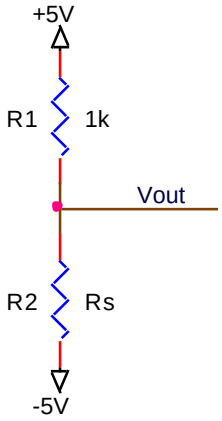
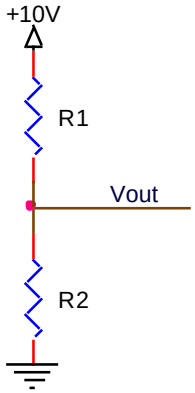
Homework Assignment #4 **ELEC 5760/6760** **Due: Wednesday 9/21/22**

1) An unbuffered resistive sensor, Rs, is in the circuit shown below, where 500 Ω ≤ Rs ≤ 1.5 kΩ. What is Vout for the minimum, mid range and maximum resistance values of the sensor?



2) For the differential resistance sensor shown below, where R1 = 1 kΩ + ΔR, R2 = 1 kΩ - ΔR, and 0 Ω ≤ ΔR ≤ 100 Ω, calculate the minimum and maximum Vout.

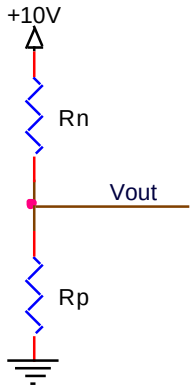


3) A rectangular resistive temperature sensor (5 mm long, 50 µm wide and 1 µm thick), where current flows through the length of the sensor, is made of a material with a resistivity of $5x10^{-6}$ Ω-cm at 0°C, and a TCR of $5x10^{-3}$ $(°C)^{-1}$. What is the approximate resistance at 0°C and 100°C?

4) A certain metal strain gauge has a nominal resistance of 10 kΩ and a gauge factor of 1.8. If it experiences a 1% axial strain, what does the resistance become?

5) If the strain gauge in (4) experiences a -1% axial strain, what does the resistance become?

6) A polysilicon differential piezoresistive sensor is connected to a 10 V source as shown below, where Rn is a N-type piezoresistor and Rp is a P-type piezoresistor. With no strain on the piezoresistors, Rn = Rp = 1 kΩ. Calculate Vout for no strain. If Rn has a GF of -30 and Rp has a GF of +30, and both piezoresistors experience a 0.2% axial strain, calculate Vout.



7) If four piezoresistors from problem (6) are connected in a Wheatstone bridge configuration, as shown below, calculate Vout = V2 –V1 for all resistors experiencing a 0.1% axial strain.