Contribution ID: **222** Type: **Oral**

Armature Shape Optimization of an Electromagnetic Launcher Using Genetic Algorithm

Wednesday 21 June 2017 15:45 (15 minutes)

Barrel side and pulsed power supply module are two crucial parts of an electromagnetic launcher, which affects the efficiency. The most important feature in the barrel side is the shape of the armature.
In this study, the shape of the armature is optimized by using independent variables to define the exact geometry of the armature. The main goal is to maximize the muzzle kinetic energy of the armature.

In the literature, most of studies put emphasis on C-shaped armature geometry including most of the commercial products. However, detailed analysis on the geometry of the armature is not available in the literature. In this paper, armature geometry is divided into pieces which are used in the optimization algorithm as independent variables. Then, discrete armature shape is interpolated and used for calculation of fitness function. The fitness function results of different armature geometries are compared in the genetic algorithm. Stationary, time dependent and frequency domain analysis are implemented with this method. In the analysis of current pulse excitation of barrel, skin and proximity effects are also taken into account in the optimization algorithm.

However, developing an anaytical fitness function for armature shape is a difficult problem, because of the complexity and the non-linearity of the system. Hence, using finite element method (FEM) in evaluation of fitness function is a more accurate approach in the optimization algorithm. Although, using FEM increases computational cost of the optimization.

In this paper, detailed analysis of the effect of the armature shape to the muzzle kinetic energy is investigated. In the analysis, MATLAB is coupled with COMSOL, and a genetic algorithm optimization is implemented to compare the performance of different armature geometries. As a result, the best shape will be presented as well as the validation of FEM and optimization results with analytic study and discussion.

Authors: Mr CEYLAN, Doga (Middle East Technical University); Mr GUDELEK, Mehmet Ugur (TOBB University of Economics and Technology); Dr KEYSAN, Ozan (Middle East Technical University)

Presenter: Mr CEYLAN, Doga (Middle East Technical University)

Session Classification: Oral session 16 - Solid State Modulators and Pulsed Magnets for Accelerators, Electromagnetic Launchers - Session Chair : Michael John Barnes

Track Classification: Pulsed Power Industrial and Bio-Medical Applications