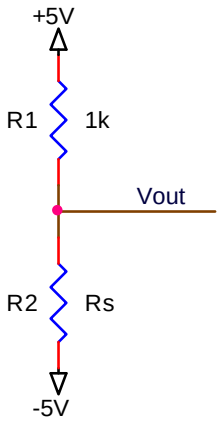
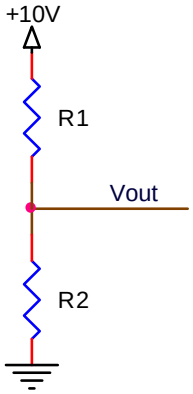
Homework Assignment #4 **ELEC 5760/6760** **Due: Friday 2/15/13**

1) An unbuffered resistive sensor, Rs, is in the circuit shown below, where $500\Omega \le Rs \le 1.5k\Omega$. What is Vout for the minimum, mid range and maximum resistance values of the sensor?



2) For the differential resistance sensor shown below, where $R1 = 1k\Omega + \Delta R$, $R2 = 1k\Omega - \Delta R$, and $0\Omega \le \Delta R \le 100\Omega$, calculate the minimum and maximum Vout.

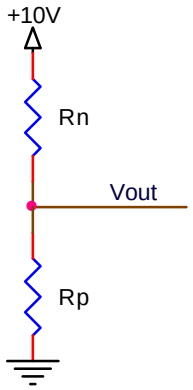


3) A rectangular resistive temperature sensor (5mm long, 50µm wide and 1µm thick), where current flows through the length of the sensor, is made of a material with a resistivity of $5x10^{-6}$ Ω-cm at 0^oC, and a TCR of $5x10^{-3}$ $(^oC)^{-1}$. What is the approximate resistance at 0^oC and 100^oC?

4) A certain metal strain gauge has a nominal resistance of 10kΩ 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 10V 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 = 1kΩ. 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 Wheatsone bridge configuration, as shown below, calculate Vout = V2 –V1 for all resistors experiencing a 0.1% axial strain.