Complete Sensor Bridge Interface
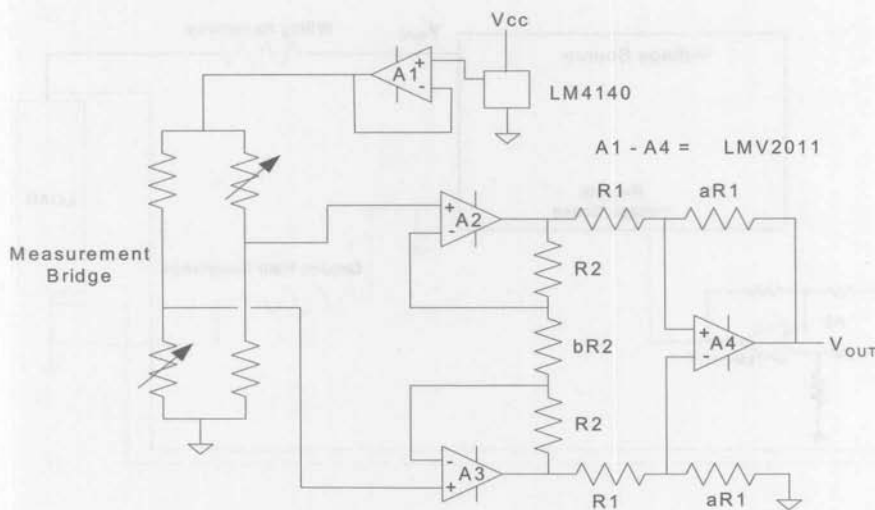
National Semiconductor

Bridge based transducers are used in a variety of measurement instruments. The signal level from Bridges are typically low level ranging from several hundred microvolts to a few millivolts. The excitation voltage must be stable since changes in the excitation voltage can be interpreted as a bridge measurement signal. The circuit shown here address both of these issues.

The bridge excitation voltage uses a LM4140 voltage reference that has a 0.1% accuracy, and more importantly, a drift specification down to 3 PPM per degree C. This reference, in conjunction with the chopper stabilized buffer, A1, provides an ultra stable excitation voltage for the Bridge.

There are four key parameters for good performance of the bridge amplifier:

The output signal from the sensor bridge is combined with a common mode voltage. In many types of instruments the common mode voltage is about half the excitation voltage with the measurement signal as a small difference voltage between the legs of the bridge. These requires a high common mode rejection ratio (CMRR) to minimize the error introduced by the common mode voltage.

The input offset voltage and input offset voltage drift must be small compared to the differential signals from the bridge.

The input bias currents of the amplifiers must be small compared to the current flowing in each leg of the bridge.

Amplifiers A2, A3, and A4 are used to construct an instrumentation amplifier to meet the requirements listed above. The total gain for this configuration is $A_V = (1 + 2R_2/bR_2)(aR_1/R_1)$