

SECTOR:
LAND SYSTEMS

OFFERINGS:
CUSTOM ENGINEERING
SOFTWARE

TECHNOLOGY:
ELECTROMAGNETICS AND
STRUCTURES

CUSTOMIZED SOFTWARE FOR STRUCTURAL DESIGN OF ELECTROMAGNETIC RAIL GUN

Our customer is an armament group that is engaged with development of rail gun to fire projectiles with high kinetic energy. A rail gun is an electrically powered launcher based on principles of electromagnetic forces to accelerate projectile. A typical design, consisting of two parallel rails and a moving armature, is likely to experience 100 kA of current during the operation. The corresponding repulsive force between rails will be as high as \sim MN/m. The ability of proposed housing structure to withstand such force is to be ascertained using finite element method.

Zeus Numerix simulated this multi-physics problem into two parts. First part was development of a module (pre-processor + solver) based on Biot Savart law to calculate magnetic field and, thereby, Lorentz force and inductance for the whole system. Second part was development of a utility to transfer Lorentz force as volumetric load distribution for carrying out FE analysis in ANSYS v12. A series of validation studies were conducted to ascertain correctness of individual modules.

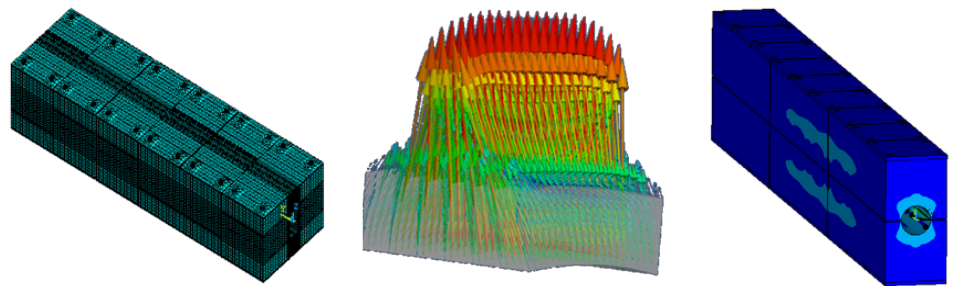


Figure 52: (a) Hexahedral meshing (b) Lorentz force vector (c) Stress distribution

Since the final design of rail gun is yet to be arrived at by the customer, a custom-built parametric software package was delivered to the customer. The package has been successfully operationalized for three components viz. Rails, Transmission Line and Bitter Coil. Integrated approach of the package enabled user to conveniently analyze and design housing structures based on the input of current distribution.