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CIRCUIT THEORY

A typical low-pass filter is shown below; the output is taken off the capacitor

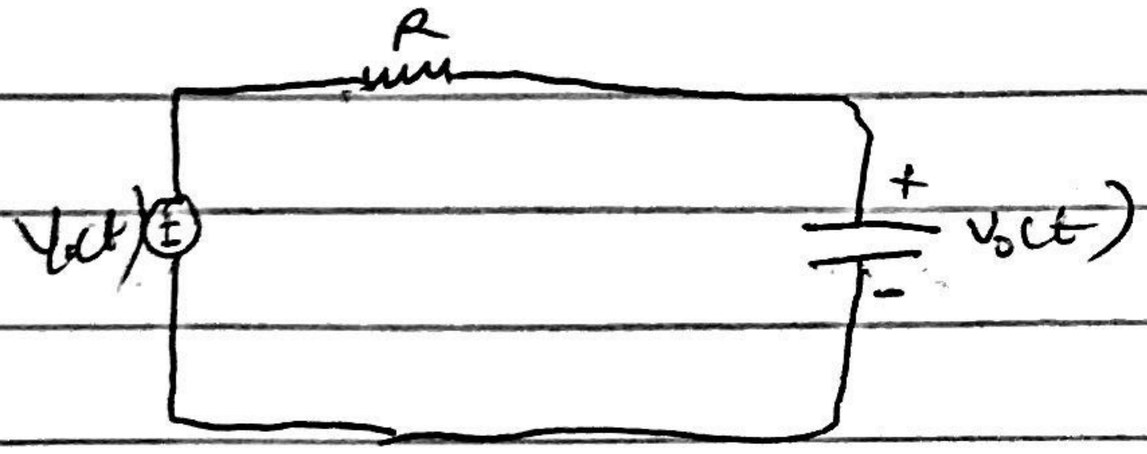


fig Typical low-pass filter

$$H(\omega) = \frac{V_0}{V_i} = \frac{1/j\omega C}{R + 1/j\omega C}$$

$$\frac{1}{j\omega C} \times \frac{1}{R + 1/j\omega C}$$

$$= \frac{1}{1 + Rj\omega C}$$

$$H(s) = 1$$

$$H(\omega) = 0$$

The cut off frequency $\omega_c$ is obtained by setting the magnitude of $H(\omega)$ to $1/\sqrt{2}$

$$|H(\omega)| = \left| \frac{1}{sRC+1} \right| = \frac{1}{\sqrt{2}}$$

$$= \frac{\sqrt{12}}{\sqrt{1^2+(\omega RC)^2}} = \frac{1}{\sqrt{2}}$$

$$= \frac{1}{\sqrt{1+|\omega^2R^2C^2|}} = \frac{1}{\sqrt{2}}$$

$$\sqrt{2} = \sqrt{1+\omega^2R^2C^2}$$

Square both side

$$2 = 1+\omega^2R^2C^2$$

Ex:-

Another circuit that gives a low pass filter is RL series circuit where the output is taken off the resistor.