Magnetic Suspension Vehicle Traction Levitation Systems

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Abstract*: We will look at the development trend for vehicle traction levitation systems with magnetic suspension below. The simple approach of traction levitation systems is examined in the context of their future development. Common approaches meant to improve transportation are discussed further. It becomes clear what level of growth investors can hope for.*

Keywords*: Magnetic suspension, Linear motor, lateral stabilization, Traction levitation system, Switched reluctance motor, Vehicle*

I. Introduction

With existing transportation issues in Russia right now, there is increased focus on contactless technology for moving objects. Many challenging and expensive projects for passenger cars, far distance trains, cargo ships and conveyor systems have been done using the new "MagTranCity" technology [1]. The principal elements in "MagTranCity" include bulk high-temperature superconductors (flight) of racecourse pieces, composite low-temperature superconductors, magnetic levitation poles, horizontal stabilisation and travel traction through permanent magnets and levitation tracks as shorted "winding Gramme" coils and discrete T-shaped squirrel cells. Because construction is too costly and the demand for passengers from trains is not pushing it to popularity, magnets are rarely used in public transit.

The line that links Shanghai with the airport at Pudong is 40 kilometers and restricts how their train system can be used, as it relies on "Transrapid" technology. Since we need a constant system for transporting passengers and clearing rights-of-way with trestles, together with the ongoing need for transport development, finding technical ways to keep the system's operating costs low is a challenge.

II. Directions for Traction Levitation System Development

Many different levitation and traction concepts have been developed since the inception of magnetic-levitation transport systems, and there are numerous variations and alterations within each principle. However, because of the selection difficulty, the better variations are still available, and none of them have become preferred [2]. The technical solutions that enable us to lower the cost of system development serve as the selection criteria in the objective context.

The only version of a new technical system with low complexity is implemented, survived, and chosen, according to engineering history. When a new technical object is being developed, simplicity and associated survivability and dependability are achieved. The development path of traction levitation systems clearly traces this periodicity. Let's provide a few instances. As is widely known, creating force systems in both vertical and horizontal planes is typically necessary for the operation of magnetic levitation vehicles. One of these secures the vehicle's mobility in the horizontal plane, the other serves as a guiding force, and the third realises the vehicle's magnetic suspension in the vertical plane.

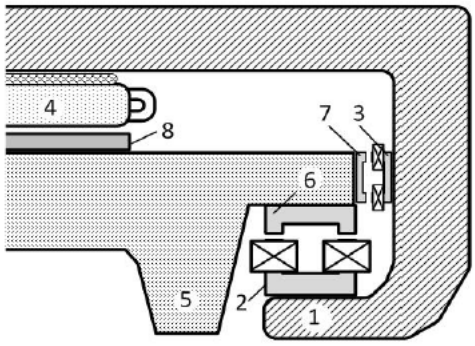

Fig 1: Three-functional mechanical configuration of Traction levitation system

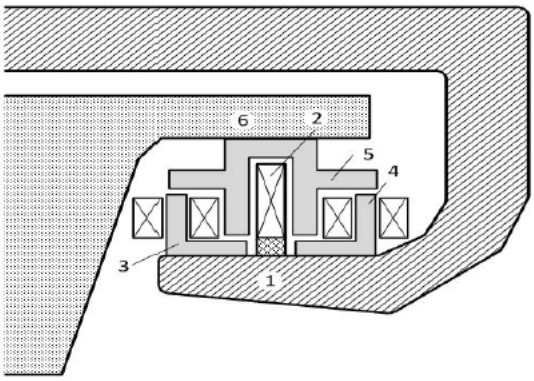

Fig 2: Combined scheme of traction levitation system

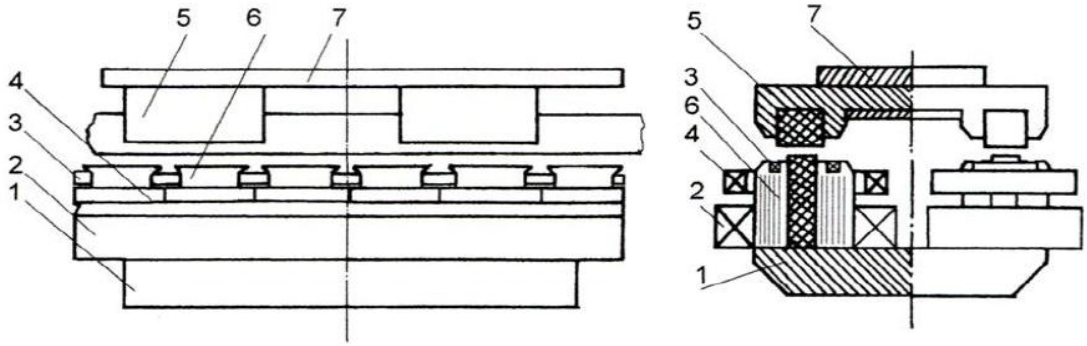

Fig 3: LSM design

III. Development of Traction Levitation Systems

Switching reluctance motors with a straight magnet design can simplify the traction levitation system. The fact that a high normal force is produced between the stator and rotor allows this machine to levitate and run safely in the guiding system. The passive rotor for this type of machine has ferromagnetic materials placed along the track framework. Because rotors are strong, the design of passive, separated track systems can make use of fewer materials and overcome problems connected to how mechanical traction and suspension are delivered. In addition, the windings of the stator using concentrated coils are straight-forward to design.

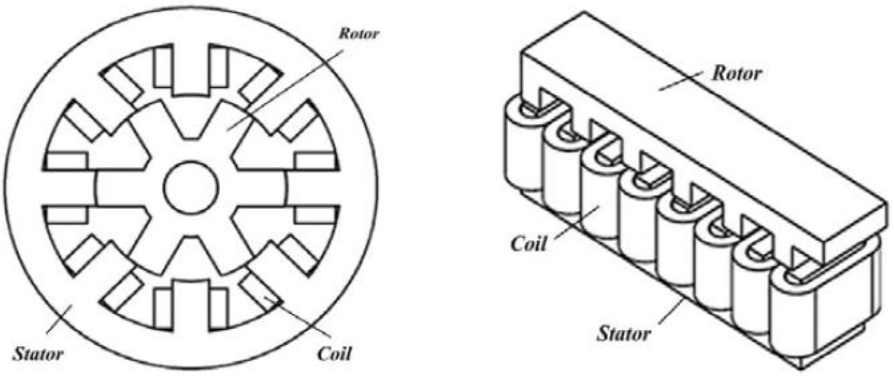

Fig 4: SRM with longitudinal flux design

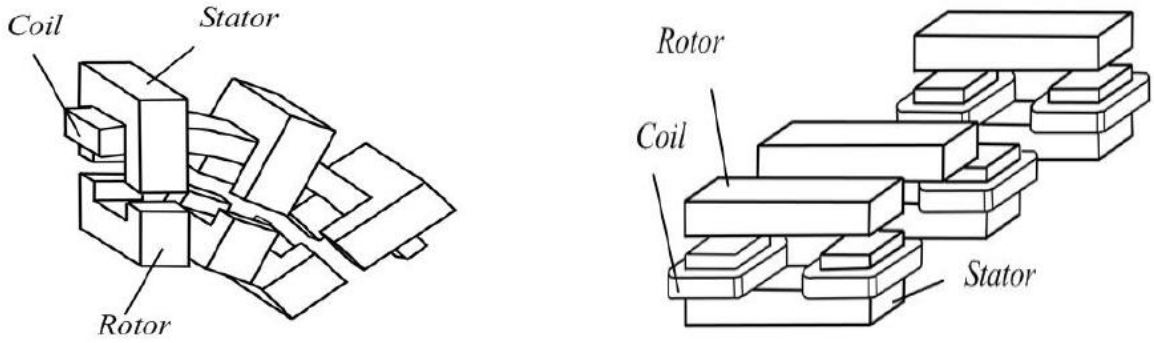

Fig 5: SRM with transverse flux design

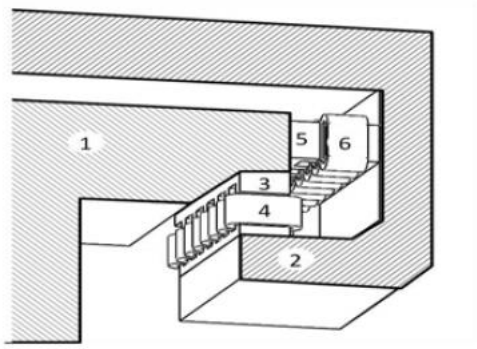

Fig 6: Concept scheme of traction levitation system

IV. Conclusion

During development, there is a preference to make the mechanical organization simpler in a traction levitation system for vehicles with magnetic suspension. The idea of using a linear reluctance motor to merge traction levitation with lateral stabilisation functions led to the practical model. Employing a linear switching reluctance motor in traction levitation systems improves their ease of development by simplifying the design. All three functions: levitation, traction and guidance, can be controlled together by using a single power element, managed by one stator winding current.

It's possible to develop a low-cost traction levitation system for fast cars on a magnetic suspension using well-proven technical techniques.

References

[1] Chie Lee and Yadav Kumar. "An Matrix Converter using Array System in Power Electronics in Communication Systems". Springer Conference in Hindustan University, Chennai, VOL. 2, NO. 3, March 2009

[2] Saritha, Srikanth, Subhakar and Sunitha, "A Process control system in Industrial Applications using Thyristors in power electronics for PMSG",". Elsevier 2011. China, 7 – 9, January 2012.

[3] Niharika, Lakshman Reddy and Shanchie, "A Novel of MIMO concepts in wireless relay networks in Space Time and Space Frequency in achieve diversity", " IEEE Conference Proceedings on Innovative Research in Communication Systems (IRCS), International Conference. vol. 2, pp. 67 – 75, January. 2010

[4] John Diesel, Shang Chee and Cooper Lee, "Standalone Grid system for On and OFF modes Using Renewable energy sources using PMMC Technology', "Springer Proceedings on Green Energy on World environmental Day", IEEE conference proceedings held at Madras University, on the 20tt Century. pp.10-19, 2020

[5] F Max Savio, M Sasi Kumar. "An Effective Control Technique for an Impedance Source Inverter Based Wind Energy System". 2012 IEEE International Conference on Emerging Trends in Electrical Engineering and Energy Management (ICETEEEM-2012)

[6] Sasikumar M and Chenthur Pandian S. "Characteristics Study of ZSI For PMSG Based Wind Energy Conversion Systems". Journal of Electrical Engineering (JEE). ISSN: 1582-4594.