Transitory Phase of Translatory Machines

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Abstract: **- Recent years Translatory motors plays a prominent role in wide range of Applications. Translatory motors need not require any gear equipment to generate linear motion. Linear Induction Motors belongs to the family of Translatory Motors. On the phase of analysis of Translatory motors, this paper deals with transitory phase of Linear Motors, during Initial stage of starting associated with small practical model. This research paper comprises the construction of Linear Motors and their behavior during starting stage.**

Key Words: Linear Induction Motor- (LIM)

1. INTRODUCTION

At present Translatory motors plays a prominent role in the Industrial sector. Especially LIMS plays an active role. Applications like Automobiles, Metallurgy and Robotic Drives were purely based on the LIMS. However, its structure belongs to the family of Induction Motor. Due to this reason there is similarity in the construction of LIMS. Construction phase of LIMS was very flexible and Cost effective. Construction phase involves two parts, named as primary and secondary. There will be further discussion on the practical model.

2. CONSTRUCTION PHASE OF TRANSLATORY MACHINE

Translatory machines comprises of two components named as Primary and Secondary. Construction phase details can be discussed further.

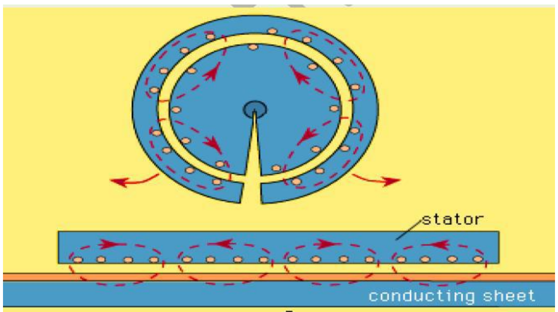

Fig: Translatory Motor

2.1 Primary of Translatory Machines

Primary of the Translatory machines were built by CRNO (Cold Rolled Non-Oriented steel) foils, which were existed in laminated to minimize the Eddy current losses. The Laminated core was separated by Varnish Film and encapsulated to improve the thermal stability. The primary will act as a house for three phase windings. This three phase windings are responsible for the three phase Translatory flux of having relative speed.

Fig: Primary of Translatory Motor

2.2 Secondary of Translatory Machines

Secondary of Translatory motors was constructed by two Sheets which behaving likes Magnetic materials laying one on each other. Upper sheet belongs to the Black Iron Family for the purpose of uniform magnetic Flux. Lower sheet belongs to Aluminum family for the purpose of supporting the Upper sheet. The thickness of the two sheets controls the magnetic flux and the speed of the Translatory machine.

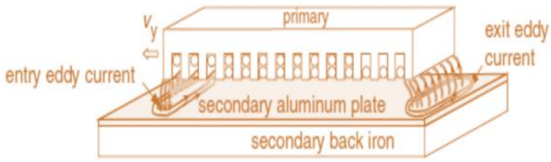

Fig: Secondary of Translatory Motor

2.3 Operation of Translatory Motor

Secondary of Translatory motors was constructed by two Sheets which behaving like Magnetic materials laying one on each other. Upper sheet belongs to the Black Iron Family for the purpose of uniform magnetic Flux. Lower sheet belongs to Zinc family for the purpose of supporting the Upper sheet. The thickness of the two sheets controls the magnetic flux and the speed of the Translatory machine.

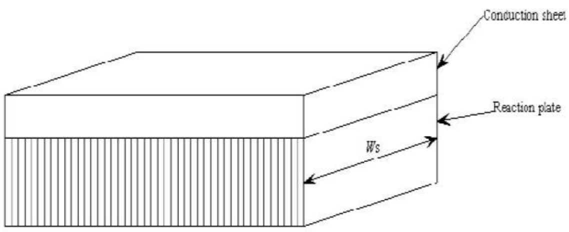

Fig: Translatory Motor

3. CONSTRUCTION OF TRANSLATORY MOTOR

The indicated terminology is listed as below

Q=Input power,

Z_s=total no. of stator conductor,
m=no. of phases,
Z_{ss}= stator conductor per slot,
Z_{ph}=no. of conductor per phase,
E_{ph}=per phase voltage,
V_s=Synchronous Speed,
I_{ph}=per phase current,
q=no. of slot/pole/phase,
f=frequency,
P=Pole,
Φ=flux,
η=efficiency,
T_{ph}=turns per phase,
$\cos\phi$ = power factor,
Y_{ss}=stator pitch,
K_w=Winding Factor,
ac =specific electric loading,
B_{av}=specific magnetic loading,
D =Diameter of stator (π D=length),
L =length (width in our case),

A= Area of the core in m^2

Taking η=0.72, cos ϕ =0.75 and V_s= 5m/sec and Rating of motor is 1 H.P

Slots= $m*p*q$
=3*4*1
=12 slots

Pole pitch $\tau = \frac{V_s}{2*f}$ = 5cm.

$\phi = B*A = 0.53 Webers/m^2 * 22.5*5*10^{-4} m^2 = 6*10^{-3} webers$

$$T_{ph} = \frac{E_{ph}}{4.44*\phi*f*K_w}$$

$$= \frac{173.2}{4.44*6*10^{-3}*50}$$

= 130 Turns

Z_s = 3*2*T_p = **780 Conductors**

Area of Conductor = $\frac{\pi D^2}{4} = \frac{\pi * 0.729^2}{4}$ = **0.417mm²**

Total Length of Copper = 780*30cm = **23,400 cm = 234meters**

3.1 Slot Dimensions

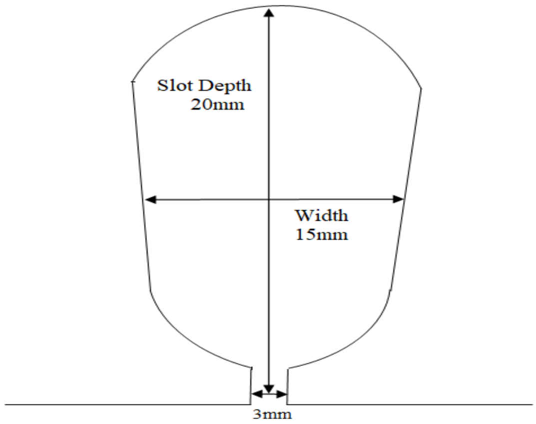

Fig: Slot Dimensions

Area of the slot = 0.5*15*20 = **150mm²**

Weight of the Copper = length of copper*area of cross section of copper*specific gravity

= 234*0.417*8920*10^ (-6) = **0.87 kg**

3.2. Motor in Motion

In this section there is a detailed study of outer structure of motor and wheels.

3.2.1. Chassis Design

Chassis design refers to outer structure. The outer structure of Translatory motor is purely based on the application of the Machine

Specifications

Length=15 cm

Width = 10 cm

Height= 15.24cm

The chassis of the Translatory Motor along with primary is shown in figure

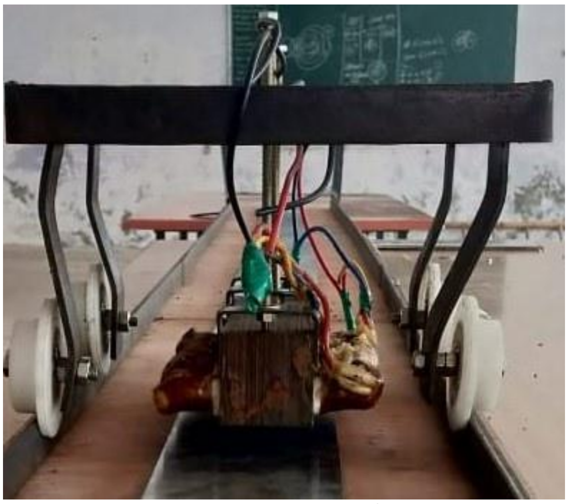

Fig: Outer cage of SLIM

3.2.2. Wheel Design

Wheels are used to move the cage on the track.

Specifications

Outer diameter = 7cm
Inner diameter = 10cm
Bearing diameter = 1.27cm

Fig: Wheel Design

3.2.3. Aluminium and Iron Sheets

Aluminium and iron sheets are used as secondary for the motor and the dimensions of the sheets are as follows

Specifications

Iron

Thickness = 0.5cm
Width = 10cm

Aluminium

Thickness = 0.2cm

Width = 10cm

The track of Translatory Motor is shown in figure 4.5

Fig: Track for Translatory Motor

3.2.4. Whole View of SLIM

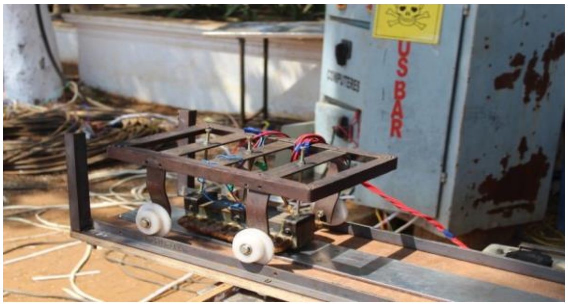

Fig: Whole View of Translatory Motor

5. CONCLUSION

Hence transitory phase characteristics of Translatory motion have been drawn on the base of proto type model. The characteristics can be drawn with the help of speed and Position sensors. In further research various controlling techniques were designed for the control of Translatory Motors.

REFERENCES

[1] Kawakami, T., "Electrical features of the New Tokaido Line," *IEEE Spectrum*, vol. 3, pp 57-63, Jan. 1966.

[2] Aboudara, D.N., et al., "Tomorrow's mass rapid transit available today," *IEEE Spectrum*, vol. 4, pp. 61-70, Jan.1967.

[3] Adamiak, K.; Ananthasivam, K.; Dawson, G.E.; Eastham, A.R.; Gieras,J.F. *"The causes and consequences of phase unbalance in single-sided linear induction motors", IEEE Transactions on* , Volume: 24 , Issue: 6 , Pages:3223 – 3233, Nov 1988.

[4] Zhang, Z.;Eastham, T.R.; Dawson, G.E "*LIM dynamic performance assessment from parameter identification*" , *Industry Applications Society Annual Meeting*, IEEE Conference, vol.1, Pages:295 – 300, 2-8 Oct. 1993.

[5] Laithwaite, E.R.;Electric, "*Adapting a linear induction motor for the acceleration of large masses to high velocities*", Power Applications, IEE Proceedings-, Volume: 142 , Issue,Pages:262 – 268, 4 , July 1995.