Case Study

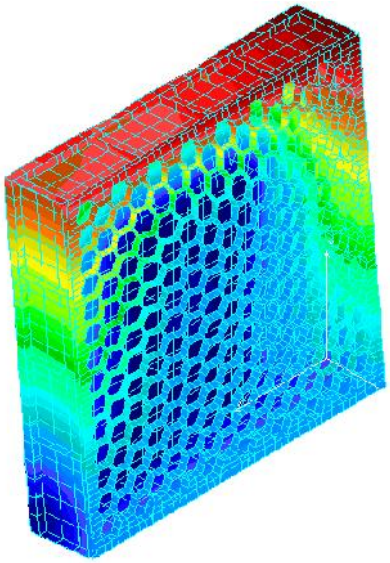
Defence Equipment Frequency Response Analysis

Description

An analysis was required on a missile defence product for a UK aerospace defence company. This equipment was to be subjected to a wide range of shock and random vibration loads during operation, so a a Finite Element Analysis was required to model these conditions.

The geometry was modelled using “shell” and “beam” elements. The unit was mounted on “spring” elements to reproduce the correct mounting stiffness.

Time domain shock loads and frequency domain random vibration loads were applied in all three axes and displacement and stress levels calculated to ensure acceptable mechanical integrity.



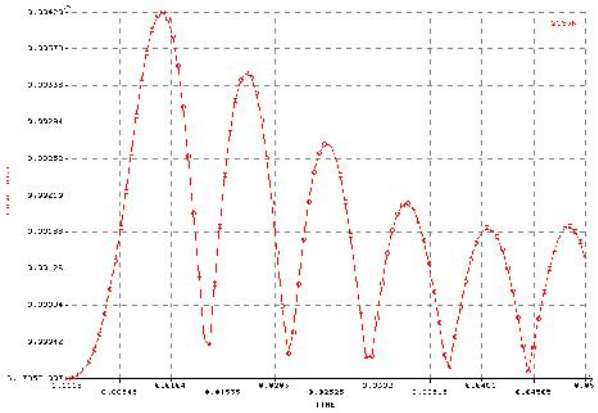
FE Model 1st Mode Shape

Specification Summary

- Coupled beam & shell finite element model
- Main structure aluminium alloy LM6 & SS S130
- Modal analysis undertaken to assess first 10 Modes, ranging from 47 Hz to 215 Hz
- 40g, 11 ms sawtooth shock load case in each direction investigated
- Random vibration curve @ 5 Hz, Power spectral density = 0.05; @ 7 to 9 Hz, PSD = 0.25; @20 to 200 Hz, PSD = 0.02 G^2 Hz
- Response calculated with critical damping ratio = 0.05 to 0.15
- Maximum stress levels and displacement investigated for shock & vibration loads at critical time points

Disciplines Used

- Vibration Finite Element Analysis
- Modal Analysis
- Frequency Response



Forced Vibration Response