AC Ampere force type magnetic levitation for a non-magnetic thin plate

Keywords: magnetic levitation, electromagnet, inductive reaction force, ac ampere force, eddy current, non-magnetic plate, linear system, rotating system

【Conventional AC Induction type MAGLEV 】

It can suspend an iron ball by using control electromagnets. This is applied to levitate a magnetic plate by multiple arrangements of electromagnets. (It is called “suspending and conveyance system for sheet steel”.)

When scope of object is extended from a magnetic thin plate to a non-magnetic thin plate (such as aluminum material and magnesium material), it enables to levitate a non-magnetic thin plate by inductive reaction force using AC electromagnets (called “AC induction type magnetic levitation and conveyance system”). The system;

〇enables passive stability by devising configuration of the system, and maintains sufficient levitation distance

●increases the heat abruptly and leads aggravation of levitation efficiency.

【MAGLEV system using AC ampere force】

It applies electromagnetic force followed by Fleming's left hand rule toward eddy current inside a thin plate. This system can be used to make an additional force to a force by AC induction type magnetic levitation.

The system;

〇suppresses a speed of heat ascent and improves levitation efficiency

●requires additional AC electromagnets and power supply.

【Linear system and rotating system】

It is possible to construct linear/rotating system by adding electromagnets considering behavior of eddy current inside of a thin plate.

【Applicable use】

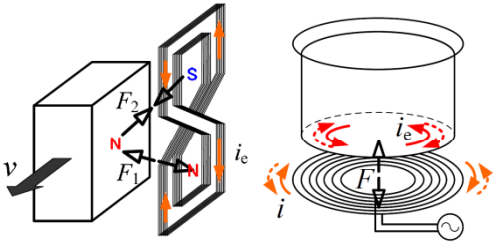
This is applicable for general systems which levitate and convey non-magnetic thin plates (such as for automobile industry, building materials and metal-foil material manufacturing).

【Comparison to EDS】

EDS (electro-dynamic suspension) is the system adopted by JR-MAGLEV.

〇Passive stability and high stiffness by superconducting magnets

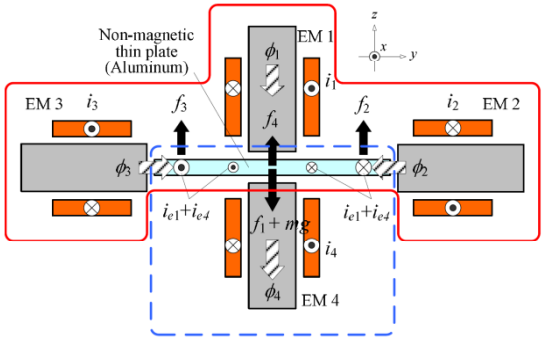
●A need for change in flux by move of DC magnetic field

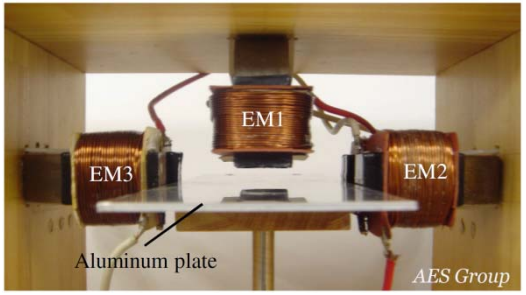


EDS (Left) and IH (Right)

・EDS acquires its repulsive force by movement. The heating target is the coils, but EDS heats it only while the boggy passes on the railway.

・IH acquires its repulsive force in alternating magnetic field. The heating target is the container. Vast amounts of eddy currents are stored.





Principle of levitation force (top) and its fundamental configuration (bottom)

Main features

	Inductive reaction type	AC ampere force type
Levitation force	△	◎
Passive control	◎	◎
Heating of a thin plate	△	○
Power consumption	△	○
Levitation efficiency	△	○
Equipment cost	○	△
Space	○	△