

Capacitance

Physics

What a capacitor stores, and how it charges.

Capacitance is charge stored per unit potential difference.

$$C = Q/V \cdot E = \frac{1}{2}QV = \frac{1}{2}CV^2 \cdot \tau = RC$$

Series capacitors

Opposite to resistors.

$$1/C = 1/C_1 + 1/C_2$$

Parallel capacitors

$$C = C_1 + C_2$$

Time constant

63% charged after one τ .

$$\tau = RC$$

THE COMMON MISTAKE

✗ Using $E = QV$ for stored energy

✓ $E = \frac{1}{2}QV$

Voltage rises from zero as charge accumulates, so the average voltage during charging is half the final value.

After 5 time constants a capacitor is over 99% charged. That is the practical rule for circuit design.