Improve Dimension of Projectile For Increasing Efficiency of Electromagnetic Launcher

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Abstract— **An advantage that electromagnetic launchers have over chemical ones is that they can accelerate projectiles to much higher (hyper) velocities. The present interest in electromagnetic launchers has resulted in a great competition between the two major types: Rail guns and coilguns. The purpose of modeling the coilgun is to provide a theoretical understanding of how the design parameters of coilgun such as magnetic flux density in the air gap, dimension of projectile, maximum current density repulsive force acting on the coil. Finite element analysis technique is employed to calculate the coilgun design parameters using two-dimensional analysis. This paper investigates how the coilgun design parameters affect the projectile dimensions using finite element technique. Also, the result of simulation will be proof with the experimental results.**

Keywords-coilgun, launcher, lorentz force, mesh

I. INTRODUCTION

The coilgun is a device used to launch a projectile using electromagnetic energy. It uses the magnetic field generated by the coil current to accelerate the projectile in the barrel. In fact, coilguns are electromagnetic guns that use the Lorentz Force to accelerate a projectile with a conducting armature [1] and [2]. In theory coilguns can be divided in two categories, asynchronous and synchronous [3]. In recent years, coilguns have been used by armed forces [4]. The design of coilgun depends on the magnetic flux density in the air gap, maximum current density over a coil cross section and repulsive force acting on the coil. In a practical case very high magnitude and short duration of current pulse is applied to the coil. In order to gain a quantitative understanding of these parameters it is desirable to calculate these parameters well in advance.

In this paper we try to examine two parameters influencing the increase of the launchers' projectile speed, including:

1) Change in projectile's width

2) Chang in projectile's length

This paper is prepared in 4 sections. In the first, paper describes the physical arrangement of the projectile and coil, and the second part discusses equations of analysis, and how designed requirements. The third part discusses the result of computer simulation model. Numerical results and performance estimates for a launcher are given in the fourth part, which contains also a comparison between theoretical predictions and experimental data obtained with a small laboratory model. At last, paper make conclusion in the last part.

II. COILGUN OPERATION

The typical induction coilgun has a shorted armature that current induced in it because of changing magnetic flux. Then the induced current and barrel coil magnetic field generate Lorentz forces that accelerate and compress the armature.

There are many way to simulate the coilgun when the projectile moves through the barrel. This paper uses the Finite Element Analysis (FEMM) method to simulate the process. In this method we enforce the current into coil. It presented in the Fig. 1. In the other analysis, the starting point of projectile has been constant assumed fixed and unchanged. Furthermore, as is shown in the Fig. 2, we have meshed the system in the software program.

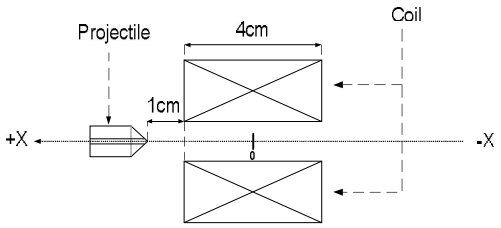

Fig. 1 the schematic of coilgun

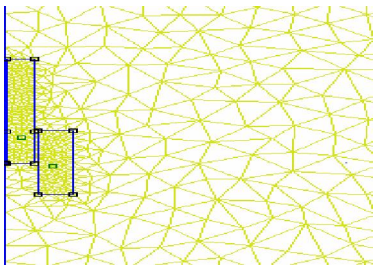

Fig. 2 Projectile and coil was meshed

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