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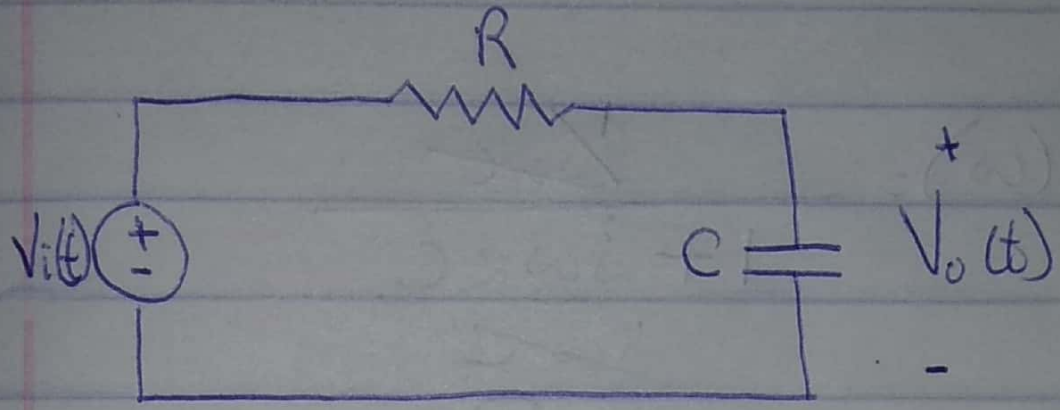
Mechatronics Engineering



The filter shown above is a lowpass filter. A lowpass filter is formed when the output of an RC Circuit is taken off the Capacitor.

To obtain the cut off frequency, we first obtain the transfer function.

$$H(\omega) = \frac{V_o}{V_i}$$

$$C = \frac{1}{j\omega C}, \quad R = R$$

$$H(\omega) = \frac{1/j\omega C}{R + 1/j\omega C}$$ } from Voltage division

$$= \frac{1/j\omega C}{\frac{j\omega RC + 1}{j\omega C}}$$

$$\therefore H(\omega) = \frac{\cancel{1/j\omega C}}{\frac{1 + j\omega RC}{\cancel{j\omega C}}}$$

$$\boxed{H(\omega) = \frac{1}{1 + j\omega RC}}$$

Cut off frequency ω_c, is obtained by setting the magnitude of $H(\omega)$ equal to $1/\sqrt{2}$.

$$\therefore |H(\omega_c)| = \frac{1}{\sqrt{2}} = \frac{1}{\sqrt{1 + \omega_c^2 R^2 C^2}}$$

$$\omega_c RC + 1 = 2$$

$$\omega_c RC = 2 - 1 = 1$$

$$\left[\omega_c = \frac{1}{RC} \right] //$$