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MODERN TRENDS IN TRACTION

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Abstract— The modern trend in the railway sector is the Maglev trains. Maglev, also called magnetic levitation train or maglev train, a floating vehicle for land transportation that's supported by either electromagnetic attraction or repulsion. The maglev transportation have very benefits such as high level of safety, no derailment, reliability, high speed, ecofriendly, low maintenance fees, energy efficient, the quietest transportation system, less space required, climbing grade and maneuverability, etc. This paper involves all the aspects, design, technology, applications, future uses of these trains.
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Index Terms— Electrodynamic suspension, Electromagnetic suspension, Inductrack, stability, power-use, magnetic induction

1 INTRODUCTION

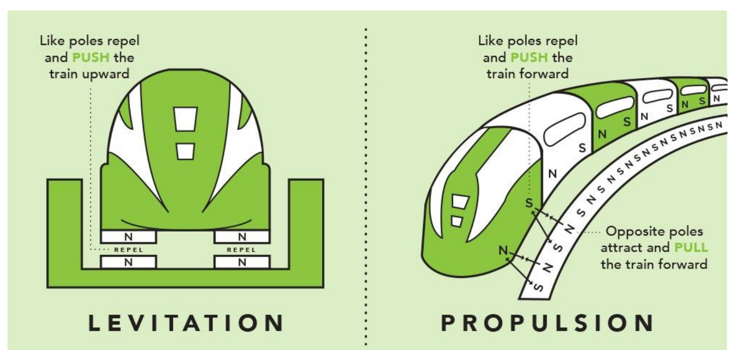
What if you'll travel from **NY** to **LA** in only under seven hours without boarding a plane? It could be possible on a Maglev train.

This idea was raised by a physics scientist in 1909 by Robert H. Goddard the American rocket scientist. After that a British electrical engineer Eric Laithwaite developed the first full sized working model of linear motor induction after that many scientist came and improved the technology. The world first commercial maglev system was a low-speed maglev shuttle that ran between the airport terminal of Birmingham international airport and Birmingham international railway station between 1984 and 1995. The track length was just 600 m and train was levitated at an

altitude Of 15mm. It operated for 11 years but due to the obsolescence problem with the electronic system it leads to closure in 1995. After that many more trains started in the world by improving technology such in Emsland,Germany in 1984 to 2012, Vancouver,Canada and Hamburg,Germany in 1986 to 1988 and south Korea in 1993, japan till present . As well as the first commercially operated high-speed superconducting Maglev train opened in Shanghai in 2004, while in the United States, a number of routes are being explored to attach cities such as Baltimore and Washington, D.C.

2 HOW MAGLEV WORKS?

"A Maglev train vehicle is only a case with magnets on the four corners," says Jesse Powell, the child of the Maglev designer. It's a smidgen more unpredictable than that, however the idea is basic. The magnets utilized are superconducting, which implies that when they are cooled to under 450 degrees Fahrenheit under zero, they can create attractive fields up to multiple times more grounded than customary electromagnets, enough to suspend and move a train. These attractive fields connect with basic metallic circles set into the solid dividers of the Maglev guideway. The circles are made of conductive materials, similar to aluminum, and when an attractive field moves past, it makes an electric flow that produces another attractive field.



Three sorts of circles are set into the guideway at explicit spans to do three significant undertakings: one makes a field that causes the train to float around 5 creeps over the guideway; a second keeps the train stable evenly. The two circles utilize attractive repugnance to keep the train vehicle in the ideal detect; the further it gets from the focal point of the guideway or the closer to the base, the more attractive opposition pushes it in the groove again. The third arrangement of circles is an impetus framework run by rotating current force. Here, both attractive fascination and aversion are utilized to move the train vehicle along the guideway. Envision the case with four magnets - one on each corner. The front corners

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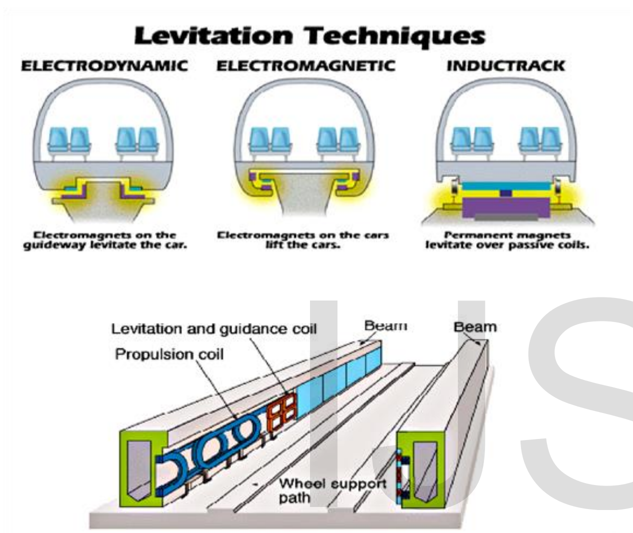
have magnets with north poles looking out, and the back corners have magnets with south poles outward. Energizing the drive circles creates attractive fields that both force the train forward from the front and push it forward from behind.

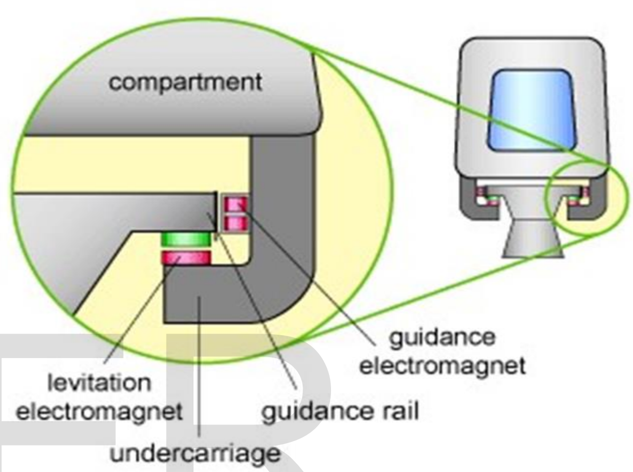
3 Types Of Maglev Technology

1. Suspension
2. Electrodynamic Suspension
3. Inductrack system



3.1 Electromagnetic suspension

In electromagnetic suspension (EMS) frameworks, the train suspends over a steel rail while electromagnets, connected to the train, are arranged toward the rail from underneath. The framework is regularly masterminded on a progression of C-molded arms, with the upper bit of the arm connected to the vehicle, and the lower inside edge containing the magnets. The rail is arranged inside the C, between the upper and lower edges.
Attractive fascination fluctuates contrarily with the square of separation, so minor changes in separation between the magnets and the rail produce incredibly differing powers. These adjustments in power are powerfully unsteady—a slight difference from the ideal position will in general develop, requiring advanced criticism frameworks to keep up a steady good ways from the track, (roughly 15 mm [0.59 in]).
The significant bit of leeway to suspended maglev frameworks is that they work at all rates, dissimilar to electrodynamic frameworks, which just work at any rate speed of around 30 km/h (19 mph). This dispenses with the requirement for a different low-speed suspension framework, and can rearrange track format. On the drawback, the dynamic unsteadiness requests fine track resiliences, which can counterbalance this favorable position. Eric Laithwaite was worried that to meet required resiliences, the hole among magnets and rail would need to be expanded to where the magnets would be absurdly large. Practically speaking, this issue was tended to through improved input frameworks, which uphold the necessary resistances.



3.2 Electrodynamic suspension (EDS)

In electrodynamic suspension (EDS), both the guideway and therefore the train apply a gorgeous field, and therefore the train is suspended by the horrible and appealing power between these attractive fields. In certain arrangements, the train are often suspended just by shocking power. within the beginning phases of maglev advancement at the Miyazaki test track, a simply awful framework was utilized instead of the later shocking and alluring EDS system. The attractive field is delivered either by superconducting magnets (as in JR– Maglev) or by a range of perpetual magnets (as in Inductrack). The horrible and appealing power within the track is formed by an initiated attractive field in wires or other leading strips within the track. A significant little bit of leeway of EDS maglev frameworks is that they're powerfully steady— changes in separation between the track and the magnets makes solid powers to restore the framework to its unique position. also, the appealing power differs within the contrary way, giving a similar change impacts. No dynamic input control is required. Nonetheless, at moderate speeds, the current instigated in these curls and also the resultant attractive motion isn't sufficiently enormous to suspend the train. Conse-

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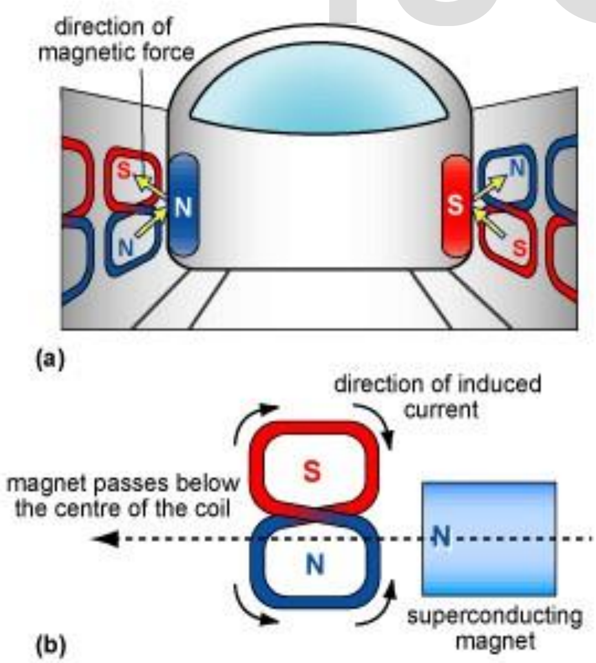
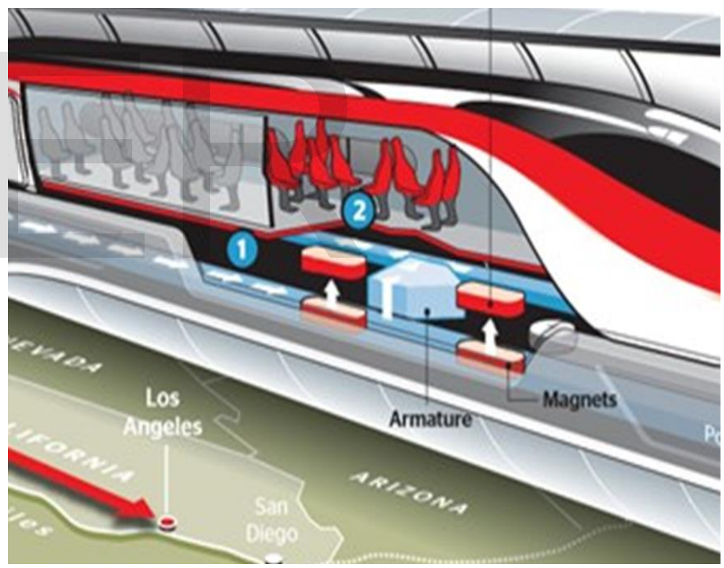
quently, the train must have wheels or another form of landing apparatus to assist the train until it arrives at take-off speed. Since a train may stop at any area, due to hardware issues for example, the entire track must have the option to assist both low-and rapid activity. Another disadvantage is that the EDS framework normally makes a field within the track in front and to the rear of the lift magnets, which acts against the magnets and makes attractive drag. this can be commonly just a worry at low speeds, and is one reason why JR surrendered a simply frightful framework and embraced the sidewall levitation system. At higher velocities different methods of drag dominate. The drag power will be utilized to the electrodynamic framework's little bit of leeway, nonetheless, because it makes a changing power within the rails that may be utilized as a traditionalist framework to drive the train, without the need for a distinct response plate, as in most straight engine frameworks. On the opposite hand, impetus curls on the guideway are utilized to use an influence on the magnets within the train and make the train push ahead. The drive curls that apply an influence on the train are adequately a straight engine: a substituting current through the loops creates a constantly shifting attractive field that pushes ahead along the track. The recurrence of the exchanging current is synchronized to coordinate the speed of the train. The balance between the sphere applied by magnets on the train and therefore the applied field makes an influence pushing the train ahead.



3.3 INDUCTRACK SYSTEM (PERMANENT MAGNET PASSIVE SUSPENSION)

It is a bomb suspension framework, no force is needed to actuate magnets; Attractive field is situated underneath the vehicle; they can produce enough power at low speeds (around 5 km/h (3.1 mph)) to suspend maglev train; in the event of intensity disappointment vehicles delayed down all alone securely; lasting magnets are orchestrated in a cluster which helps in drive of the trains. they Require either wheels or track sections that move for when the vehicle is stopped. Neither Inductrack nor the Superconducting EDS can suspend vehicles at a halt, despite the fact that Inductrack gives levitation down to a much lower speed; wheels are needed for these frameworks. EMS frameworks are wheel-less



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4 SOME IMPORTANT FACTOR OF MAGLEV TRAINS

4.1 STABILITY

According to Earnshaw's hypothesis, any blend of static magnets can't be in a steady balance. Consequently a unique attractive field is needed to accomplish adjustment. EMS frameworks depend on dynamic electronic adjustment which continually measure the bearing separation and change the electromagnet current appropriately. All EDS frameworks depend on changing attractive fields making electrical flows, and these can give detached stability. Because maglev vehicles basically fly, adjustment of pitch, roll and yaw is needed by attractive innovation. Notwithstanding pivot, push ahead and in reverse, influence (sideways movement) or hurl (all over movements) can be risky with certain innovations

4.2 POWER AND ENERGY USE

Energy for the maglev trains is utilized to quicken the train, and the force could be recaptured when the train eases back down ("regenerative slowing down"). It is likewise used to cause the train to suspend and to balance out the development of the train. The primary portion of the energy is expected to compel the train through the ("air drag"). Likewise some energy is utilized for cooling, warming, lighting and different incidental frameworks.

At low speeds the level of intensity (energy per time) utilized for levitation can be huge burning-through up to 15% more force than a metro or light rail service. Also for extremely short separations the energy utilized for quickening may be significant. Be that as it may, the force used to beat air drag increments with the 3D square of the speed, and thus rules at fast.

4.3 COMPARISION WITH CONVENTIONAL TRAINS

Ordinary railroad is most likely more productive at lower speeds. Yet, because of the absence of actual contact between the track and the vehicle, maglev trains experience no moving obstruction, leaving just air opposition and electromagnetic drag, conceivably improving force productivity. A few frameworks anyway, for example, the Focal Japan Railroad Organization SCMaglev utilize elastic tires at low speeds. The heaviness of the electromagnets in numerous EMS and EDS plans appears to be a significant plan issue. A solid attractive field is needed to suspend a maglev vehicle. For the Transrapid (German maglev), this is somewhere in the range of 1 and 2 kilowatts for each ton.

Another way for levitation is the utilization of superconductor magnets to diminish the energy utilization of the electromagnets, and the expense of keeping up the field. Most energy use for the TRS is for drive and conquering the grinding of air opposition at speeds more than 100 mph. Convectional trains would weigh not exactly maglev. Because the significant wellspring of commotion of a maglev train originates from uprooted air, maglev trains produce less clamor than a customary train at equal velocities. Nonetheless, an examination presumed that maglev commotion should be evaluated like street traffic while ordinary trains have a 5–10 dB "reward" as they are discovered less irritating at a similar clamor level. Maglev configuration disposes of the utilization of slowing down and over head wire dissimilar to the convectional one „s, they get their electricalgracefully from ground, their plan is aerodynamical to the point that they reach around 300 mph quick than the convectional rapid trains.

4.4 CONTROL SYSTEMS

There are no flagging frameworks for high or low speed maglev frameworks. There is no need since every one of these frameworks are PC controlled. Plus, at the very high speeds of these frameworks, no human administrator could respond sufficiently quick to back off or stop as expected. This is additionally why these frameworks require devoted privileges of way and are generally proposed to be raised a few meters over the ground level.

Two maglev framework microwave towers are in contact with an EMS vehicle consistently for two-route correspondence between the vehicle and the headquarters place's primary activities PC. There are no requirement for train whistles or horns, by the same token.

4.5 FLEXIBILITY AND RELIABILITY

Airplane are hypothetically adaptable however business air courses are most certainly not. Fast maglevs are intended to contend on venture times with trips of 800 kilometers (500 miles) or less. Furthermore, while maglevs can serve a few urban areas in the middle of such courses and be on time in every climate condition, aircrafts can't approach such unwavering quality or execution.

Since maglev vehicles are controlled by power and don't convey fuel, maglev admissions are less defenseless to the substantial value swings made by oil markets. Voyaging by means of maglev additionally offers a critical security edge over air travel since maglevs are planned not to collide with different maglevs or leave their guideways. Airplane fuel is a huge threat during departure and arriving as there are chances for mishaps. In certifiable circumstances the speed of maglev are not as much as airplane, yet maglev actually spare time because of less number of obstacles it takes to go in them when contrasted with air travel. With air travel, individuals need to invest energy at air terminals for registration, security, boarding, and so on In air travel, time is likewise devoured (basically in occupied air terminals) by the airplane for burdening, sitting tight in line for take-off and landing, which are immaterial if there should be an occurrence of maglev.

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5 Conclusion

These trains burn-through exceptionally less energy contrasted with ordinary trains. They require no enormous motor sort of stuff as they run utilizing straight engines. They Move significantly quicker than typical trains since they are not influenced by ground grinding; they would just have air opposition or drag obstruction. They are contrary with existing rail lines since they need aseperate track to suspend, dissimilar to the conventional rapid trains. Initially the expense is exceptionally high yet it might diminish in not so distant future

References

[1] Shwethasingh , Aradhanasingh. "Magnetic Levitation Methods and Modeling in Maglev Trains", 2014 ISSN: 2277 128 xx.

[2] H. Behbahani, H. Yaghoubi, and M. A. Rezvani, "Development of technical and economical models for widespread application of maglev system publicly transport," International Journal of Civil Engineering, vol. 10, no. 1, pp. 13–24, 2012.

[3] H.Yaghoubi and H. Ziari, "Assessment of structural analysis and design principles for maglev guideway: a case-study for implementing low-speed maglev systems in Iran," in Proceedings of the 1st International Conference on Railway Engineering, High-speed Railway, Heavy Haul Railway and Urban Rail Transit, pp. 15– 23, China Railway Publishing House, Beijing Jiaotong University, Beijing, China, 2010.

[4] H. Yaghoubi and M. A. Rezvani, "Development of Maglev guideway loading model," Journal of Transportation Engineering, vol. 137, no. 3, pp. 201–213, 2010. View at Publisher · View at Google Scholar · View at Scopus

[5] H. Yaghoubi and H. Ziari, "Development of a maglev vehicle/guideway system interaction model and comparison of the guideway structural analysis with railway bridge structures," Journal of Transportation Engineering, vol. 137, no. 2, pp. 140–154, 2010. View at Publisher · View at Google Scholar · View at Scopus

[6] H. Behbahani and H. Yaghoubi, "Procedures for safety and risk assessment of maglev systems: a case- study for long-distance and high-speed maglev project in MashhadTehran route," in Proceedings of the 1st International Conference on Railway Engineering, High-speed Railway, Heavy Haul Railway and Urban Rail Transit, pp. 73–83, China Railway Publishing House, Beijing Jiaotong University, Beijing, China, 2010.