Effect of Notch Dimensions in the Backside of Armature on Railgun Performance

A. KeshtkarH. B. KhanikiFaculty of Electrical Engineering, Tabriz University, Tabriz, IranAdvanced Electronic Research Center, Tehran, Iran

Abstract

Idea of notching the armature trailing, in order to improve the railgun performance, is minded by researchers from erstwhile. These improvements are observed by some experimentation. In this paper, railgun is simulated by a FEM code. Then the effects of slit dimensions on current density, field and armature accelerating force are investigated. Finally, Normalized accelerating force is plotted versus slit depth and width. Then optimized slit depth and width are obtained. Using the optimum dimensions, we can increase accelerating force and system efficiency. The variation of maximum current density versus slit depth and width, the armature accelerating force versus slit dimensions will be presented in this paper.

Key words: Railgun, FEM, Force, Notched armature.



1- Railgun 2- Lorentz

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$$\vec{J} = \vec{J}_{s} + \sigma \vec{E} \qquad () \qquad \nabla \times \vec{E} = -\frac{\partial \vec{B}}{\partial t} \qquad ()$$

$$\vec{\sigma} \qquad \vec{\mu}_{0} \qquad \nabla \times \vec{H} = \vec{J} + \frac{\partial \vec{D}}{\partial t} \qquad ()$$

$$\vec{\sigma} \qquad \vec{\partial} \frac{\partial \vec{A}}{\partial t} + \frac{1}{\mu_{0}} \nabla \times (\nabla \times \vec{A}) + \sigma \nabla V = \vec{J}_{s} \qquad ()$$

$$\vec{\sigma} \qquad () \qquad \vec{E} = \mathbf{0} \qquad () \qquad \vec{E} = \nabla \times \vec{A} \qquad ()$$

$$\vec{\nabla} \cdot \vec{E} = \mathbf{0} \qquad () \qquad \nabla \times \vec{E} = -\frac{\partial}{\partial t} (\nabla \times \vec{A}) \qquad ()$$

$$\nabla \nabla \cdot \vec{E} = \mathbf{0} \qquad () \qquad \nabla \times \vec{E} = -\frac{\partial}{\partial t} (\nabla \times \vec{A}) \qquad ()$$

$$\nabla \nabla \left(-\frac{\partial \vec{A}}{\partial t} - \nabla V \right) = \mathbf{0} \qquad () \qquad \nabla \times \left(\vec{E} + \frac{\partial \vec{A}}{\partial t} \right) = \mathbf{0} \qquad ()$$

$$\nabla \left(-\frac{\partial \vec{A}}{\partial t} - \nabla V \right) = \mathbf{0} \qquad () \qquad E + \frac{\partial \vec{A}}{\partial t} = -\nabla V \qquad ()$$

$$\vec{E} = -\nabla V - \frac{\partial \vec{A}}{\partial t} \qquad ()$$

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 $\vec{A} \times \vec{n} = 0$ روی مرزهای S₁,5₂,5₃ $\vec{A}\vec{n} = 0$ روی یقیۂ مرزها ديوارة الكثريكي () = 1⁄2 روى مرز ا 5

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