

Activity 18

Signals and Systems

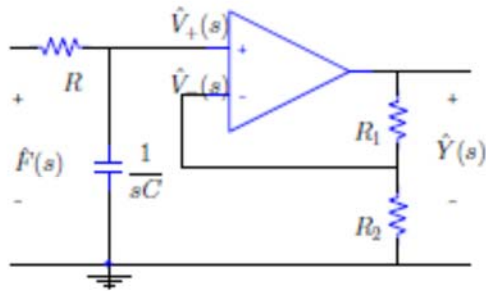
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Name _____

1. Derive the transfer function $\hat{H}_a(s)$ of the 1st-order active filter circuit depicted

Solution:

The equivalent s-domain circuit is



Applying voltage division with impedances R and $\frac{1}{sC}$, we obtain

$$\hat{V}_+(s) = \left(\frac{\frac{1}{sC}}{R + \frac{1}{sC}} \right) \hat{F}(s).$$

Then assuming linear conditions, the non-inverting amplifier has a gain of $K = \left(1 + \frac{R_1}{R_2} \right)$, which yields

$$\hat{Y}(s) = K \left(\frac{\frac{1}{sC}}{R + \frac{1}{sC}} \right) \hat{F}(s).$$

Therefore, the transfer function is

$$\hat{H}_a(s) = \frac{\hat{Y}(s)}{\hat{F}(s)} = K \left(\frac{\frac{1}{sC}}{R + \frac{1}{sC}} \right) = \frac{\frac{K}{RC}}{s + \frac{1}{RC}}.$$