Magnetic Levitation Train

System Block Diagrams

By:

Dusty Funk

&

Kyle Getsla

Project Advisor:

Dr. Anakwa

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Introduction

The Magnetic Levitation Train (MAGLEV) project uses the concepts of electromagnetism and electrical machinery to levitate and propel a train along a track. The previous work of Paul Friend on this topic includes the development of a laboratory scale model of an Inductrack on a rotating wheel and a train containing permanent magnets. Using his previous work as a starting point, the goal for MAGLEV will be to have a levitating train that is propelled along a track with reasonable stability and controllability.

Subsystems

The highest level system block diagram is shown in figure 1.1.

Figure 1.1 Highest Level System Block Diagram

The overall MAGLEV system is made up of two subsystems: levitation and propulsion. The levitation system can be broken into subsystems of the Inductrack and the Halbach arrays. Propulsion is done through the use of a linear induction motor. A lower level overall block diagram is shown in figure 1.2 to illustrate how the subsystems interact. The feedback signals shown in figure 1.2 are ideal and it is unlikely that this portion of the project will be completed.

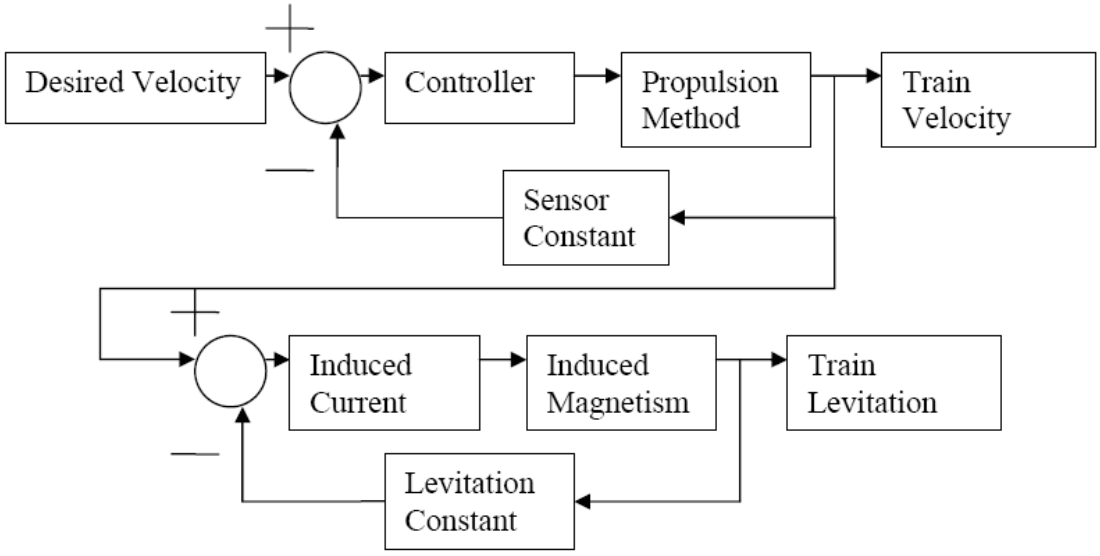

Figure 1.2 – Subsystem Block Diagram

Inductrack

The laminated sheets can be chemically or mechanically etched to create slots. Dr. Richard F. Post specifies using ten 0.5 mm thick aluminum sheets. The chemically etched slots would be 0.5 mm wide terminating 25 mm from the edge of the track. The "lands" between the slots would be 4 to 5 mm wide. An illustration of the aluminum track being used for project is shown in figure 2.1, as simulated by Lawrence Livermore National Laboratory.

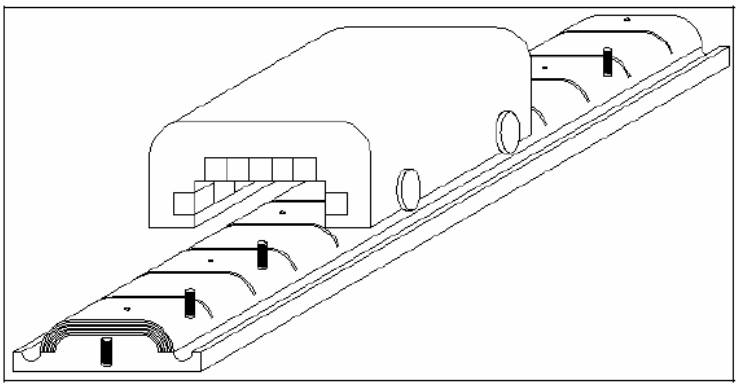

Figure 2.1 – Passive Levitation and Guidance Using Aluminum Sheets

Halbach Arrays

A Halbach array creates a quasi-unipolar magnet. The Halbach Array is created by placing magnets at 90 degree angles to each other, as illustrated in figure 2.2. The current magnets in our test setup are Neodymium-Iron-Boron (NdFeB), grade 38, 12mm cube magnets.

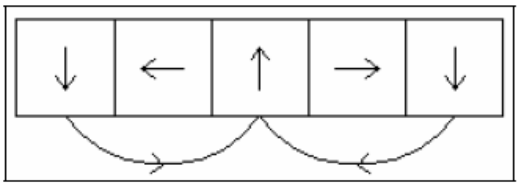

Figure 2.2 – Halbach Array

Propulsion

Propulsion is to be done through the use of a linear induction motor (LIM). The LIM is made up of a set of magnets on the train and coils of wire along the track. The motor works by using position sensors to activate coils along a track. These coils create magnetic fields that "pull" the train along the track. (*we are still researching the LIM, but we should have a diagram of this setup for the final version of this paper*). Figure 3.1 shows the theoretical block diagram for the propulsion system.

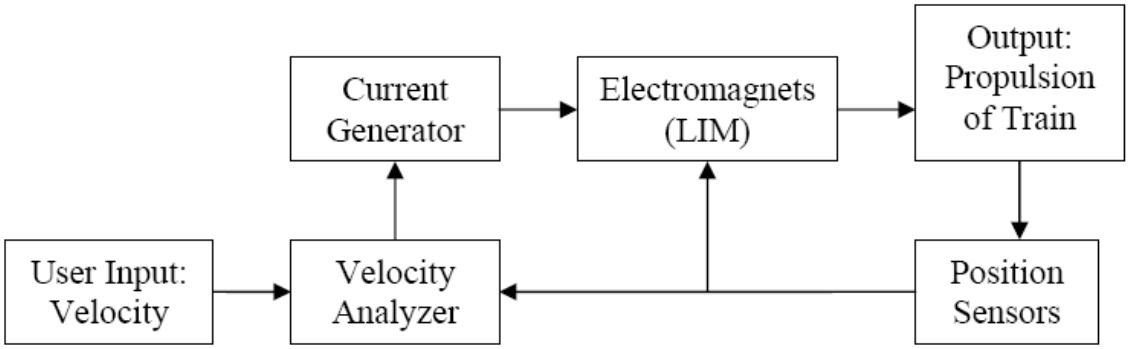

Figure 3.1 – Propulsion Subsystem Block Diagram