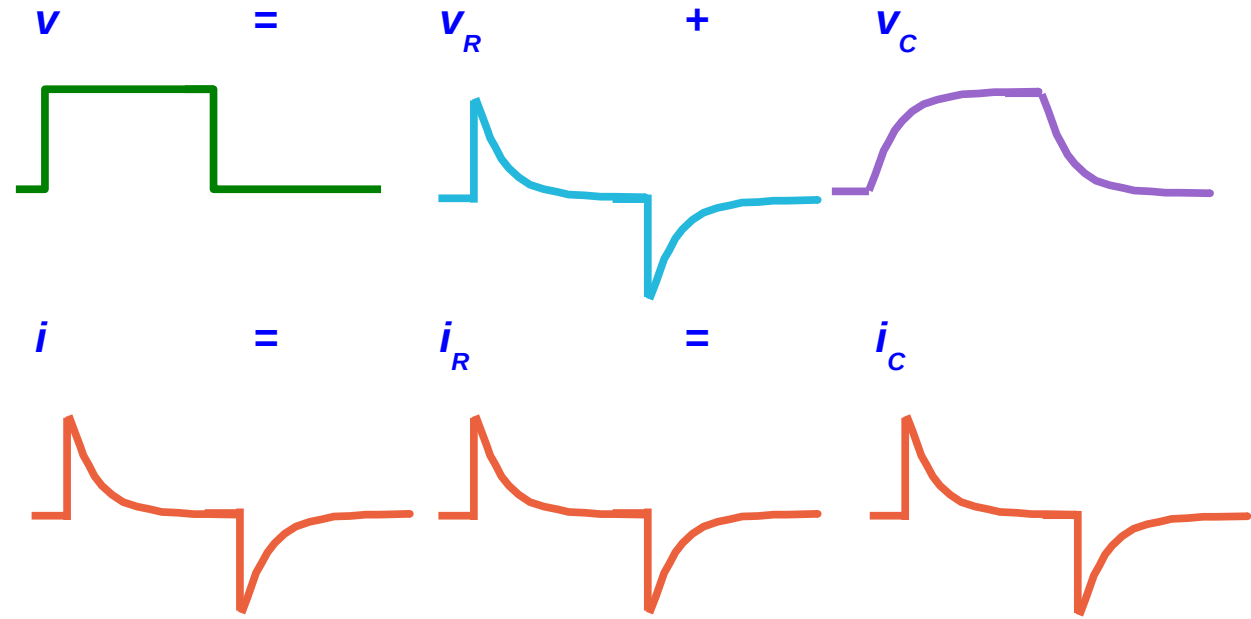
the capacitor voltage slowly follows the the shape of the applied step input voltage



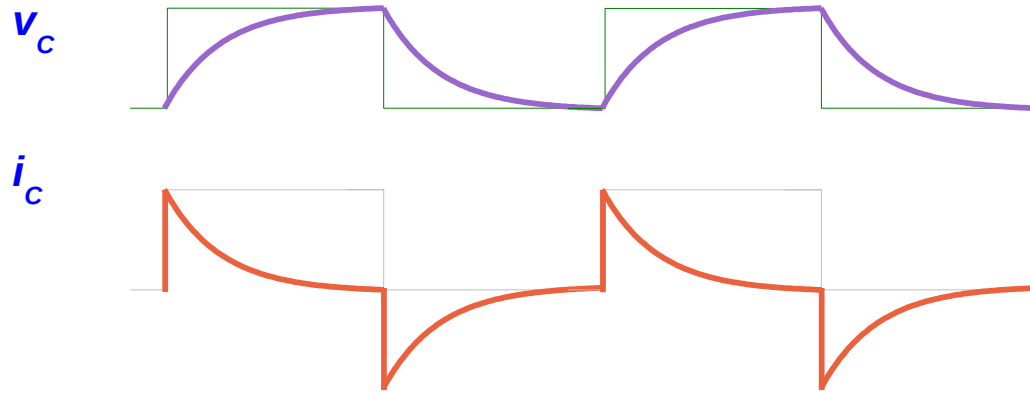
the capacitor current changes abruptly by the applied step input voltage and then slowly becomes zero



Pulse

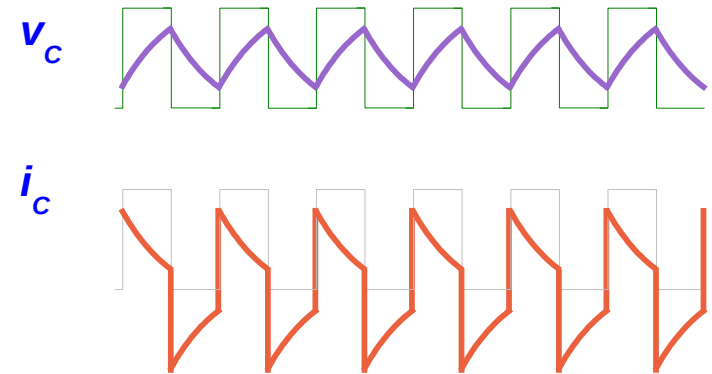
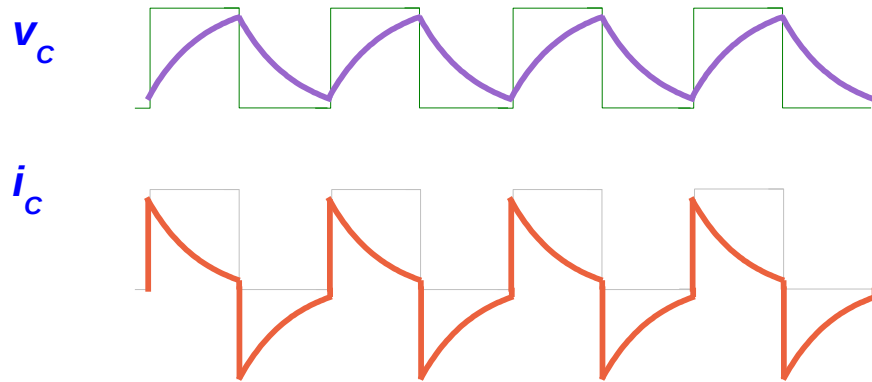


Pulse



$$i_c = C \frac{dv_c}{dt}$$

ω ↑ i_c ↑ X_c ↓



References

[1] <http://en.wikipedia.org/>

[2] J.H. McClellan, et al., Signal Processing First, Pearson Prentice Hall, 2003