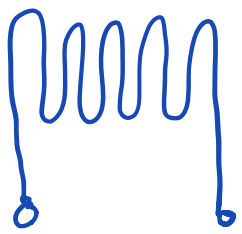
ELL301 (03)

13.01.2019



Why so many "turns" in strain gauge?

As $\frac{\Delta L}{L}$ is independent of the net length.

→ better estimate of $\frac{\Delta L}{L}$ as L is larger ...

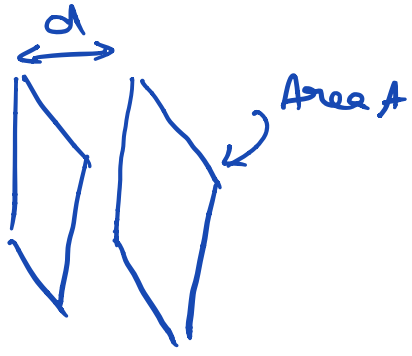
Some other sensors / transducers of Length (Angle)

↑ linear displacement

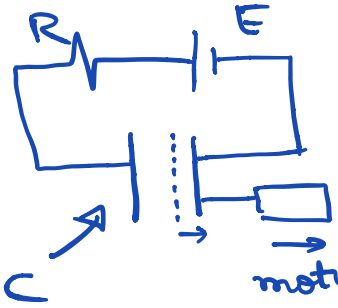
↑ rotational displacement

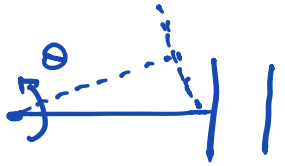
- Capacitive - based

$$C \propto \frac{A}{d}$$



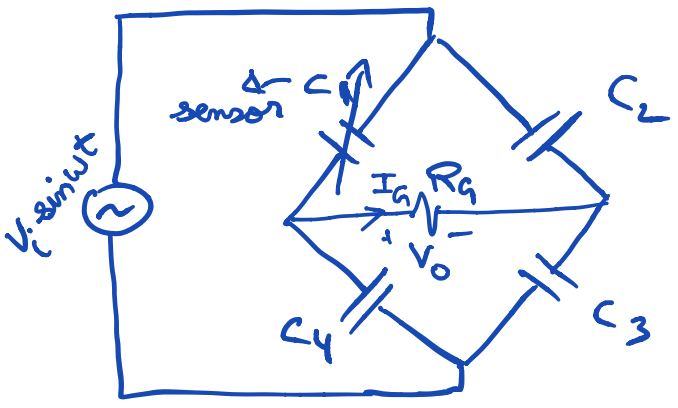
If motion is coupled to one of the plates, then capacitance changes with the motion.





effective area changes

⇒ capacitance changes



This is how capacitance sensor is interfaced to other instrumentation. Initially, bridge is balanced, change in capacitance causes the current I_G to flow

How is V_o related to $V_i, \omega, C_1, C_2, C_3, C_4, R_G$??

Replace $R \leftrightarrow \frac{1}{j\omega C}$ in previous expression

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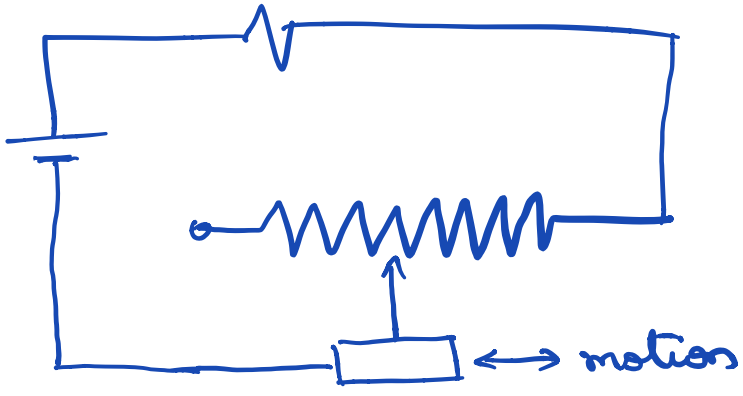
- Resistance-based



As motion happens, the amount of net resistance in the circuit changes, and the change in resistance gives estimate of the distance

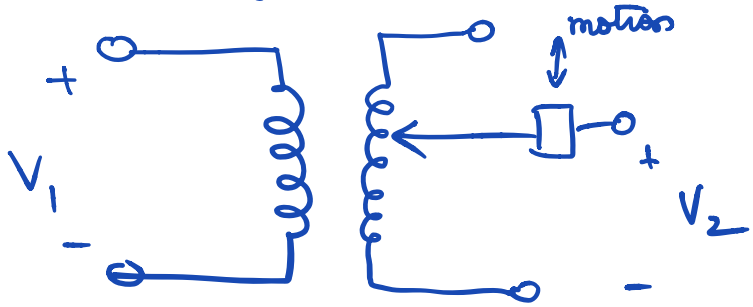
Typical arrangement is in a Wheatstone Bridge.

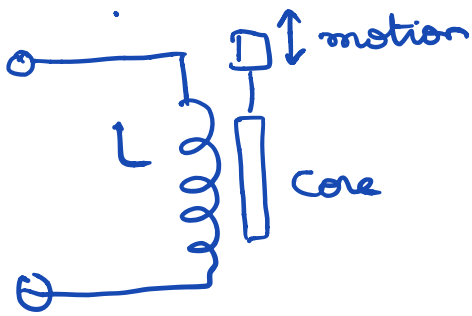
Inductive-Based sensors for length?

- change number of turns
- distance of core

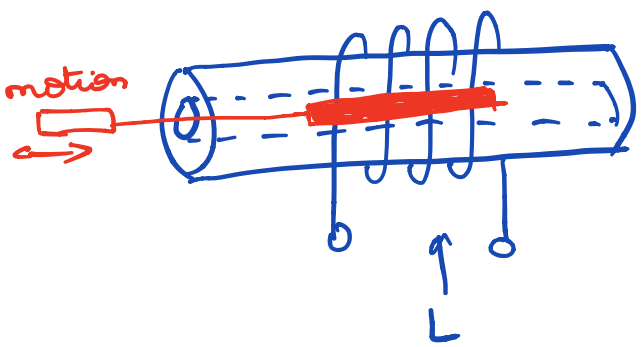
- length of core inserted in the coil)

Number of turns



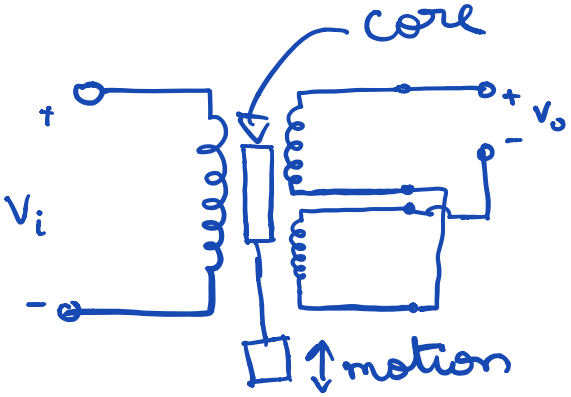


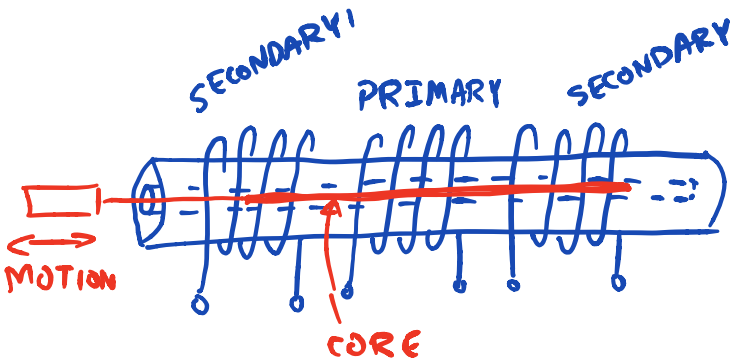
motion causes the extent of core inside the coil to change.
⇒ this changes the inductance.



LVDT

Linear Variable Differential Transformer Transducer





Core provides magnetic coupling between the primary and the two secondaries.

If the core is symmetrically placed, then, no net difference in the induced voltages on the secondary.

But, if the core is shifted towards one secondary, then that secondary coil develops a larger voltage, which can be used to estimate the amount by which the core moved.