METHODS OF CORRECTION FOR INTERFERING AND MODIFYING INPUTS

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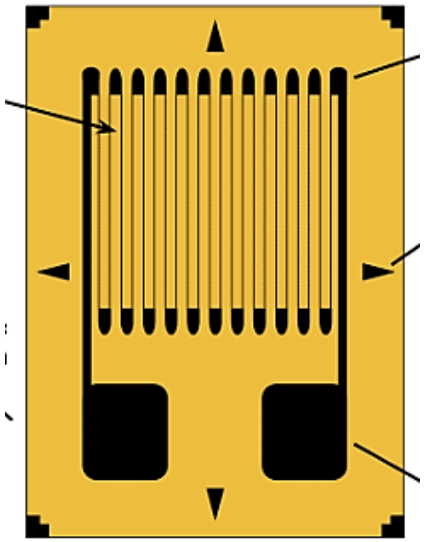
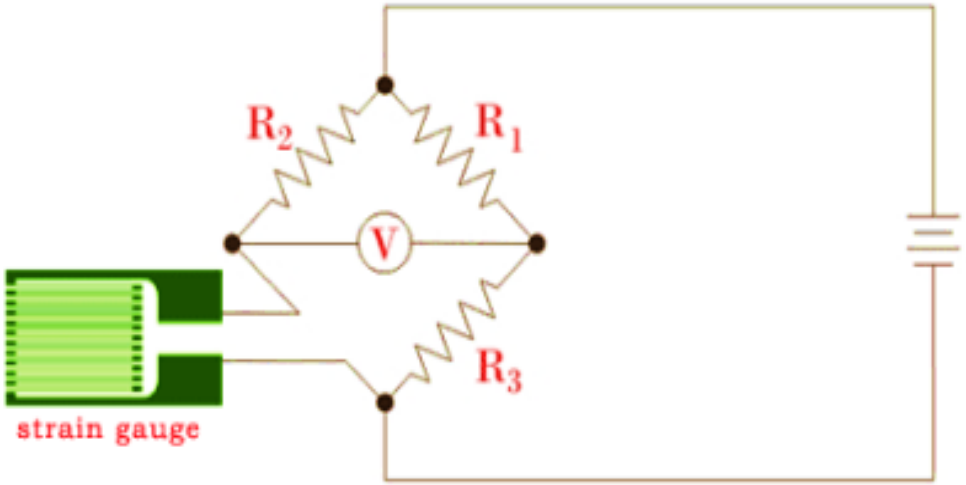
METHODS OF CORRECTION FOR INTERFERING AND MODIFYING INPUTS

1. ***Method of inherent insensitivity:*** The elements of the instrument should be inherently be sensitive only to the desired inputs.

Example: A gage material that exhibits an extremely low temperature coefficient of resistance while retaining its sensitivity to strain.





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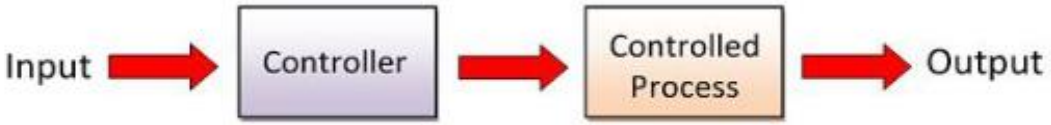
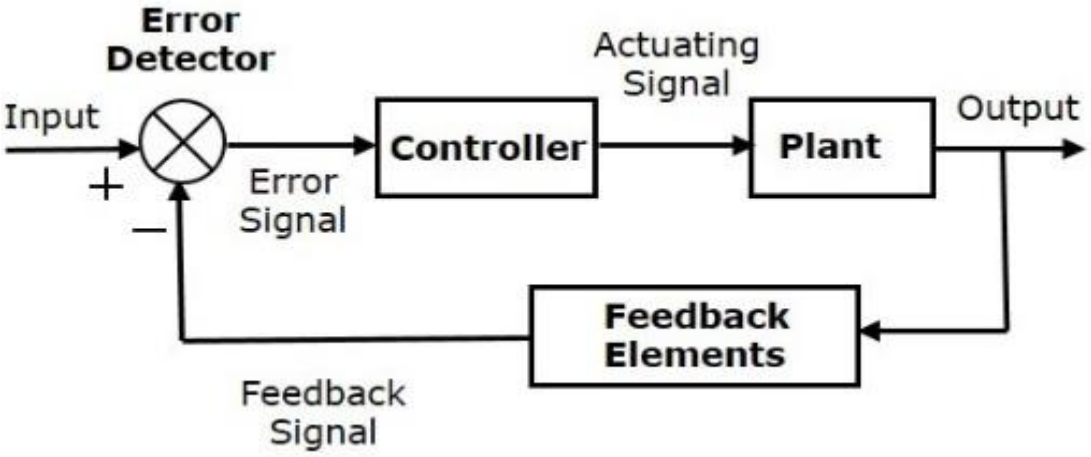
2. *The method of high gain feedback*



Open Loop System



Closed Loop System

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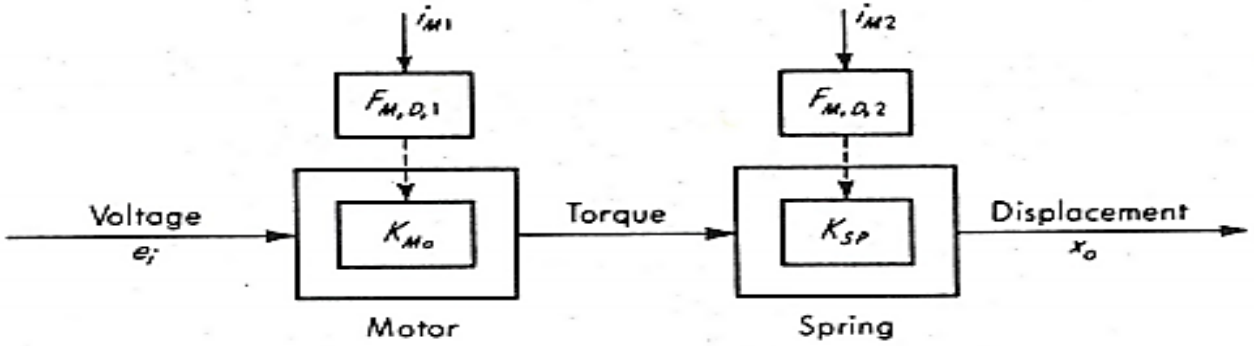

(a) Open-loop system

Suppose we wish to measure a voltage e_i by applying it to a motor whose torque is applied to a spring, causing a displacement x_o, which may be measured on a calibrated scale. For this properly designed open-loop system:

$$x_o = (K_{Mo} K_{SP}) e_i$$

If modifying inputs i_{M1} and i_{M2} exist, they can cause changes in K_{Mo} and K_{SP} that lead to errors in the relation between e_i and x_o. These errors are in direct proportion to the changes in K_{Mo} and K_{SP}.

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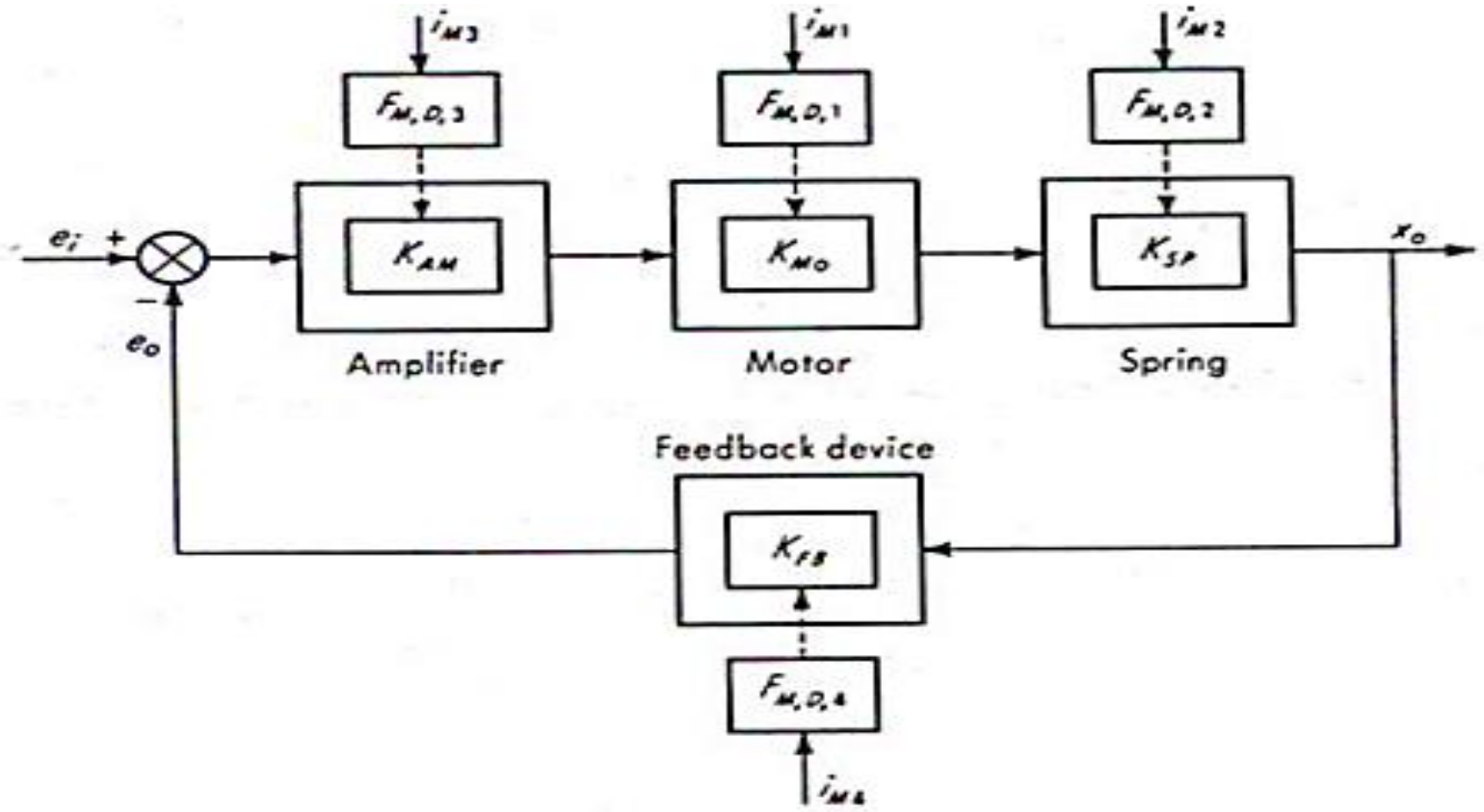

(6) Closed-loop or feedback system

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Consider a closed-loop system. Here x_o is measured by a feedback device which produces a voltage e_o proportional to x_o. This voltage is subtracted from the input voltage e_i, and the difference is applied to an amplifier which drives the motor and thereby the spring to produce x_o:

$$x_o = \frac{K_{AM}K_{Mo}K_{SP}}{1+K_{AM}K_{Mo}K_{SP}K_{FB}}e_i$$

Suppose we design K_{AM} to be very large (a "high-gain" system) so that $K_{AM}K_{Mo}K_{SP}K_{FB} >> 1$. Then $x_o \approx \frac{1}{K_{FB}}e_i$

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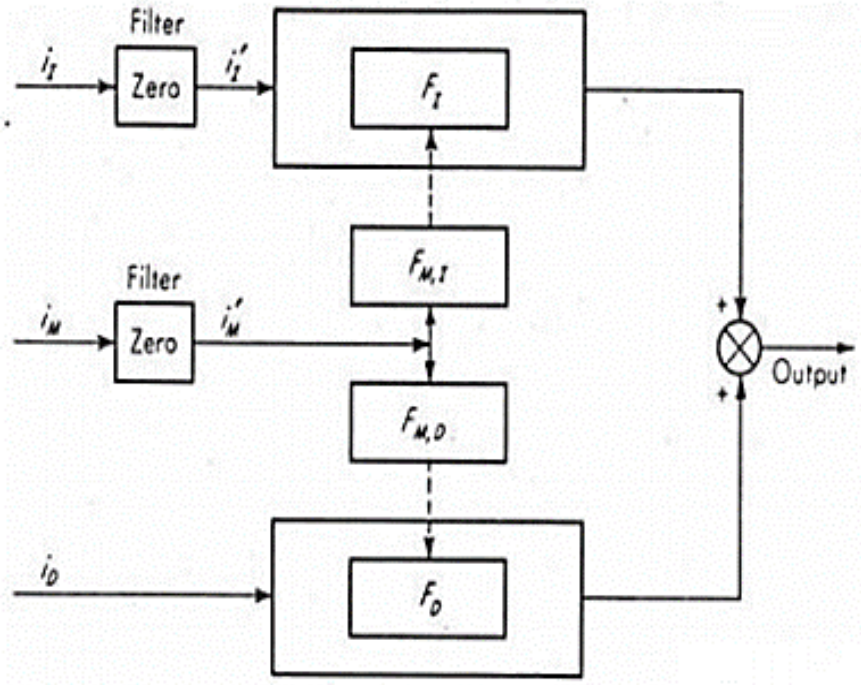
3. ***Method of calculated output corrections***

The method of calculated output corrections requires one to measure or estimate the magnitudes of the interfering or modifying inputs and to know quantitatively how they affect the output. With this information it is possible to calculate corrections which may be added to or subtracted from the indicated output so as to leave only that component associated with the desired input.

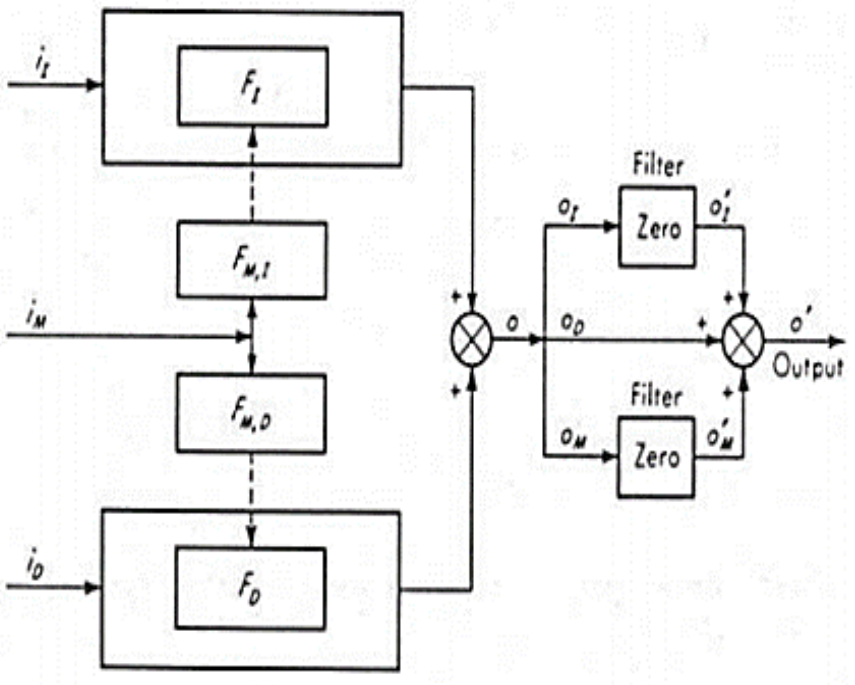
CONTINUED

4. Method of signal filtering (Input & Output)

This method is based on the possibility of introducing certain elements (“filters”) into the instrument which in some fashion block the spurious signals, so that their effects on the output are removed or reduced. The filter may be applied to any suitable signal in the instrument, be it input, output, or intermediate signal.

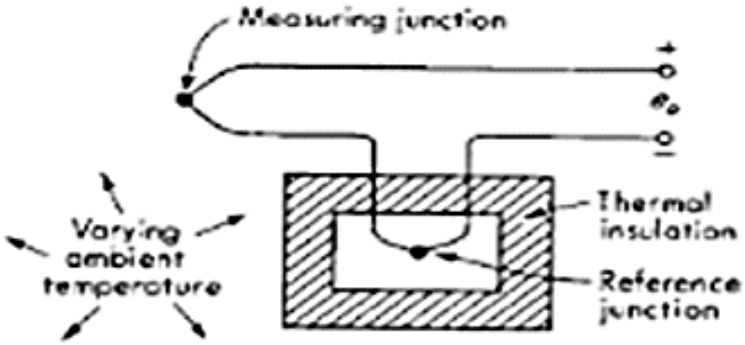


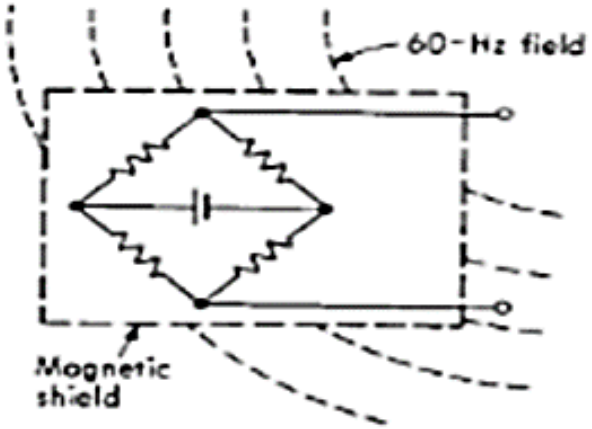
Input Filtering

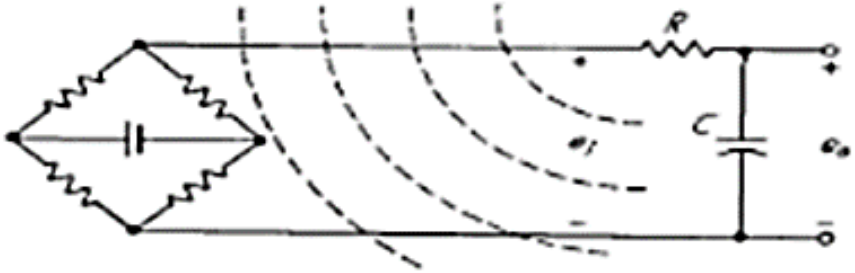


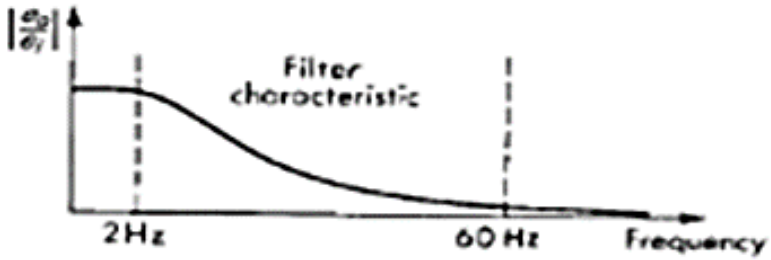
Output Filtering

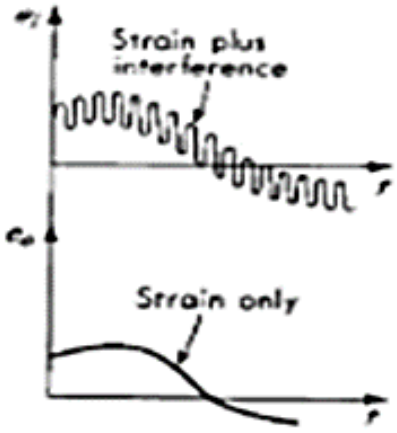
EXAMPLES OF FILTERING





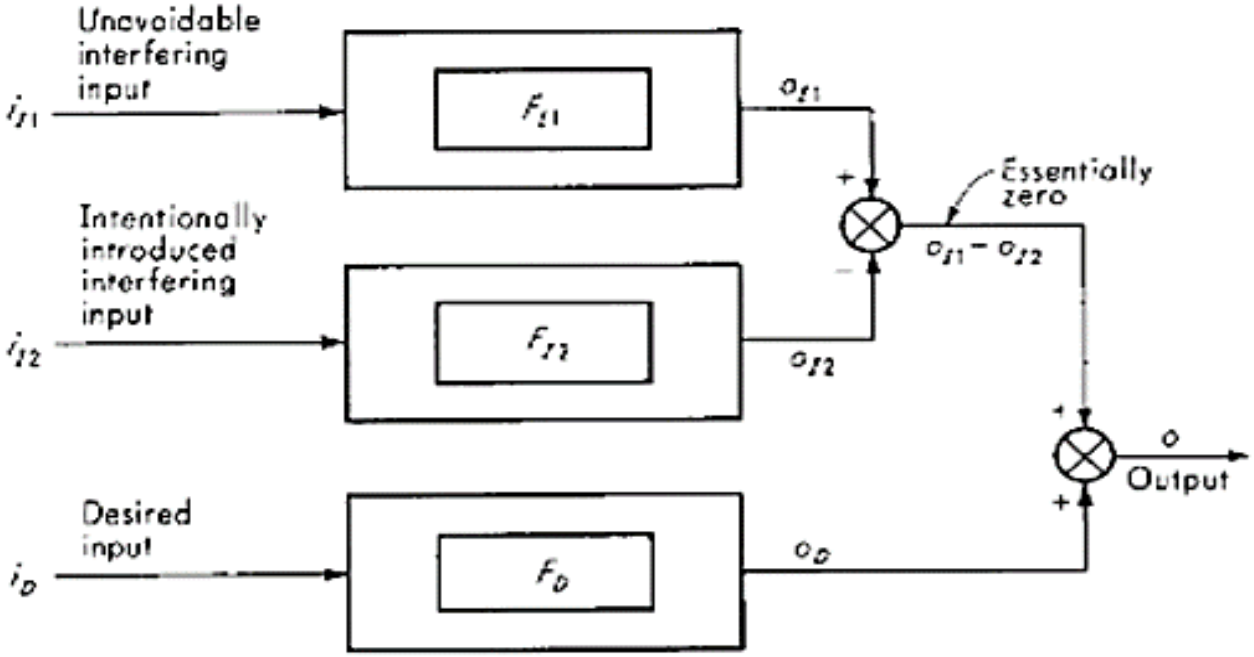






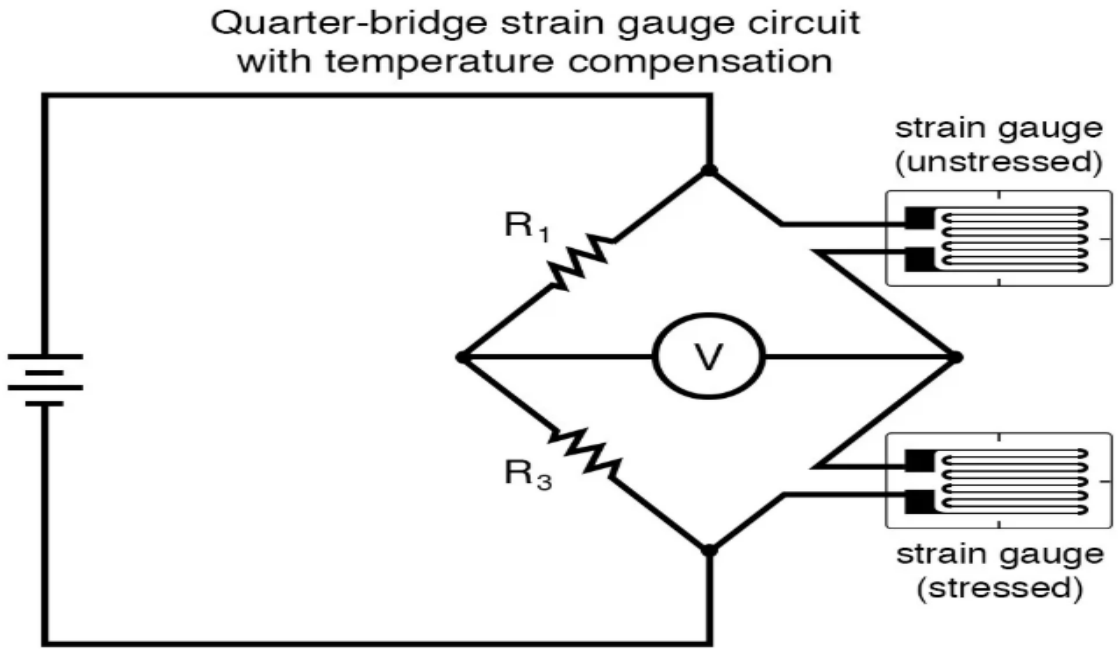
Method of opposing inputs

- Intentionally introducing into the instrument interfering and/or modifying inputs that ten to cancel the bad effects of unavoidable spurious inputs.



Example of method of opposing inputs

An unfortunate characteristic of strain gauges is that of resistance change with changes in temperature. If all we want to do is measure strain, this is not good. We can rectify this problem, by using a "dummy" strain gauge in place of R_2, so that *both* elements of the rheostat arm will change resistance in the same proportion when temperature changes, thus canceling the effects of temperature change:



THANK YOU