# EIPC
# NEE-403
# Unit-1
# TRANSDUCERS

# VARIABLE-INDUCTANCE TRANSDUCERS

- An inductive electromechanical transducer is a transducer which converts the physical motion into the change in inductance.

- Inductive transducers are mainly used for displacement measurement.

- The inductive transducers are of the self generating or the passive type. The self generating inductive transducers use the basic generator principle i.e. the motion between a conductor and magnetic field induces a voltage in the conductor.
- The variable inductance transducers work on the following principles.
- Variation in self inductance
- Variation in mutual inductance

# PRINCIPLE OF VARIATION OF SELF INDUCTANCE

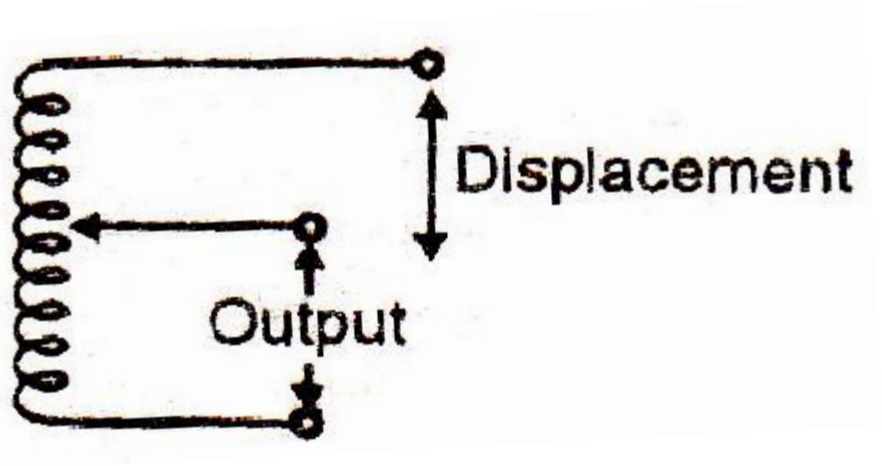
- Let us consider an inductive transducer having N turns and reluctance R. when current I is passed through the transducer, the flux produced is
- $\Phi = Ni / R$
- Differentiating w.r.t. to t,
- $d\Phi/dt = N/R * di/dt$
- The e.m.f. induced in a coil is given by
- $e = N * d\Phi/dt$

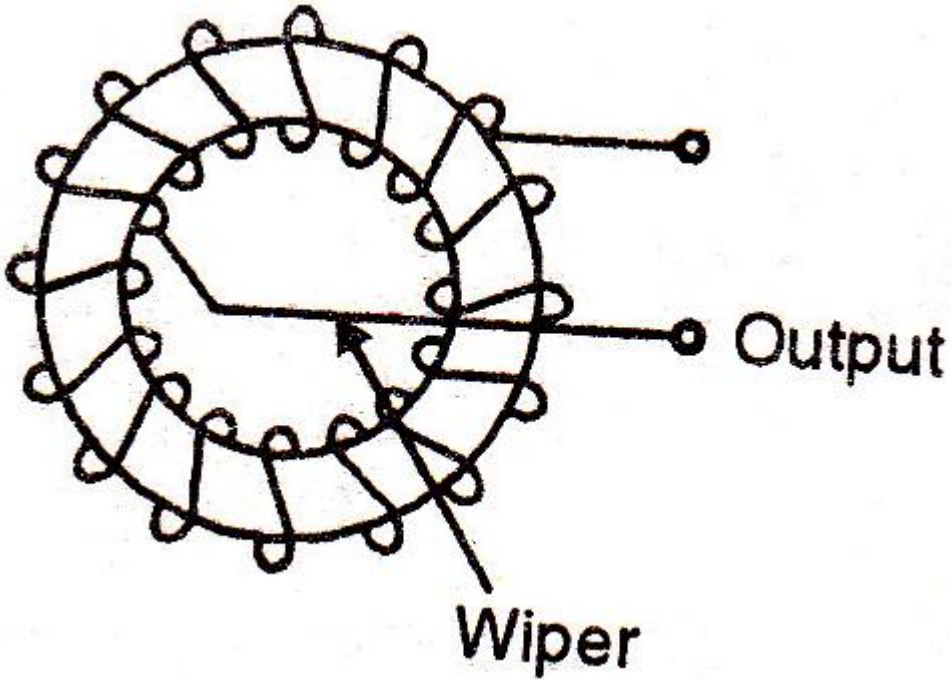
- $e = N * N/R * di/dt$
- $e = N^2 / R * di/dt$
- Self inductance is given by
- $L = e/di/dt = N^2 / R$
- The reluctance of the magnetic circuit is $R = l/\mu A$
- Therefore $L = N^2 / l/\mu A = N^2 \mu A / l$
- From eqn we can see that the self inductance may vary due to

i. Change in number of turns N
ii. Change in geometric configuration
iii. Change in permeability of magnetic circuit

# CHANGE IN SELF INDUCTANCE WITH CHANGE IN NUMBER OF TURNS N

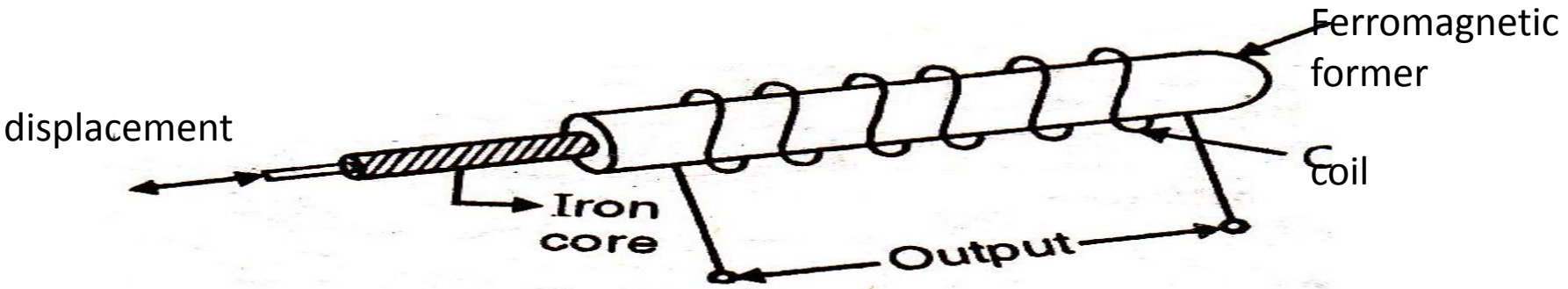
- From eqn we can see the output may vary with the variation in the number of turns. As inductive transducers are mainly used for displacement measurement, with change in number of turns the self inductance of the coil changes in-turn changing the displacement
- Fig shows transducers used for linear and angular displacement fig a shows an air cored transducer for the measurement of linear displacement and fig b shows an iron cored transducer used for angular displacement measurement.


Displacement
Output


Output
Wiper

# CHANGE IN SELF INDUCTANCE WITH CHANGE IN PERMEABILITY

- An inductive transducer that works on the principle of change in self inductance of coil due to change in the permeability is shown in fig
- As shown in fig the iron core is surrounded by a winding. If the iron core is inside the winding then the permeability increases otherwise permeability decreases. This cause the self inductance of the coil to increase or decrease depending on the permeability.
- The displacement can be measured using this transducer



# Thank You