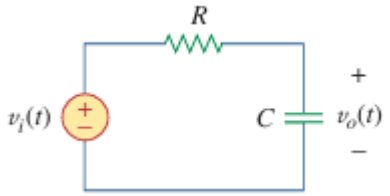
20 - Filter

There are two types of filter that exists, Active filter and passive filter. For the sake of simplicity, we are just going to discuss about passive filters.

Low Pass Filter

A typical lowpass filter is formed when the output of an RC circuit is taken off the capacitor as shown in the following figure.



The transfer function

$$H(\omega) = \frac{V_o}{V_i} = \frac{1/j\omega C}{R + 1/j\omega C} = \frac{1}{1 + j\omega RC}$$$Notethat, $H(0) = 1$, $H(\infty) = 0$![[Pastedimage2025040

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

\Rightarrow \omega_c = \frac 1{RC}

The cutoff frequency is also called the rolloff frequency A lowpass filter is designed to pass only frequencies fr

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

$Notethat$H(0) = 0$, $H(\infty) = 1$. ![[Pastedimage20250402112928.png]]$Again, thecornerorcutofffre

\omega_c = \frac{1}{RC}

A highpass filter is designed to pass all frequencies above its cutoff frequency ω_c A highpass filter ca

H(\omega) = \frac{V_o}{V_i} = \frac R{R + j(\omega L - 1/\omega C)}

$Weobservethat$H(0) = 0$, $H(\infty) = 0$. ![[Pastedimage20250402114307.png]]$Thebandpassfilterpass

\omega_0 = \frac{1}{\sqrt{LC}}

Bandstop Filter A filter that prevents a band of frequencies between two designated values $(\omega_1$ and

H(\omega) = \frac{V_o}{V_i} = \frac{j(\omega L - 1 / \omega C)}{R + j(\omega L - 1 / \omega C)}

$Here, $H(0)$ = 1, $H(\infty)$ = 1.![[Pastedimage20250402122403.png]]$Again, thecenterfrequencyisgive

\omega_0 = \frac 1{\sqrt{LC}}

$Here, \$\omega_0\$ is called the frequency of rejection, while the corresponding bandwidth (\$B = \omega_2 - \omega_1\$) is knou$