UNIT-5
(Lecture-9)

OP-AMP CIRCUITS

3.5 Inverse function Generation :

Fig. 19 (a) and (b) show an interesting concept according to which if a network having

$$e_0 = T\, e_i$$

is put in the feedback path of an op-amp the overall circuit generates

$$v_0 = T^{-1}\, v_{in}$$

As an example in Fig 19 (c) we show by putting an integrator in the feedback path, one obtains a differentiator.

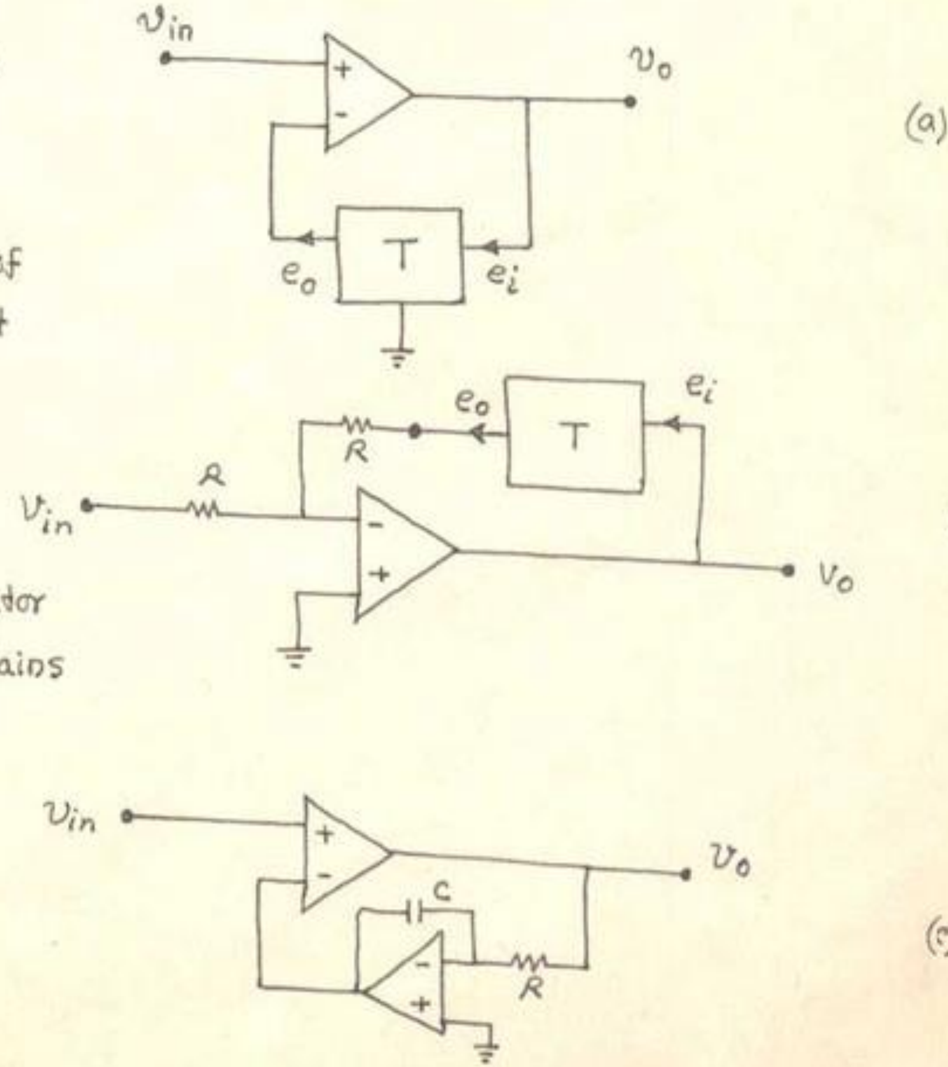
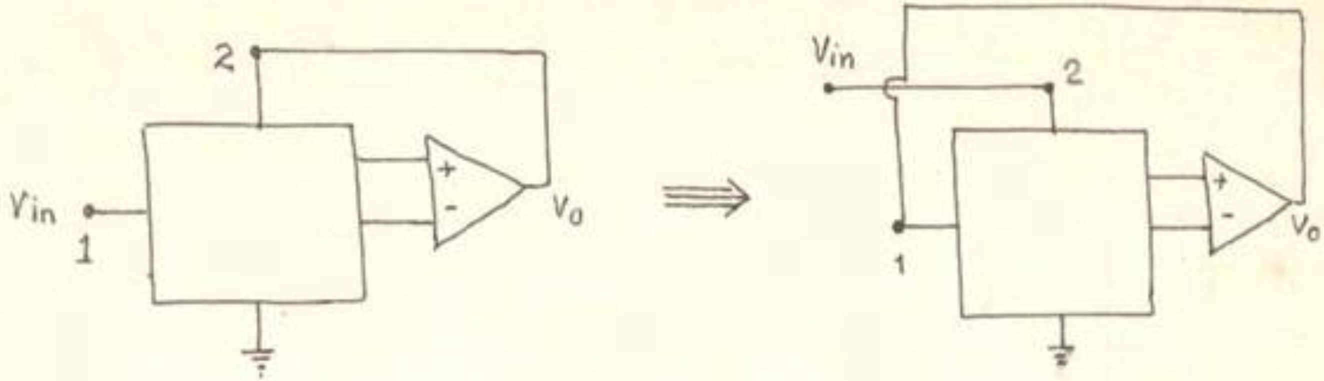


Fig. 19 (a) $v_0 = T^{-1}\, v_{in}$

(b) $v_0 = -T^{-1}\, v_{in}$

(c) $v_0 = -sCR\, v_{in}$

The following fig. shows how this idea can be implemented on a given single



$V_o = T\,V_{in}$ $\qquad$ $V_o = T^{-1}\,V_{in}$

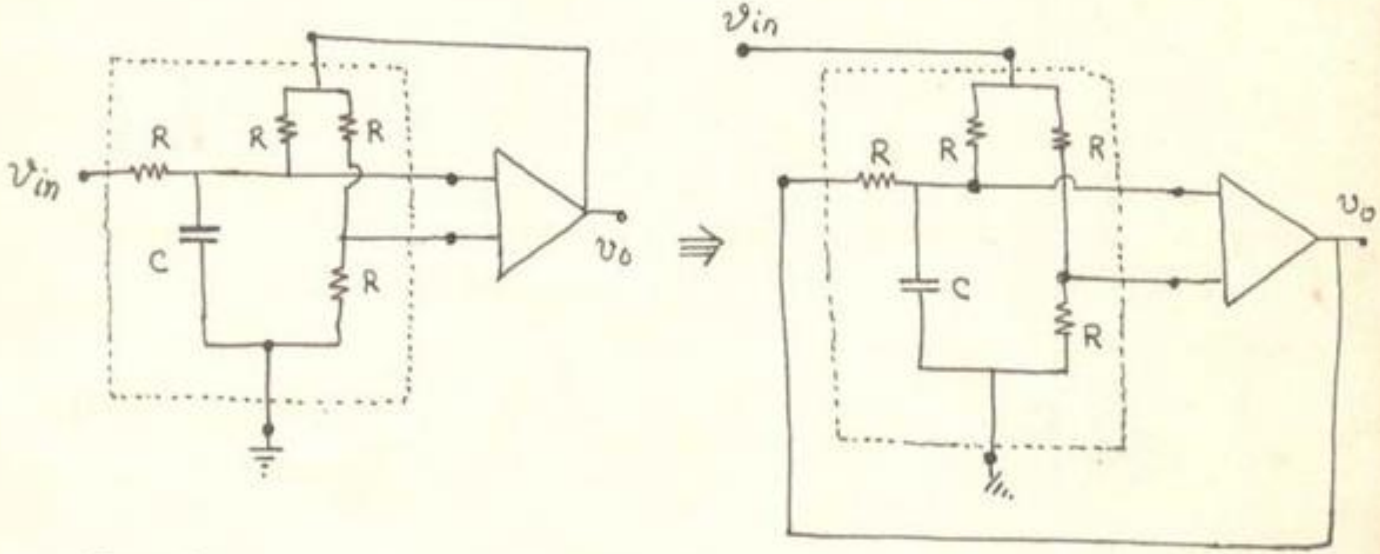
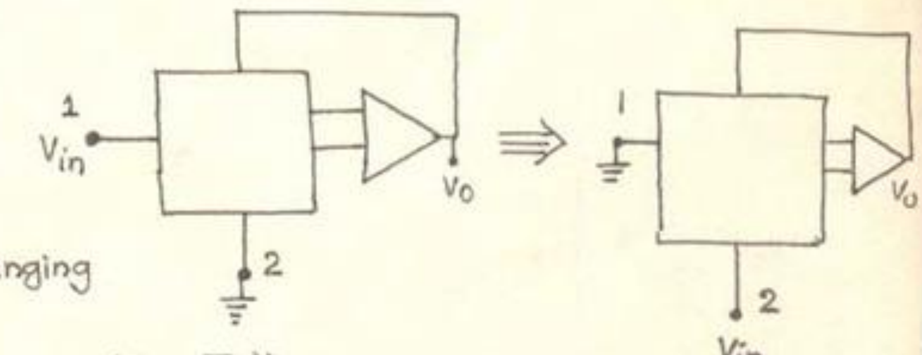


Fig. 20

op-amp circuit without requiring any additional op-amp. As an example, Deboo's integrator and Horrocks differentiator are shown to be derivable from each other.

3.6 Complementary function generation:

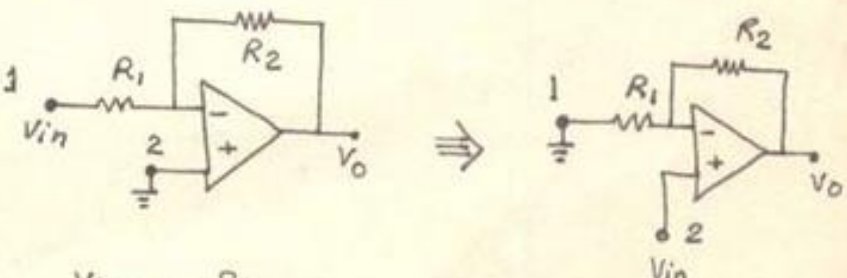
In some cases one requires to generate a complementary function $(1-T)$ starting from a given function T (relating V_o and V_{in}). This can be accomplished by simply interchanging input and ground terminals as shown in Fig. 21



$$V_o = T\, V_{in}$$

$$V_o = (1-T)\, V_{in}$$

Note that inverting amplifier and non inverting amplifier can be seen to be related to each other by this transformation.



$$\frac{V_o}{V_i} = -\frac{R_2}{R_1}$$

$$\frac{V_o}{V_{in}} = 1 - \left(-\frac{R_2}{R_1}\right)$$

$$= 1 + \frac{R_2}{R_1}$$

An important application of this transformation is in deriving a notch filter circuit starting from a bandpass circuit and vice versa.

Fig. 21 The complementary transformation (Hilberman's Theorem)