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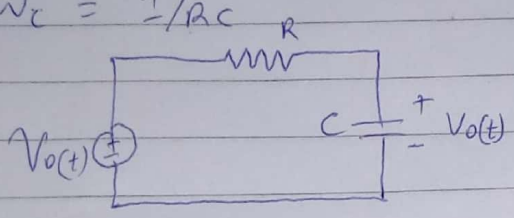
17/ENG04/070
ELECTRICAL/ELECTRONICS

CIRCUIT THEORY II (EEE 322)

Assignment 1

Determine the type of filter shown below, and show that its cut-off frequency is:

$$w_c = 1/RC$$



Answer

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

The transfer function is

$$H(s) = \frac{V_o}{V_i} = \frac{1/jwC}{R + 1/jwC}$$

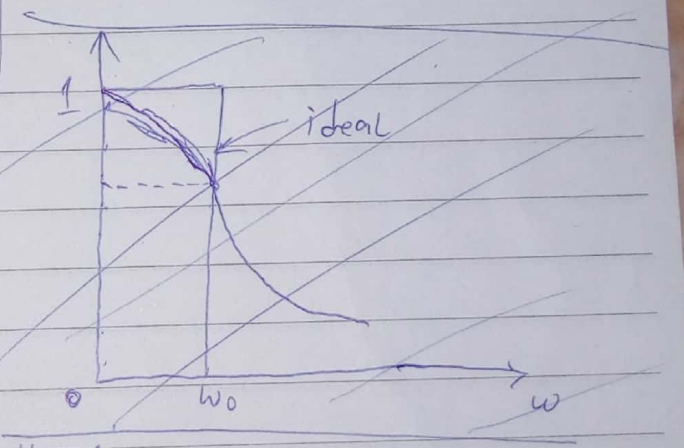
$$H(s) = \frac{1}{1 + jwC}$$

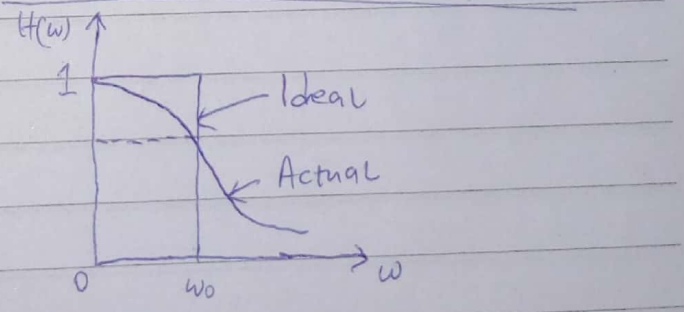
Note that $H(s) = 1$, $H(\infty) = 0$

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 w_c is obtained by setting the magnitude of $H(w)$ equal to $1/\sqrt{2}$ thus

$$H_{(wc)} = \frac{1}{\sqrt{1 + w_c^2 R^2 C^2}} = \frac{1}{\sqrt{2}}$$

$w_c = 1/RC$





Ideal and actual frequency response of lowpass filter.

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

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