

Date: 19/5/21

Experiment no. 7

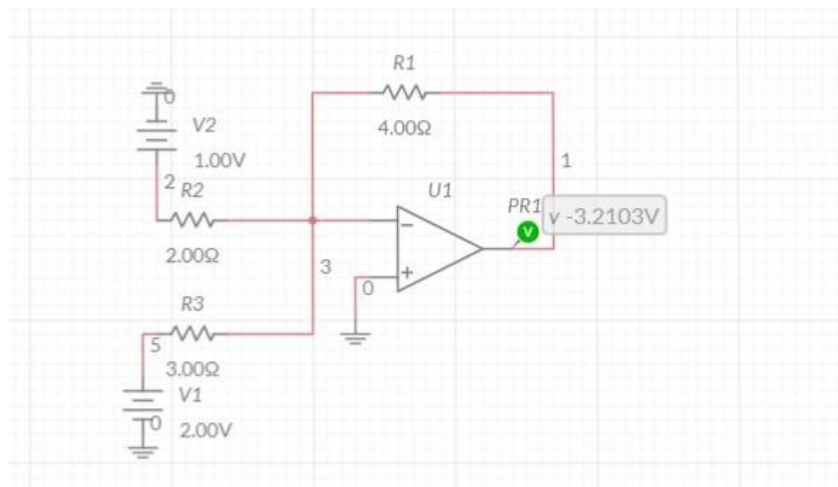
Objective: Design analysis of adder and subtractor using operational amplifier

Software used: Multisim Live

Theory: An adder is digital logic circuit in electronics that implements addition of numbers. A subtractor is digital logic circuit in electronics that implements subtraction of numbers

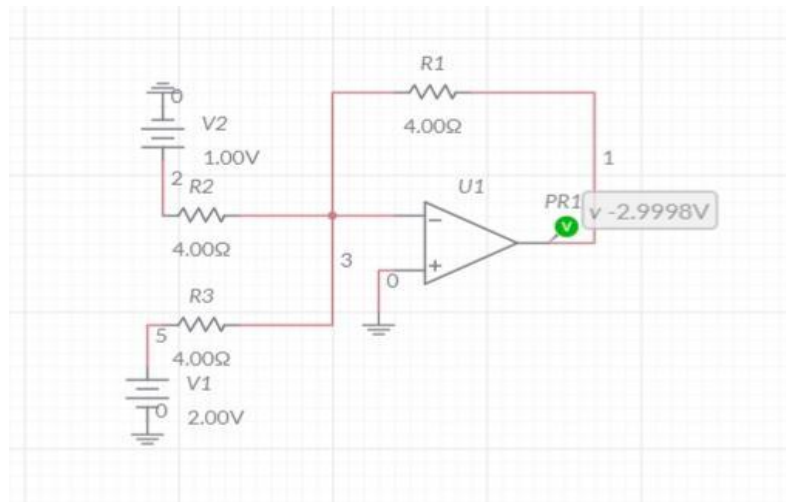
Circuit diagram and observations:

1. Adder circuit



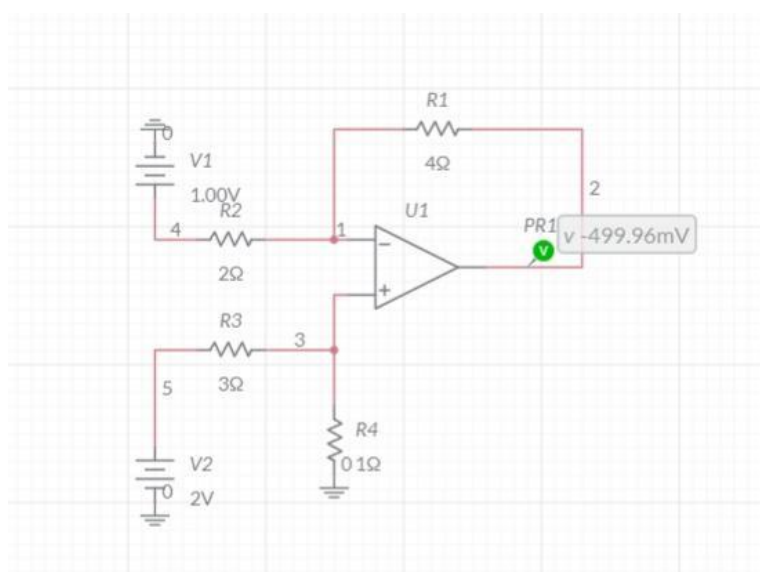
$$\begin{aligned}V_0 &= -R_1 \left(\frac{V_2}{R_2} + \frac{V_1}{R_3} \right) \\&= -(4) \left(\frac{1}{2} + \frac{2}{3} \right) \\&= -(4) \left(\frac{3+4}{6} \right) \\&= -(4) \left(\frac{7}{6} \right) \\&= -\frac{14}{3} \approx -4.67\end{aligned}$$

If $R_1=R_2=R_3=R=4$ then



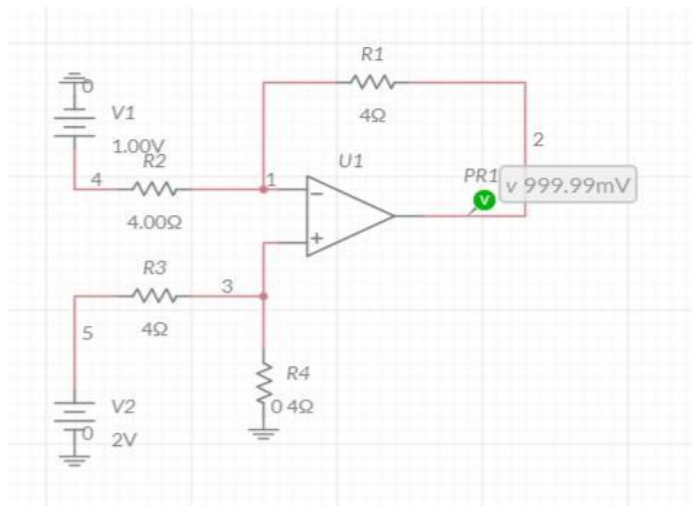
$$\begin{aligned}
 V_0 &= -R \left(\frac{V_2}{R} + \frac{V_1}{R} \right) \\
 &= -(V_2 + V_1) \\
 &= -(1 + 2) \\
 &= -3V
 \end{aligned}$$

2.Subtractor circuit



$$\begin{aligned}
 V_0 &= V_2 \left(\frac{R_4}{R_3 + R_4} \right) \left(1 + \frac{R_1}{R_2} \right) - \left(\frac{R_1}{R_2} \right) V_1 \\
 &= 2 \left(\frac{1}{3+1} \right) \left(1 + \frac{4}{2} \right) - \left(\frac{4}{2} \right) (1) \\
 &= \frac{1}{2} \left(\frac{6}{2} \right) - \frac{4}{2} \\
 &= \frac{6}{2} - \frac{4}{2} \\
 &= \frac{6-4}{2} \\
 &= \frac{2}{2} = 1 = -0.5V
 \end{aligned}$$

If $R_1=R_2=R_3=R_4=R=4$ then



$$\begin{aligned}
 V_0 &= V_2 \left(\frac{R}{2R} \right) \left(1 + \frac{R}{R} \right) - \left(\frac{R}{R} \right) V_1 \\
 &= V_2 \left(\frac{1}{2} \right) (2) - V_1 \\
 &= V_2 - V_1 \\
 &= 2 - 1 \\
 &= 1
 \end{aligned}$$

Result: Above circuit Diagrams and observations will explain design analysis of adder and subtractor using operational amplifier