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Performance Analysis of Passive Compulsators used for EML Application with Different Compensation Shield Thickness

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Compulsators (compensated pulsed altarnators) are ac generators designed maximize the short circuit current that could be delivered to the load. The role of the compensation (active/passive/selectively passive) is to minimize the inductance of the alternator during the discharge process. Over the last three decades, many topologies of the compulsator have been evolved in order to achieve a better performance.
It was required to design and develop a compulsator for the railgun which is already available in the author's laboratory. The parameters of the existing railgun (the inductance and the resistance gradient) are calculated using a commercially available FEM software. The topology of the compulsator to be designed is rotating field, iron core, 2 poles, passive compensation. This paper discusses the variation in the performance of the system with variation in the thickness of the compensating shield of the compulsator.
From the initial performance analysis of the passive compulsators driven railgun with two different compensating shield thicknesses, two designs which result in the same peak current were selected for a detailed analysis. By performing the transient electromagnetic analysis, the following parameters are compared between the two: (a) magnetization curve, (b) flux density distribution in the air gap on no load (radial and angular), (c) current density distribution on the shield during the discharge phase of the compuslator, (d) diffusion of the magnetic field in the compensating shield produced by the armature reaction, (e) maximum stress on the armature conductors and on the compensation shield, (f) magnetic field seen by the armature conductors, (g) transient field winding current during the discharge.
The results of the study will be presented and discussed in the final manuscript.

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