SECTOR:
LAND SYSTEMS

OFFERINGS:
ENGINEERING SIMULATION SERVICES

TECHNOLOGY:
STRUCTURES

STRUCTURAL ANALYSIS OF ARTILLERY SHELL DURING IN-BORE TRAVEL

Our customer is large defence organization working on the development of artillery shell for its new 155 mm gun. During in-bore travel, the shell is subjected to large amounts of loads typically due to axial acceleration and high temperature due to gas pressure, centrifugal force of rotating mass, rotational acceleration through driving band, large frictional forces on the bands etc. It is possible that due to large loads either the shell structure or the driving band may fail, resulting in loss of projectile. The customer desires to estimate the load and find the factor of safety in each of the component.

Zeus Numerix did CAD cleaning job and used appropriate elements to make a fine mesh with half a million nodes. Places where the stresses should be high were given a higher mesh density. The tail experiences hundreds of MPa of pressure and causes the shell to accelerate. Simulations were carried out on the shell body assuming the material to be linear and nonlinear. Differences in the stresses were noted for both. Most complicated simulation was done on the driving band as the band experiences axial compression, radial deformation, and frictional forces due to engraving. After the completion of simulations for individual load cases simulations for done for combined load cases. Finally, modal analysis was carried out to find the natural frequencies of the shell.

Figure 1: Sample image above and caption

It was seen that the stress state of shell body is primarily dictated by the gas pressure. Locations of high stresses were found on the shell and the driving band. Impact load on the nub that finally transfers to the shell was also indicated. Final results indicated that the shell would be safe in most cases, but the customer will have to redesign the driving band.

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