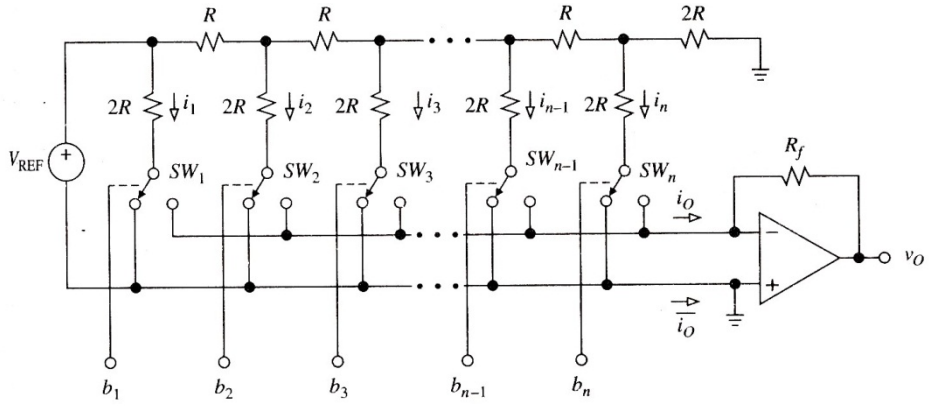
INVERTED OR CURRENT AND VOLTAGE MODE DAC

INVERTED OR CURRENT MODE DAC

As the name implies, Current mode DACs operates based on the ladder currents. The ladder is formed by resistance R in the series path and resistance 2R in the shunt path. Thus the current is divided into i1 , i2, i3 ……in. in each arm. The currents are either diverted to the ground bus (io) or to the Virtual-ground bus ($\overline{io}$).



The currents are given as

i1 = VREF/2R = (VREF/R) 2-1, i2 = (VREF)/2)/2R = (VREF/R) 2-2……in = (VREF/R) 2-n.

And the relationship between the currents are given as

i2 = i1/2

i3 = i1/4

i4 = i1/8

in = i1/2n-1

Using the bits to identify the status of the switches, and letting V0 = -Rf io gives

V0 = - (Rf/R) VREF (b12-1 + b22-2+ …….. + bn2-n)

The two currents io and $\overline{io}$ are complementary to each other and the potential of io bus must be sufficiently close to that of the $\overline{io}$ bus. Otherwise, linearity errors will occur. The final op-amp is used as current to voltage converter.

Advantages

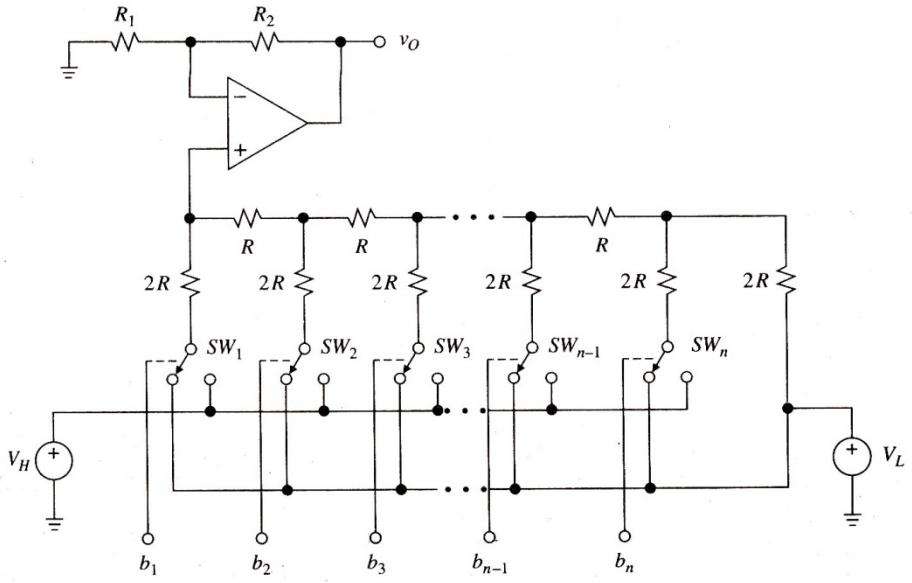
1. The major advantage of current mode D/A converter is that the voltage change across each switch is minimal. So the charge injection is virtually eliminated and the switch driver design is made simpler.

2. In Current mode or inverted ladder type DACs, the stray capacitance do not affect the

speed of response of the circuit due to constant ladder node voltages. So improved speed performance.

VOLTAGE MODE DAC

This is the alternative mode of DAC and is called so because, the 2R resistance in the shunt path is switched between two voltages named as VL and VH. The output of this DAC is obtained from the leftmost ladder node. As the input is sequenced through all the possible binary state starting from All 0s (0…..0) to all 1s (1…..1). The voltage of this node changes in steps of 2-n (VH - VL) from the minimum voltage of Vo = VL to the maximum of Vo = VH - 2-n (VH - VL).



The diagram also shows a non-inverting amplifier from which the final output is taken. Due to this buffering with a non- inverting amplifier, a scaling factor defined by $K = 1 + (R_2/R_1)$ results.

Advantages

1. The major advantage of this technique is that it allows us to interpolate between any two voltages, neither of which need not be a zero.

2. More accurate selection and design of resistors R and 2R are possible and simple construction.

3. The binary word length can be easily increased by adding the required number or

R-2R sections.

Source : https://aihteienotes.files.wordpress.com/2014/07/lic-notes.doc