

AKUNA SUNDAY · U.

17/ENG04/009

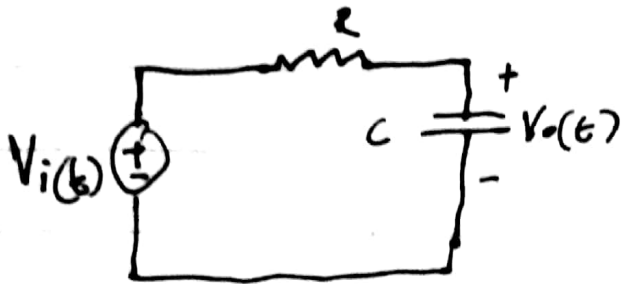
Electrical circuit theory II
Assignment 1

17th April, 2020

Determine the type of filter shown below and show that

Its cut-off frequency is

$$\omega_c = 1/RC$$



Answer

This is a lowpass filter. A typical low pass filter is formed when the output of an RC circuit is taken off the capacitor.

The transfer function is

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

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

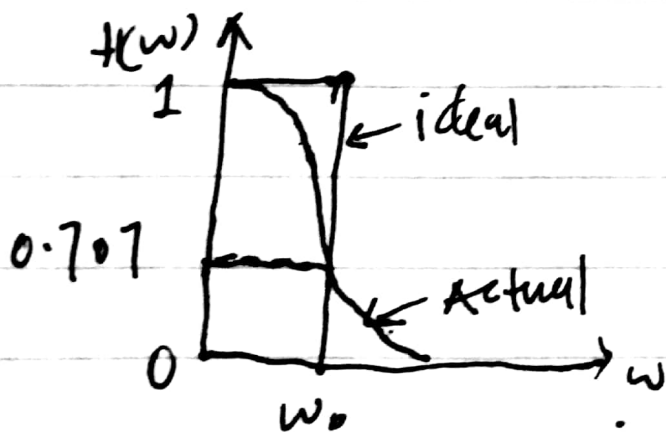
Note that $H(0) = 1$, $H(\infty) = 0$

The half-power frequency which is equivalent to the corner frequency on the Bode plots but in the context of filters is usually known as the cut off frequency ω_c , is obtained by setting the magnitude of $H(\omega)$ equal

equal to $1/\sqrt{2}$ rms

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

$$\omega_c = \frac{1}{RC}$$



Ideal and actual frequency response of low pass filter.

The cut-off frequency is also called the roll off frequency.