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Design & Fabrication of LIM for Maglev Train

Ankit A. Zade¹, Visharad D. Chikate²

Assistant Professor, Department of Electrical Engineering, Jagadambha College of Engineering & Technology,
Yavatmal, Maharashtra, India¹

Assistant Professor, Department of Electrical Engineering, Jagadambha College of Engineering & Technology,
Yavatmal, Maharashtra, India²

ABSTRACT: Electric traction system is playing very vital role in the progress of country. Railway is country's major in industry and boosting economy up to a great extent in addition to that it is making convenience to the travelling of passengers transporting goods within the country as well as abroad. Considering this point the new technology for that purpose the new invention the Design and Fabrication of LIM for Maglev Train is the new invention in this paper we give the details of this modern trend in electric traction system as in this case fast speed is achieved in the range of 300-400 Km/hr. Thus, there is too much saving of time.

KEYWORDS: Linear induction motor, Traction, Maglev Train.

I. INTRODUCTION

A specific type of alternating current (AC) motor is a linear induction motor (LIM), it is designed to produce motion in a straight line. A linear induction motor operates on same principles as its AC rotary motor equivalent, typically powered by a three-phase voltage scheme with a force that is produced by a moving magnetic field [1]. The main difference between a typical rotary motor and a linear induction motor is the way the magnetic field is formed. Inside of an AC rotary motor the magnetic field produced is in an infinite loop rotary motion. A LIM, however, does not operate in an infinite magnetic field loop. A LIM can be likely as an AC rotary motor with the loop cut down the center and the stator and rotor spread out on a flat line, the induced magnetic field now moves linearly across the flat motor face instead of rotating.

This idea was what spurred the first development of a linear induction motor. Force is achieved in a linear direction and it is understandable that this would have certain applications in production, such as rotating large radius wheels and in industrial conveying machines. More recent technological advancements are linear induction machines that have been used in conjunction with high-speed magnetic levitation systems. Very high speeds are obtainable because of minimal friction losses due to the magnetic levitation of the system.

• Hybrid motors • Induction motors • Synchronous motors including reluctance and stepper motors • DC motors • Oscillatory motors these all can classify as Linear Electric motors. The Linear motors (LM) are very effective drive mechanisms for transportation and actuation systems. The high power linear motors are used in rapid transportation, baggage handling, conveyors, crane drives, theme park rides and flexible manufacturing systems. The low power ones are used in robotics, gate control, guided trajectories and stage and curtain movement. NASA envisions the use of such motors in launching spacecrafts in future in the closed loop magnetic levitation system senior project.

II. RELATED WORK

1. TYPES OF LIM:

On the basis of the construction the L.I.M. is classified into three types are as follows:

- I. Moving primary fixed secondary single sided LIM (MPFSSS LIM)
- II. Moving secondary fixed primary single sided LIM (MSFPSS LIM)
- III. Moving secondary fixed primary double sided LIM (MSFPDS LIM)

I) Moving primary fixed secondary side L.I.M

Fig 1. shows the construction of moving primary fixed secondary side L.I.M., in this type of motor stator is make movable while the rotor i.e. Iron plates are fixed. Here the slots are made in the stator side and the winding are placed in it. When we give supply to stator, it will create the flux, this flux is get cut by the rotor and e.m.f gets induced in it according to faradays law of electromagnetic induction. And current start flowing through the rotor. This induced current will interact with the rotating flux to produce the thrust, hence stator will move from one end to another. as the flux moves in the straight line and not in the circular portion. The winding used in the motor is connected in star.

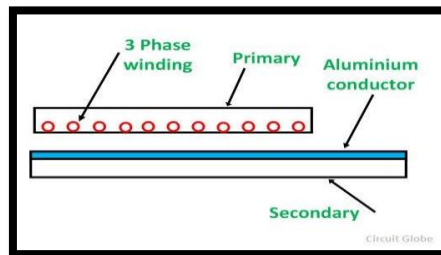


Fig 1. Moving primary fixed secondary side L.I.M

II) Moving secondary fixed primary side L.I.M.:

The construction of moving secondary fixed primary side L.I.M is shown in fig.2, the operating principle this type of machine is same as that of moving primary fixed secondary side L.I.M, only difference is in the construction. Here we take stator side (primary) placed on the ground floor, while rotor is made movable on it. As the slots are present on stator side i.e., primary side. When we give the supply to the stator side it will produce the flux, which is get link with the rotor side, current start to flow through the rotor and rotor start rotating on the stator side when the torque is get produced.

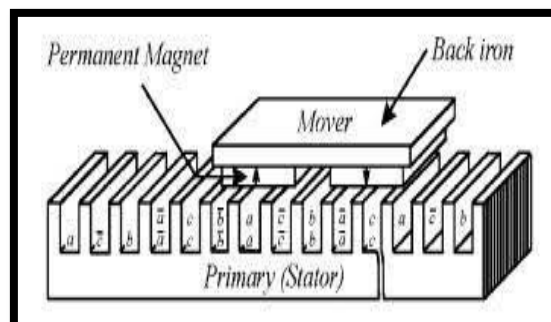


Fig 2. Moving secondary fixed primary side L.I.M

III) Moving Primary and Fixed Secondary Double Sided LIM

The linear induction motor seen above has a single primary reacting with a secondary facing it and it is called as single sided linear induction motors (SLIM). Conceptually, two SLIM can be combined effectively to form a double sided linear induction motor as shown in the fig3. In this figure we can see that the primary is movable on the secondary which is fixed. The two SLIMs are placed back to back and will have the force approximately twice as that of single LIM.

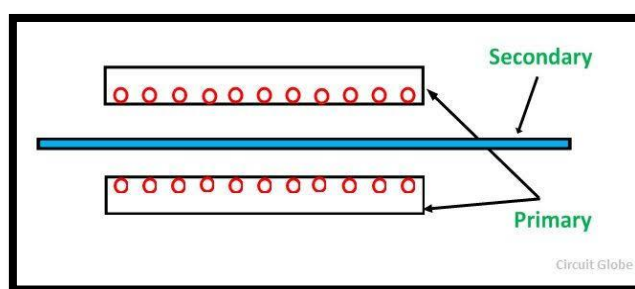


Fig. 3 Moving primary and fixed secondary double sided LIM

2. CONSTRUCTION OF L.I.M

The construction of LIM is shown in fig 4, The basic construction of Linear induction motor is similar to a three phase induction motor but it does not look like a conventional induction motor if we cut the stator of the three phase induction motor and lay on the flat surface it forms the primary of the linear induction motor similarly after cutting the rotor of induction motor and making it flat, we get secondary of the system.

A linear electric motor's primary typically consists of a flat magnetic core (generally laminated) with transverse slots that are often straight cut with coils laid into the slots, with each phase giving an alternating polarity so that the different phases physically overlap. The secondary is frequently a sheet of aluminum, often with an iron backing plate. Some LIMs are double sided with one primary on each side of the secondary, and, in this case, no iron backing is needed.

Two types of linear motor exist: a short primary, where the coils are truncated shorter than the secondary, and a short secondary, where the conductive plate is smaller. Short secondary LIMs are often wound as parallel connections between coils of the same phase, whereas short primaries are usually wound in series. The primaries of transverse flux LIMs have a series of twin poles lying transversely side-by-side with opposite winding directions. These poles are typically made either with a suitably cut laminated backing plate or a series of transverse U-cores.



Fig.4: Constructional View of Project Model

3. WORKING OF LIM

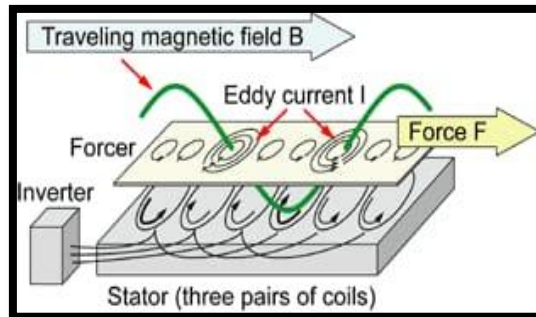


Fig. 5 : Working Of LIM

When the primary of a LIM gets excited by a balanced three-phase power supply, a flux starts travelling along the entire length of the primary. This linearly travelling magnetic field is equivalent to the rotating magnetic field in the stator of a three phase induction motor or a synchronous motor. Electric current gets induced in the conductors of the secondary due to the relative motion between the travelling flux and the conductors. Then the induced current interacts with the travelling flux wave to produce linear force or thrust.

If the primary is fixed and the secondary is free to move, the force will pull the secondary in the direction of the force and will result in the required rectilinear motion. When we give supply to the system the developed field will result in a linear traveling field, the velocity of which is given by the equation, $V_s = 2t f_s$ m/sec, Where f_s is the supply frequency in Hz, V_s is the velocity of the linear traveling field in meter per second, and t is the linear pole pitch i.e. pole to pole linear distance in meter.

For the same reason as in the case of an induction motor, the secondary or runner cannot catch the speed of the magnetic field. Hence there will be a slip. For a slip of s , the speed of the linear induction motor will be,

$$V = (1 - S)V_s$$

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III. EXPERIMENTAL RESULTS

LENGTH OF TRACK (L) = 2.4 MTR

Sr. No.	I/P Voltage (Vph) in volt	I/P Current (Iph) in amp	Time (In Sec) For One Rotation
1	100	7.81	25
2	120	8.26	16
3	140	8.78	11
4	160	9.32	7

IV. CONCLUSION

In this way we have seen the construction of linear induction motor, how it works & where it is used. In future it will be for much purpose, because of its simplicity and efficiency in work. Its speed is higher as compare to the other motor .It gives the reliable operation. Also it is very simple in construction by making one part as a movable & other is stationary i.e., rotor. It is very advantageous over the other motors.

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