Electro Magnetic Coupling of A Train By Using Arm Processor

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Abstract-*Now a day a lot of train accidents occur due to fire accidents in the train. This may cause danger to people's life and we cannot avoid the spreading of fire in the train. Because the train are coupled together with bolts and is impossible to remove the compartments when it catches the fire. To overcome this problem, the magnetically coupled train is implemented. In this, the train is coupled using the electromagnetic coupling. In the magnetically coupled train, the temperature sensor is used to measure the fire and gives the information through the Zigbee to the base station. Then the speed of the train is reduced by using the breaking system. By using this system, the fire accidents can be avoided and thus can safeguard the people's life.*

Keywords-ARM, Temperature Sensor, Relay, Magnetic coupler, Zigbee

I. INTRODUCTION

Railway signaling is the baseline safety system controlling the movements of the trains. It is the safety critical part of the train that controls the function of the railway. Once instructed by a signaler or an automatic system, it is responsible for setting up non-conflicting and safe routes for trains, for defining (safe) limits of movement and for transmitting instructions or commands to train drivers.Magnetic couplings are generally used to transmit torque from one system to another, where the magnetic transmission is required to maintain a hermetic seal to prevent leakage and contamination. The couplings are synchronous and the output shaft speed is exactly equal to the input speed. These types of coupling can be designed with a maximum 100% efficiency.Magnetic couplings are widely used in pump systems to isolate the electrical motor from the liquid. This has the advantage of removing the dynamic seals which have a finite lifetime and are prone to leakage, which can cause failure of the machine and contamination of the working fluid.A membrane/seal wall is located in the magnetic gap between the rotors providing complete isolation between the wet and dry systems.

II. LITERATURE REVIEW

MAGNETICALLY COUPLED USED IN VEHICLE

High-Temperature Superconducting (HTS) interaction shows a great potential in rotational bearing and linear Maglev technology. Besides the superconductor, each application sets additional specific technical requirements. The challenges of using the various constructions and applications in the combination of the cold HTS material and the required technical periphery are discussed. ATZ's 0.5-ton HTS production per annum has increased performance in some magnetic applications. Engineering properties, advanced magnetic excitation systems and thermal and mechanical stability of robust high-load YBCO bearings have been demonstrated. The effort is being made in the development of mobile HTS Maglev devices. We have designed and produced advanced 40-cm-long bulk cryostats, having the 2-mm magnetic distance outside and operating more than one day without refilling. 24 vacuum cryostats have been manufactured for a magnetic train construction capable to transport up to 60-kN total vehicle and passenger weight. It operates on a 200-m-long track. The guide way consists of two parallel permanent magnetic tracks, whose concentrating magnetic field at 20 mm height above the surface. Superconductors are fixed on the bottom of a liquid nitrogen vessel and cooled by liquid nitrogen.

MAGNETICALLY COUPLED USING LEVITATION

After the levitation force relaxation had been studied for different field-cooling height and working-levitation height. The high-temperature superconductor (HTS) bulk is horizontally moved in the lateral direction above the permanent magnet guide way. Both levitation and guidance force were collected by the measurement system at the same time. It was found that the decay of levitation force is dependent on both the maximum lateral displacement and the movement cycle times, while the guidance force hysteresis curve does not change after the first cycle. This work provided scientific analysis for the HTS maglev system design. The contactless electrical energy transfer system (CEES), by which electrical energy may be transmitted without electrical connection or physical contact, through the large air gap. In this case, energy is transmitted via the coreless transformer. Coupling between the coils changes and depend on the dimension of the air gap. The efficiency of cents is mainly dependent on the transmission frequency. Additionally, large leakage inductances may also be compensated in resonance condition by adding capacitors to the coils. The article presents theoretical analyses and simulation results of transformer equivalent circuit with capacitors. Theoretical developments are compared with practical measurements from a prototype contactless system.

MAGNETICALLY COUPLED USING SINUSOIDAL GUIDEWAY

The vertical component of the Halbach array's magnetic field exhibits a sinusoid distribution because of the closed magnetic flux area between two neighboring poles, so that field can be regarded as the sinusoidal magnetic field. This article mainly discusses the influence of the closed flux region on the levitation performance of the bulk high-temperature superconductor (HTS). Moreover, the levitation performance is compared between the closed and diverging region of magnetic flux. The experimental results can be analyzed by the magnetic circuit theory and the frozen-image model. The analysis indicates that the closed region of magnetic flux can influence the levitation performance of bulk HTS obviously and provide an extra useful guidance force. These conclusions are helpful to optimize the HTS Maglev system. This mainly discusses the influence of the closed flux region on the levitation performance of the bulk high-temperature superconductor.The levitation performance is compared between the closed and diverging region of magnetic flux. The design and analysis of a scale-model suspension test facility for MAGLEV is discussed. This work describes techniques for the design, construction, and testing of a prototype electrodynamics (EDS) levitation system. The viability of future high-temperature superconducting magnet designs for MAGLEV has been investigated concerning about their application to active secondary suspensions. A set of approximate design tools and scaling laws have been developed to evaluate forces and critical velocities in the suspension.

GEOMETRIC COUPLED FOR MAGNETIC APPROACH

It is the geometric approach for the enhancement of the coupling coefficient between two magnetically coupled coils. Each of the two coils is assumed to be composed of concentric circular loops. It is the geometric approach for the enhancement of the coupling coefficient between two magnetically coupled coils. It is demonstrated that the coupling coefficient can be considerably enhanced if the turns of the coils are not concentrated at the circumferences, but distributed across the diameters. For analysis, each of the two coils is assumed to be composed of concentric circular loops.

III.EXISTING METHOD

Each compartment of the train is coupled by bolts. Therefore if a fire accident occurs it spreads through other compartments. It is impossible to remove or separate a particular compartment as it is mechanically connected. This is the drawback of the existing system.

Drawbacks of the Existing System

It will consume more power for coupling two compartments of the train. Power losses may occur. This method of coupling costs high economically.

IV.PROPOSED SYSTEM

In the recent time, we have seen a lot of railway accidents but yet Indian Railways have not implemented any effective Anti-Collision System, which can avoid such type of accidents. So, we come up with a project "Magnetically Coupled Train" which can avoid such type of railway accidents. In this project, we have used Arm processor, Wireless Trans Receiver Unit (Zigbee) and power supply. We can couple the compartment of train by using an electromagnet. When fire occurs, the temperature sensor senses the fire and gives the message to both the base station and the compartments of the train by using the Zigbee technology.The power supply will decouple the compartment on both sides.Then the breaking system will reduce the speed.

- Zigbee
- Temperature Sensor
- Time Delay
- Breaking Sensor
- Power Supply

V. BLOCK DIAGRAM

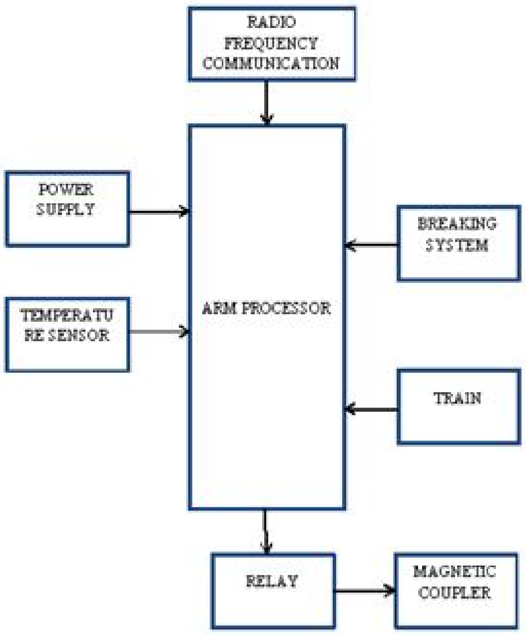

Fig 1: Block diagram for magnetically coupled train

VI. HARDWARE DESCRIPTION

Relay

A Relay is an electrically operated switch. Many relays use an electromagnet to operate a switching mechanism mechanically, but other operating principles are also used. Relays are used to control a circuit by a low-power signal (with complete electrical isolation between control and controlled circuits), or to control several circuits by one signal. A machine tool relay is a type of relay used in standardized for industrial control of machine tools, transfer machines, and other sequential control. They are characterized by a large number of contacts (sometimes extendable in the field) which are easily converted from normally-open to normally-closed status, easily replaceable coils, and a form factor that allows compactly installing many relays in a control panel. Relays are the backbone of automation such as automobile assembly, the programmable logic controller (PLC). A contactor is a very heavy-duty relay used for switching electric motors and lighting loads, although contactors are not generally called relays. Continuous current ratings for common contactors range from 10 amps to several hundred amps. High-current contacts are made with alloys containing silver. The unavoidable arcing causes the contacts to oxidize. However, silver oxide is still a good conductor.Such devices are often used for motor starters.A type of relay that can handle the high power required to directly drive an electric motor is called a contactor. Solid-state relays, control power circuits with no moving parts, instead uses a semiconductor device to perform switching.Relays with calibrated operating characteristics and sometimes multiple operating coils are used to protect electrical circuits from overload or faults. In modern electric power systems, these functions are performed by digital instruments called protective relays. A simple electromagnetic relay consists of a coil of wire surrounding a soft iron core, an iron yoke which provides a low reluctance path for magnetic flux, a movable iron armature, and one or more sets of contacts (there are two in the relay pictured). The armature is hinged to the yoke and mechanically linked to one or more sets of moving contacts. It is held in place by a spring so that when the relay is de-energized there is an air gap in the magnetic circuit. In this condition, one of the two sets of contacts in the relay pictured is closed and the other set is open. Other relays may have more or fewer sets of contacts depending on their function. The relay in the picture also has a wire connecting the armature to the yoke.This ensures continuity of the circuit between the moving contacts on the armature, and the circuit track on the Printed Circuit Board (PCB) via the yoke, which is soldered to the PCB.

Transistor

A Transistor is a semiconductordevice used to amplify and switch electronic signals. It is made of a solid piece of semiconductor material, with at least three terminals for connection to an external circuit. A voltage or current applied to one pair of the transistor's terminals changes the current flowing through another pair of terminals. This is because the controlled (output) power can be much more than the controlling (input) power, the transistor provides amplification of a signal. Today, some transistors are packaged individually, but much more are found embedded in integrated circuits.

Temperature sensor

The LM35 series are precision integrated-circuit temperature sensors, whose output voltage is linearly proportional to the Celsius (Centigrade) temperature. The LM35 thus has an advantage over linear temperature sensors calibrated in ° Kelvin, as the user is not required to subtract a large constant voltage from its output to obtain convenient Centigrade scaling. The LM35 does not require any external calibration or trimming to provide typical accuracies of ±¼°C at room temperature and ±¾°C over a full -55 to +150°C temperature range. Low cost is assured by trimming and calibration at the wafer level. The LM35's low output impedance, linear output and precise inherent calibration make interfacing to readout or control circuitry especially easy. It can be used with single power supplies or with plus and minus supplies. As it draws only 60 µA from its supply, it has very low self-heating, less than 0.1°C in still air. The LM35 is rated to operate over a -55° to +150°C temperature range while the LM35C is rated for a -40° to +110°C range (-10° with improved accuracy).The LM35 series is packaged in hermetic TO-46 transistor packages, while the LM35C, LM35CA, and LM35D are also available in the plastic TO-92 transistor package. The LM35D is also available in an 8-lead surface to mount small outline package and a plastic TO-220 package.

Battery

An electrical **battery** is one or more electrochemical cells that convert stored chemical energy into electrical energy. Since the invention of the first battery (or "voltaic pile") in 1800 by Alessandro Volta and especially since the technically improved Daniel cell in 1836, batteries have become a common power source for many households and industrial applications. According to a 2005 estimate, the worldwide battery industry generates US$48 billion in sales each year. With 6% annual growth. There are two types of batteries: primary batteries (disposable batteries), which are designed to be used once and discarded and secondary batteries (rechargeable batteries), which are designed to be recharged and used multiple times. Batteries come in many sizes from miniature cells used to power hearing aids and wristwatches to battery banks the size of rooms that provide standby power for telephone exchanges and computer data centers.

VII.TECHNOLOGY USED

ZIGBEE

Zigbee is a specification for a suite of high-level communication protocols using small, low-power digital radios based on an IEEE 802 standard for personal area networks. Applications include wireless light switches, electrical meters with in-home-displays and other consumer and industrial equipment that require the short-range wireless transfer of data at relatively low rates. The technology defined by the Zigbee specification is intended to be simpler and less expensive than other WPANs, such as Bluetooth. Zigbee is targeted at radio-frequency (RF) applications that require a low data rate, long battery life, and secure networking. Zigbee has a defined rate of 250 kbps best suited for periodic or intermittent data or a single signal transmission from a sensor or input device. The name refers to the waggle dance of honey bees after their return to the beehive.Zigbee is a low-cost, low-power, wireless mesh network standard. The low cost allows the technology to be widely deployed in wireless control and monitoring applications. The Zigbee network layer natively supports both star and tree typical networks and generic mesh networks. Every network must have one coordinator device, tasked with its creation, the control of its parameters and basic maintenance.We are using ZigBee Tran receiver for wireless communication. **Zigbee** is the specification of a low-cost, low-power wireless communications solution, meant to be integrated as the main building block of ubiquitous networks. It is maintained by the Zigbee Alliance, which develops the specification and certifies its proper implementation. Zigbee builds upon the physical layer and medium access control defined in IEEE standard 802.15.4 for low-rate WPAN's. The specification goes on to complete the standard by adding four main components: network layer, application layer, Zigbee device objects (ZDO's) and manufacturer-defined application objects which allow for customization and favor total integration. These are responsible for some tasks, which include the keeping of device roles, management of requests to join a network, device discovery, security. Its network layer natively supports three types of topologies: both star and tree typical networks and generic mesh networks.Every network must have one coordinator device, tasked with its creation, the control of its parameters and basic maintenance. Within star networks, the coordinator must be the central node. The main function of the network layer is to enable the correct use of the MAC sublayer and provide a suitable interface for use by the next upper layer, namely the application layer. The routing protocol used by the Network layer is AODV. To find the destination device, it broadcasts out a route request to all of its neighbors. The neighbors then broadcast the request to their neighbors etc. until the destination is reached. Once the destination is reached, it sends its route reply via unicast transmission following the lowest cost path back to the source.Once the source receives the reply, it will update its routing table for the destination address with the next hop in the path and the path cost.

VIII.APPLICATIONS

1. All the industries at present are fully automated. Therefore, the possibility for fire accident in those industries is high. If we implement this concept in industries we can decrease the fire accidents.
2. This concept can be used in nuclear power plant stations.

IX.FUTURE SCOPE

At present we have just given an idea to safeguard the other compartments from the fired compartment. In future the fire can be detected in the initial stage and we can avoid the fire accident by sensing it.

REFERENCES

[1] F. N. Werfel, U. Floe gel Delora, R. Roth Feld, T. Riedel, B. Goebel, D.Wippich, and P. Schirrmeister, "Recent up-scaling in HTS magnetic device technology," IEEE Trans. Appl. Supercond., vol. 21, no. 3, pp.1473–1476, June 2011.

[2] G.G. Sotelo, D. H.N. Dias,O. J.Machado, E. D.David, R. de Andrade,Jr., R. M. Stephan, andG. C. Costa, "Experiments in a real scalemaglevvehicle prototype," J. Phys.: Conf. Ser., vol. 234, p. 032054, 2010.

[3] G. Ma, J. Wang, and S. Wang, "Numerical investigation of the lateral movement influence on the levitation force of the bulk HTS based on a 3-Dmodel," IEEE Trans. Appl. Supercond, vol. 20, no. 3, pp. 924–928,June 2010.

[4] G. T. Ma, J. S. Wang, and S. Y. Wang,"3-D modeling of high-Tc superconductor for magnetic levitation/suspension application validation with experiment," IEEE Trans. Appl. Supercond, vol. 20, no. 4, pp.2228–2233, 2010.

[5] H. Jing, J. Wang, S. Wang, L. Wang, L. Liu, and J. Zhenget al., "Two-pole Halbach permanent magnet guideway for high temperature superconducting maglev vehicle," Physica C, vol. 463, pp. 426–430,Oct. 2007.

[6] H. Song, O. de Haas, C. Beyer, G. Krabbes, P. Verges, and L. Schultz,"Influence of the lateral movement of the levitation and guidance force in the high-temperature superconductors maglev system," Appl.Phys.Lett, vol. 86, p. 192506, 2005.

[7] J. R. Hull and A. Cansiz, "Vertical and lateral forces between a permanentMagnet and a high-temperature superconductor," J. Appl. Phys.,vol. 86, pp. 6396–6404, 1999.

[8] J. S.Wang, S. Y.Wang, Y.W. Zeng, H. Y. Huang, F. Luo, and Z. P. Xuet al., "The first man-loading high temperature superconducting Maglev test vehicle in the world," Physica C, vol. 809–814, pp. 378–381,2002.

[9] N. D. Valle, A. Sanchez, and E. Pardo, "Enhanced stability of field cooling in superconducting levitation with translational symmetry,"Appl. Phys. Lett., vol. 91, p. 112507, 2007.

[10] S.Wang, J.Wang, C.Deng,Y.Lu, Y. Zeng, andH. Song et al., "An update high-temperature superconducting Maglev measurement system,"IEEE Trans. Appl. Supercond., vol. 17, no. 2, pp. 2067–2070, Jun.2007.

[11] W. Liu, J. S.Wang, H. Jing, J. Zheng, and S. Y.Wang, "Levitation performance of high- superconductor in the sinusoidal guideway magnetic field," Physica C, vol. 468, pp. 2345–2350, August 2008.

[12] W. Liu, J. S. Wang, X. L. Liao, C. Q. Ye, G. T.Ma, J. Zheng, and S.Y. Wang, "Influence of the trapped field on the levitation performanceof the magnetized bulk height-superconductor," J. Supercond. Nov.Magn, vol. 24, pp. 1563–1569, 2011