Device for Measuring the Efficiency of Electromagnetic Launchers

Haverinen, Petteri (School: Lahden Lyseo)

The goal of this project was developing a system for measuring the efficiency of single-stage electromagnetic launchers. This device was designed to measure the amount of energy dumped into the launching coil and how much of that energy is transferred to the projectile as kinetic energy. Input energy measurement is done by measuring the voltage of a capacitor bank (2340µF total capacitance) and inserting the given values into the capacitor energy formula EC=½·CU2. Measuring output energy is done by measuring the speed of the projectile and weighing the mass of the projectile with external scale. The given values are inserted into the kinetic energy formula Ek=½·mv2. Efficiency is calculated by comparing the given values. The system was designed to be modular with easily swappable launching coils. Used applications and tools: In this project Fusion 360 was used for CAD-modeling, Cura (2.5.0) for creating g-code for 3D-printing, EasyEDA for designing electronics and LoggerPro for collecting calibration data. The tools used for creating the project were: a Prusa i3 3D-printer, ZD-931 soldering iron, wood and metal handsaws, Bosch-GSR 18 V-li cordless drill, various hand tools (such as pliers, screwdrivers, file) and CS-4025 20MHz oscilloscope. Used resources: Resources used in this project were either recycled materials, 3D-printed parts and parts or parts that were in storage, except two 2n5777 phototransistors. This resulted to some interesting technical solutions. Final product: In the end, the device was working as intended with measuring errors of ±0.5V (capacitor voltmeter) and ±0.5m/s (projectile speed sensor).

Awards Won: