FILTER CAPACITOR

POWER SUPPLY BUILDING BLOCKS

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TOPIC OUTLINE

Filter Capacitor

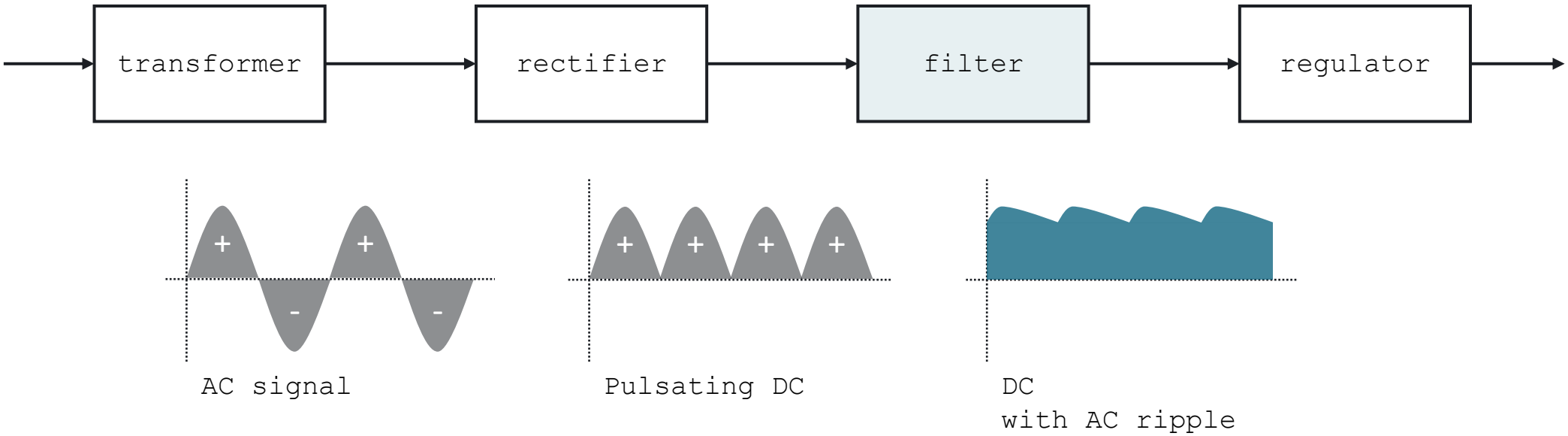
Smoothing Pulsating DC

FILTER CAPACITOR

FILTER CAPACITOR

A **filter capacitor** charges up when the voltage rises and discharges when the voltage drops, filling in the gaps of the pulsating DC waveform. This results in a **smoother DC** output.

Power Supply Block Diagram



SMOOTHING PULSATING DC

SMOOTHING HALF-WAVE

Discharging equation

$$v_c(t) = v_o e^{-\frac{t}{\tau}}$$

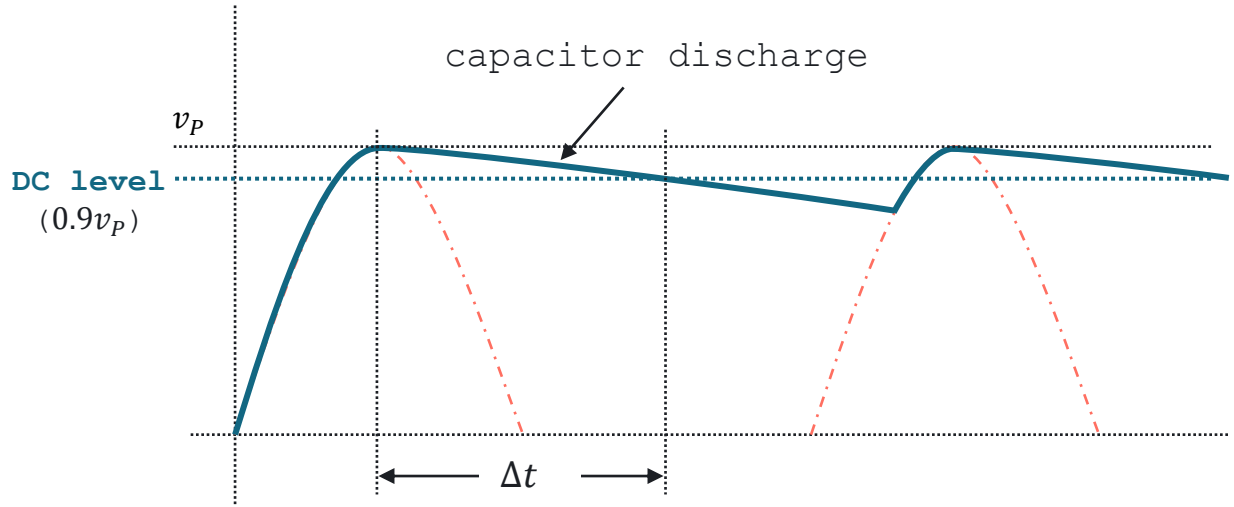
where: $\tau = RC$

Let $\tau = 10\Delta t$

$$v_c(\Delta t) = v_o e^{-\frac{\Delta t}{10\Delta t}}$$

$$v_c(\Delta t) = 0.905 v_o$$

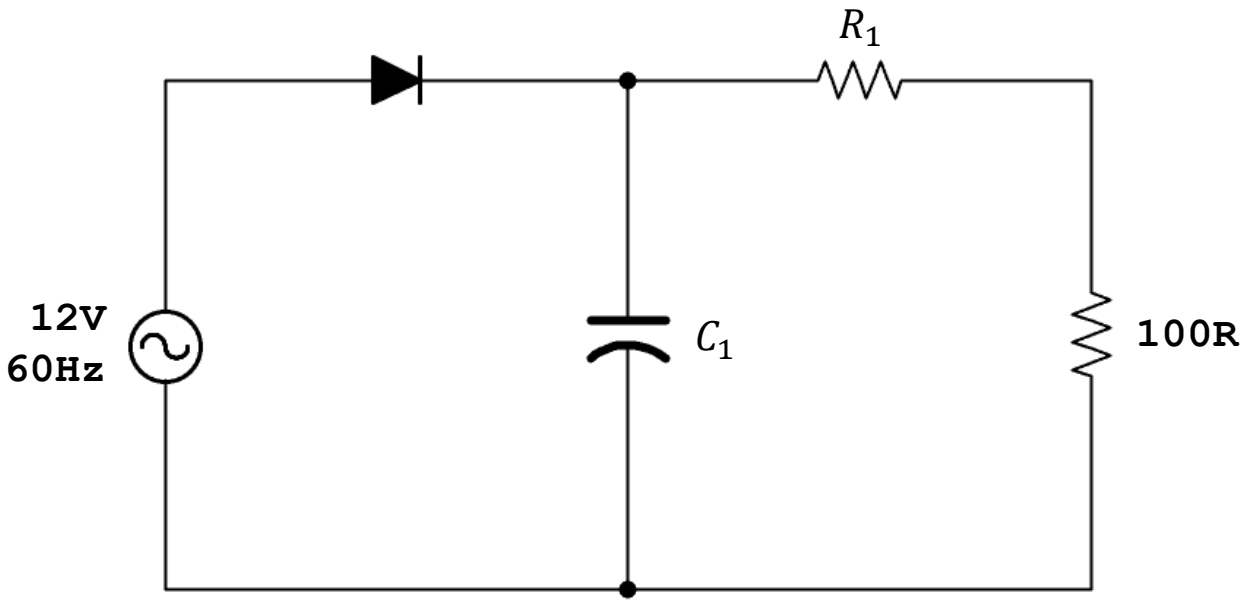
DC with AC Ripple



For half-wave, if the discharge time constant for the capacitor is 10 times the pulse duration, the average DC output level is approximately **90% of v_P**.

EXERCISE

The AC input to the given rectifier circuit is a $12V_{RMS}$, 60Hz sine wave. For this circuit, you need 9V DC across the 100Ω load resistor. Determine the value of R_1 and C_1.



Solution

SMOOTHING FULL-WAVE

Discharging equation

$$v_c(t) = v_o e^{-\frac{t}{\tau}}$$

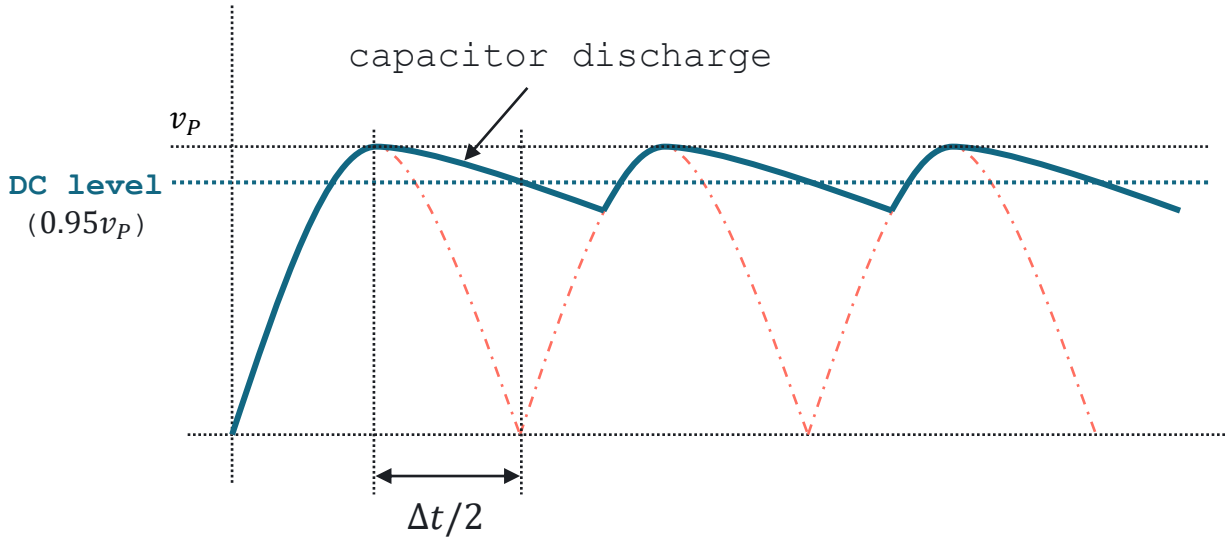
where: $\tau = RC$

Let $\tau = 10\Delta t$

$$v_c(\Delta t/2) = v_o e^{-\frac{\Delta t/2}{10\Delta t}}$$

$$v_c(\Delta t/2) = 0.95 v_o$$

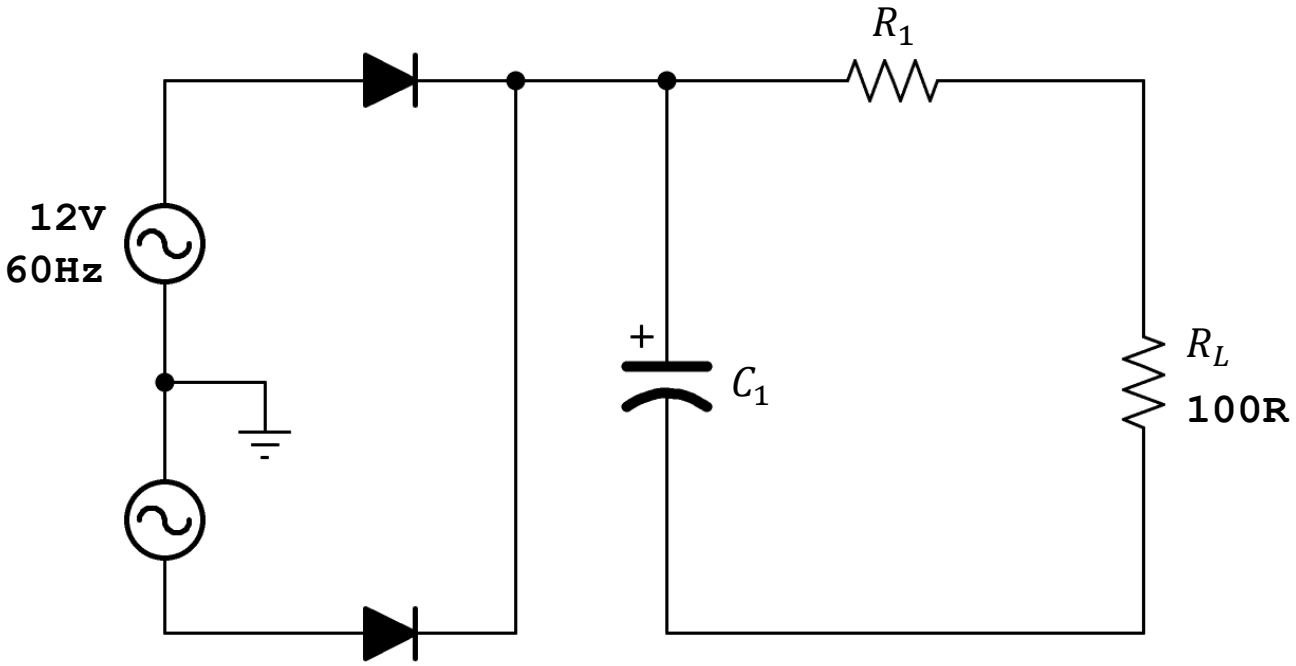
DC with AC Ripple



For full-wave, if the discharge time constant for the capacitor is 10 times the pulse duration, the average DC output level is approximately **95% of v_P**.

EXERCISE

The AC input to the given rectifier circuit is a $12V_{RMS}$, 60Hz sine wave. For this circuit, you need 9V DC across the 100Ω load resistor. Determine the value of R_1 and C_1.



Solution

LABORATORY