Keywords: Femap, NX Nastran, Stress Analysis, Vehicle Antenna, Normal Modes Analysis, Linear Contact, Plastic thread analysis, wind loading, failure analysis

Main Graphic:

Trailer mounted antenna

Analysis Type: Static Stress, Linear Contact, Normal Modes

MOBILE AND SPACE-BASED ANTENNA STRESS AND VIBRATION ANALYSIS

A vehicle mounted antenna was analyzed (see Figure 1) for stress, deflection and natural frequencies. This analysis inspected the resulting stresses based on pressures generated by a CFD drag analysis of the antenna moving at 80 MPH down the road. Additionally, a normal modes analysis was performed to determine if the natural frequency of the structure was within the range of standard road noise.

The antenna was meshed with solid elements (see Figure 2) and linear contact was enforced between the different parts. Linear contact was used to fully understand the interaction of the plastic threads so that they could be correctly sized. As many designers already know, a plastic thread benefits from its own unique thread profile. Stress and deflection results confirmed our client's confidence that the design was adequately robust to survive "Indy Race Track" –like conditions.

The normal modes analysis showed that there was no chance that typical road noise would excite any of the natural frequencies of the antenna system from mount to deployment. This analysis provided detailed information to the client allowing them to have high confidence that their product would meet the design requirements.

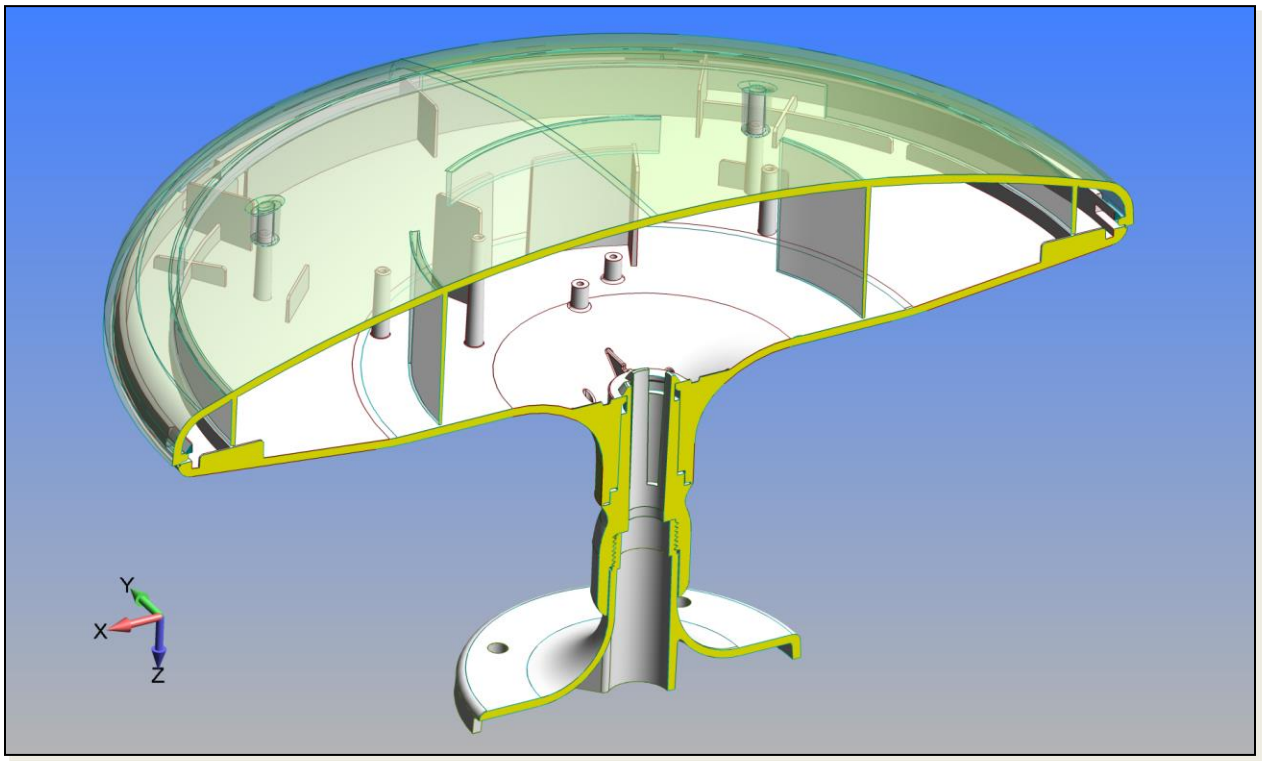

Figure 1: The CAD geometry used to build the finite element model.

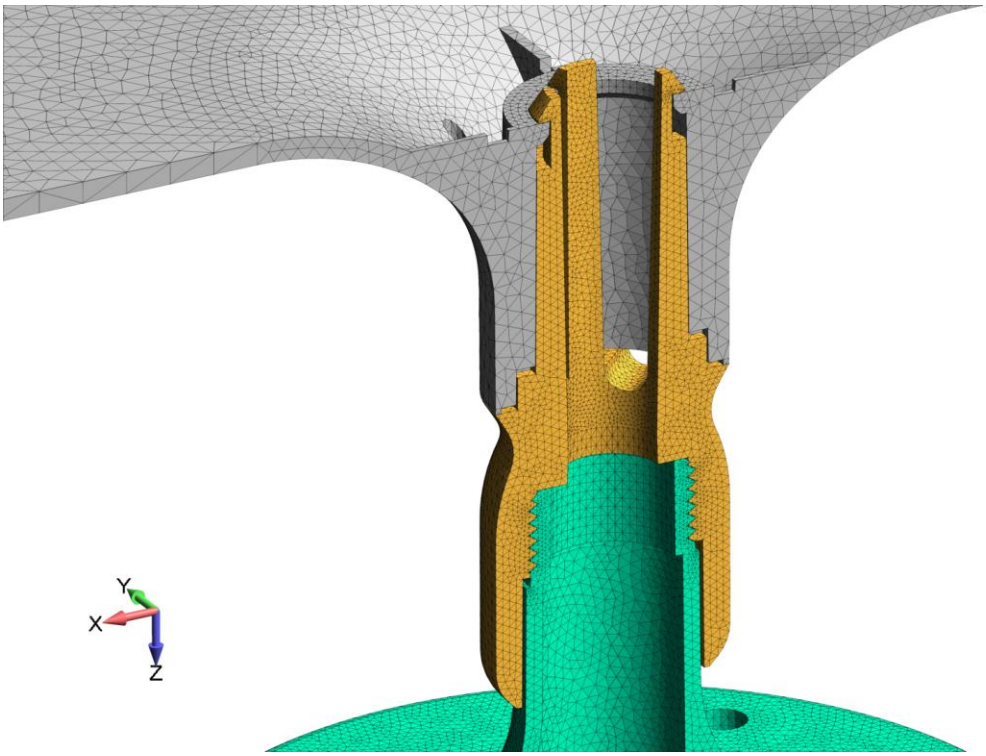

Figure 2: Solid element model of the structure.

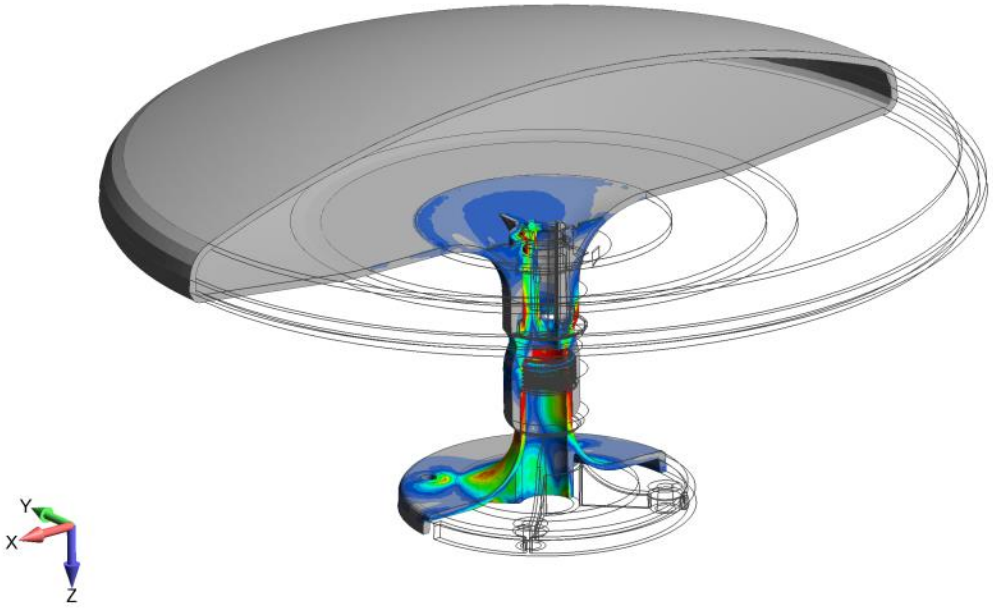

Figure 3: Stress contour plot.

Predictive has done other antenna analyses for aerospace (see Figure 4) where optical signals were focused onto high-precision ceramic mirrors.

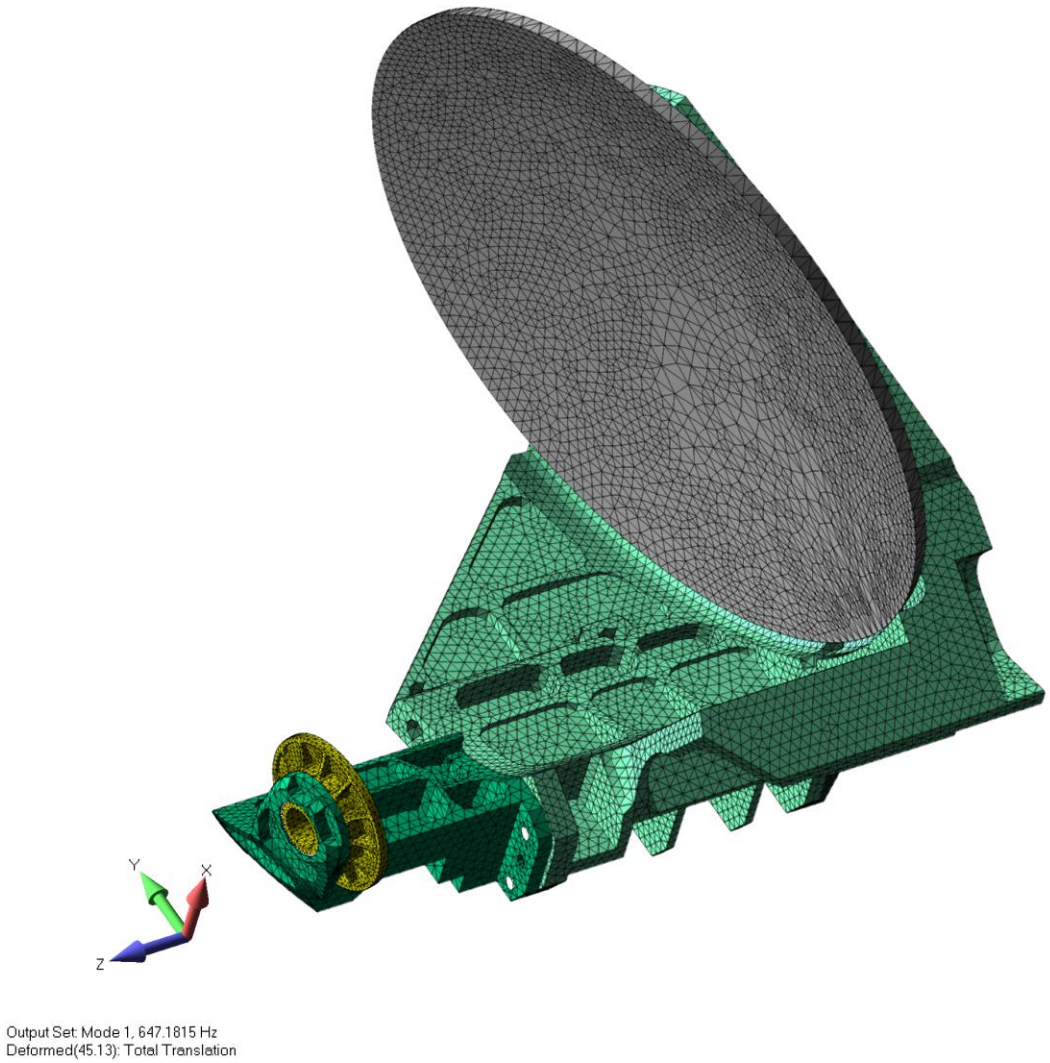

Figure 4: SiC ceramic antenna assembly for high-precision optical work

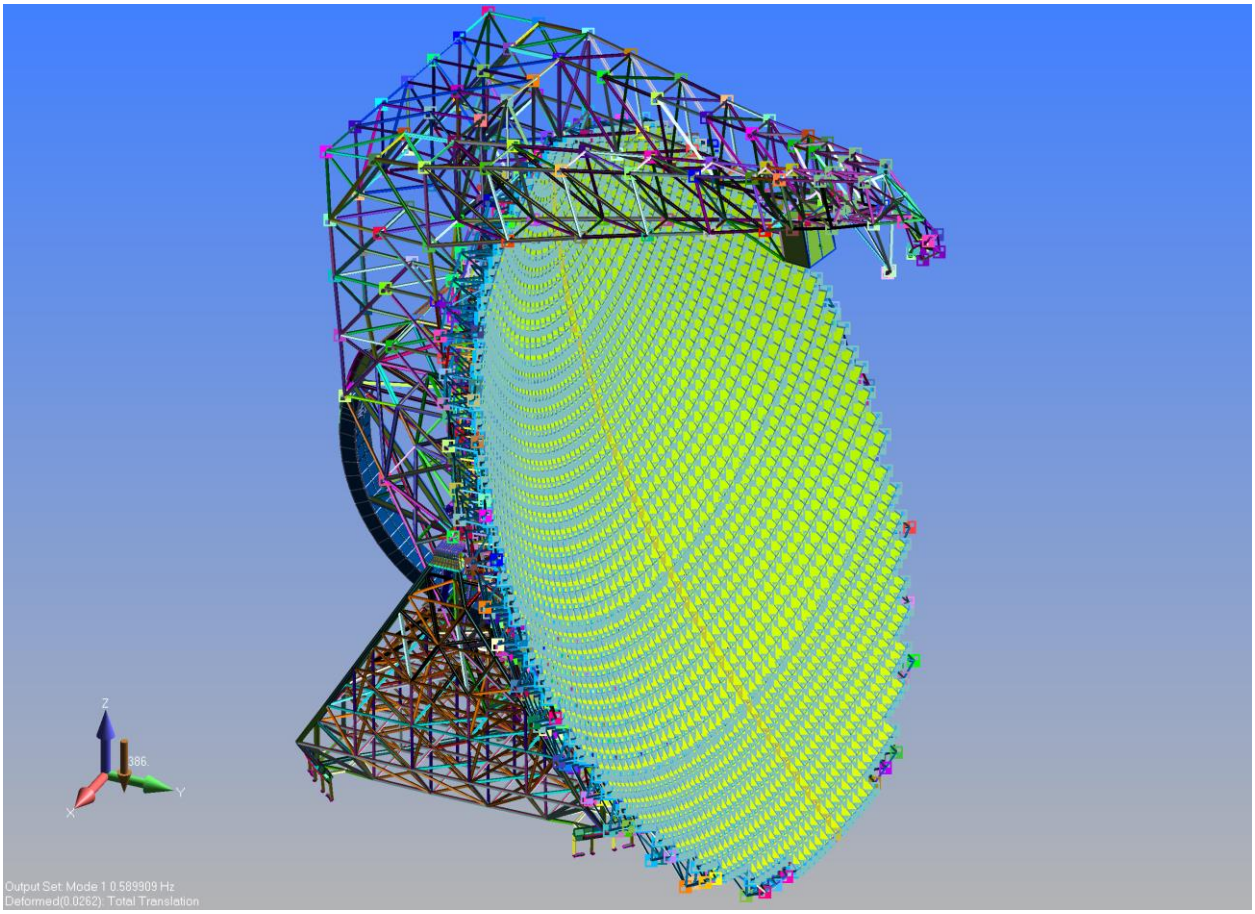

Figure 5: And from one of our clients, this beautiful antenna deep-space observation. Courtesy of the NRAO