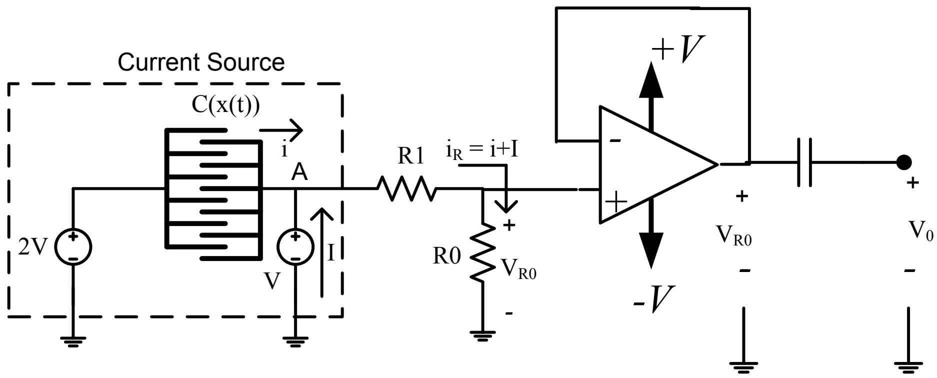

In this design two DC voltage sources are attached to the two sides of the MEMS capacitor. The voltage of the sources is such that the left source is twice the right source. Thus the voltage across the capacitor is ($2V$-V) = V. This is a dc voltage. For this dc voltage a charge Q will gather on each plate of the capacitor.

$$Q = C(x(t))V$$

Since the 2V source is a dc source no current will be passed through the capacitor in the resistors since the capacitor do not allow dc components to pass. So the dc current through the resistors will be due to dc source V.

$$I = \frac{V}{R1 + R0}$$

But due to thermal vibration the capacitor is vibrating with x(t) amplitude. The capacitance is expressed by

$$C(x(t)) = \phi(L_0 + x(t))$$

The charge has two components one is fixed component and another is time varying component due to mechanical energy. Thus

$$Q = \phi(L_0 + x(t))V$$

Current through the capacitor is

$$i = \frac{dQ}{dt} = \phi V \frac{dx(t)}{dt}$$

Thus the current through the resistor is a summation of dc and ac component. $i_R = i + I$. Thus KCL remains valid. Thus the left side is acting as a current source and the voltage of this current source is not fixed but depends on the circuit attached to it.

The voltage across resistance R0 is

$$V_{R0} = (i + I)R0$$

Thus the voltage across R0 has a dc component and an ac component. The Ohm's law still remains valid as we make the mechanical displacement x(t)=constant i.e. i=0.

If we use a buffer to pass this voltage and use another fixed capacitor to eliminate dc component we will get:

$$V_0 = iR0 = \phi VR0 \frac{dx(t)}{dt}$$