→ LVDT -

* LVDT → Linear Variable Differential Transformer.

* LVDT is a modified type of plunger sensors.

* LVDT is arranged with two sets of coils, one as the primary and other as a secondary having two coils connected differentially for providing the output.

* the coupling between primary and secondary coil varies with the core moving linearly.

* an alternative voltage supply V_i and frequency is applied across the primary coil and depending on the position of the core with respect to primary and two secondary coils, an output voltage 'V_o' is obtained.

* the induction in secondary coil is given as,

$$\left\{ V_{os} = -n\frac{d\phi}{dt} = -M\frac{di_p}{dt} \right\} \quad -\ (1)$$

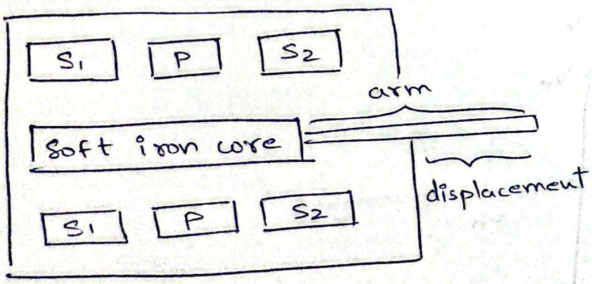
n → no. of turns in secondary coil

ϕ → magnetic flux

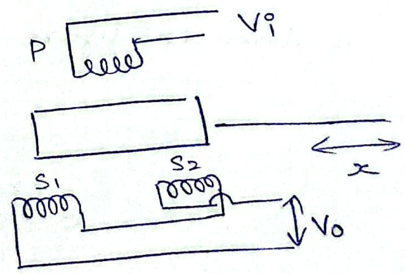
M → mutual inductance

i_p → primary current

Cross Section of LVDT



Model - LVDT



* for the two coils differentially connected,

$$\left\{ V_o = V_{os1} - V_{os2} = (M_1 - M_2)\frac{di_p}{dt} \right\} \quad -\ (2)$$

* Both M_1 and M_2 being functions of x

$$\{ M_1 - M_2 = M(x) \}$$

* if the function is linear over a certain range;

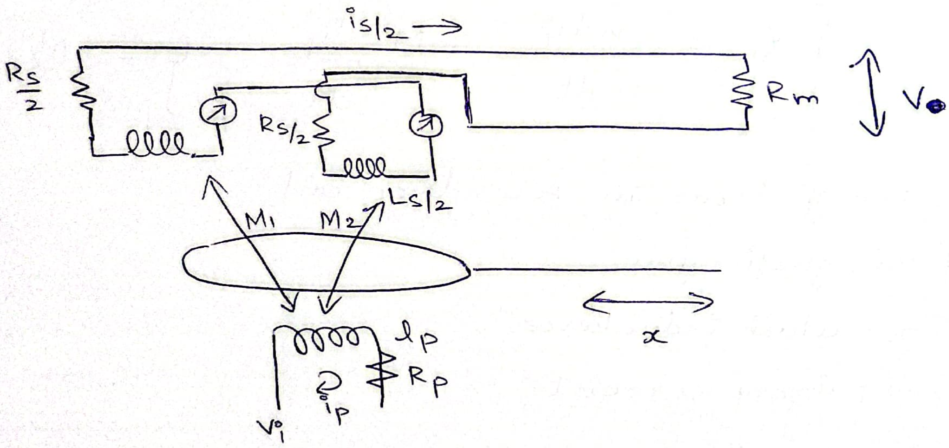
$M(x) = kx$, such that,

$$\left\{ x = \frac{V_o}{k\left(\frac{di_p}{dt}\right)} \right\} \quad \text{— (3)}$$

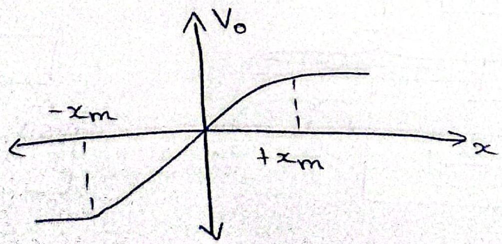
* loss components are to be considered for obtaining output, V_o, per unit displacement of the core.

* when arranged in a differential manner, loss components be compensated by appropriate circuit components.

* The equivalence circuit of LVDT is -



* The phase rectified secondary o/p voltage V_o with x is shown in figure below,



* three cases based on position of core - (1) Max Left
(2) Null
(3) Max Right

(1) $\Rightarrow E_{OUT} = E_1 - E_2$

(2) $\Rightarrow E_{OUT} = 0$

(3) $\Rightarrow E_{OUT} = E_2 - E_1$