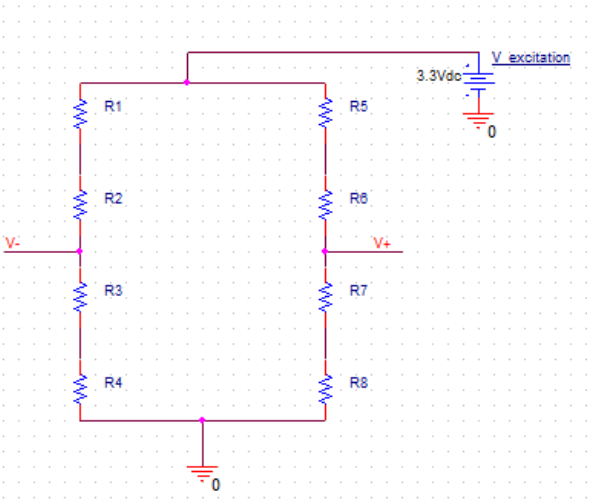
Wheatstone Bridge Circuit



- Wheatstone bridge circuit is how the strain gauges will be arranged electrically.
- There will be 3 of these circuits in the final deliverable, accommodating 24 strain gauges.
- The input to this circuit is force, the output is a small voltage.
- This differential voltage is outputted to an amplifying circuit and then from there to a microcontroller.
- An excitation voltage is provided to this circuit, which is supplied from the batteries, 3.3V in this case.
- We will need to consider the length of the lead wires going to the strain gauges because they are additional resistance.

- Strain gauges are essentially resistors that change resistance based on the strain they see.
- Therefore, the differential voltage can be expressed by using voltage division:

$$V^+ - V^- = V_{EX}\{\frac{R7 + R8}{R5 + R6 + R7 + R8} - \frac{R3 + R4}{R1 + R2 + R3 + R4}\}$$

- When there is no force being seen by the sensors, all resistance values are equal, making zero voltage output.
- When force is being seen by the sensors, some of the resistance values change, making the bridge unbalanced.
- The maximum differential output of the bridge can be expressed as $|V_{OS}| = V_{EX} * \frac{TOL}{100}$ where TOL is the tolerance of the strain gauge in % and V_{EX} is the excitation voltage.

Circuit Design Details

Strain Gauge Part Number	RPT-125CY-350-1
Nominal Resistance	350 ohms
Tolerance	1%
V_{EX}	3.3 V

- Based on the circuit design details, the maximum output of this circuit is 33mV.