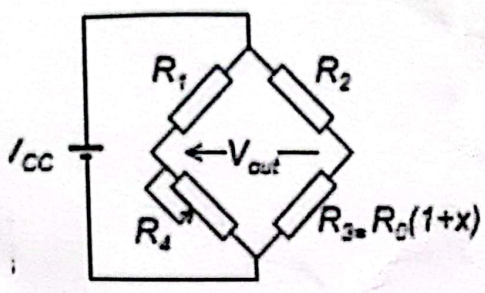


$\Delta R/R$
 $X = \frac{\Delta R}{R} \rightarrow 10$
 $\Delta L/L \rightarrow \text{Starr}$
 $\text{DET AV} = \frac{40 \times D_G}{10} = 4$

$\Delta L/L$

Wheatstone bridge
Null mode

$V_{out} = 0 \Leftrightarrow R_3 = R_4 \frac{R_2}{R_1}$



Deflection mode :

$V_{out} = V_{CC} \left(\frac{R_3}{R_2 + R_3} - \frac{R_4}{R_3 + R_4} \right)$

$V_{PTAT} = \frac{2R_1(V_{BE} - V_N)}{R_2} = 2 \frac{R_1}{R_2} \frac{kT}{q} \ln(N)$

8-bit resolution:

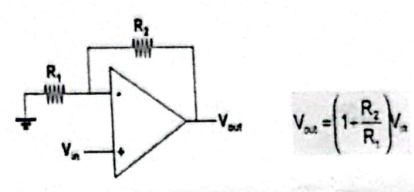
- 100%/255 \Rightarrow 0.39% per step
- 5V/255 \Rightarrow 19.6 mV per step

Arduino default PWM frequency:

- Pins 5/6: ~976 Hz
- Pins 3/9/10/11: ~488 Hz
- Frequency can be increased to as much as 62.5 kHz by altering timer control registers
 - Pins 5/6: TCCR0B
 - Pins 9/10: TCCR1B
 - Pins 3/11: TCCR2B

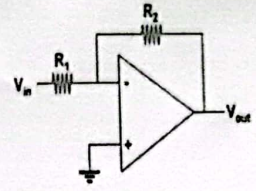
-20

$+25$
 $+15$
 $+10$
 $+5$
 $+10$
 Minimi 60
 Maximi 472



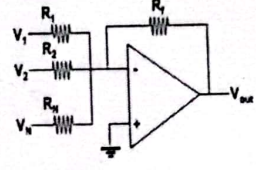
$V_{out} = \left(1 + \frac{R_2}{R_1} \right) V_{in}$

■ Inverting amplifier



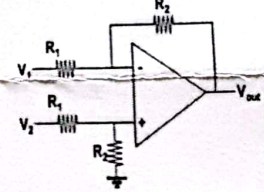
$V_{out} = -\frac{R_2}{R_1} V_{in}$

■ Summing amplifier



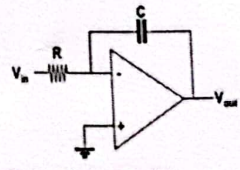
$V_{out} = - \left(V_1 \frac{R_f}{R_1} + V_2 \frac{R_f}{R_2} + \dots + V_n \frac{R_f}{R_n} \right)$

■ Differential amplifier



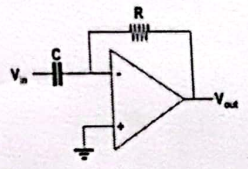
$V_{out} = \frac{R_2}{R_1} (V_2 - V_1)$

■ Integrating amplifier



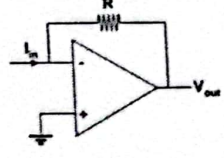
$V_{out} = -\frac{1}{j\omega CR} V_{in} = -\frac{1}{RC} \int V_{in} dt$

■ Differentiating amplifier



$V_{out} = -\frac{R}{1/j\omega C} V_{in} = -RC \frac{dV_{in}}{dt}$

■ Current-to-voltage



$V_{out} = -I_{in} R$