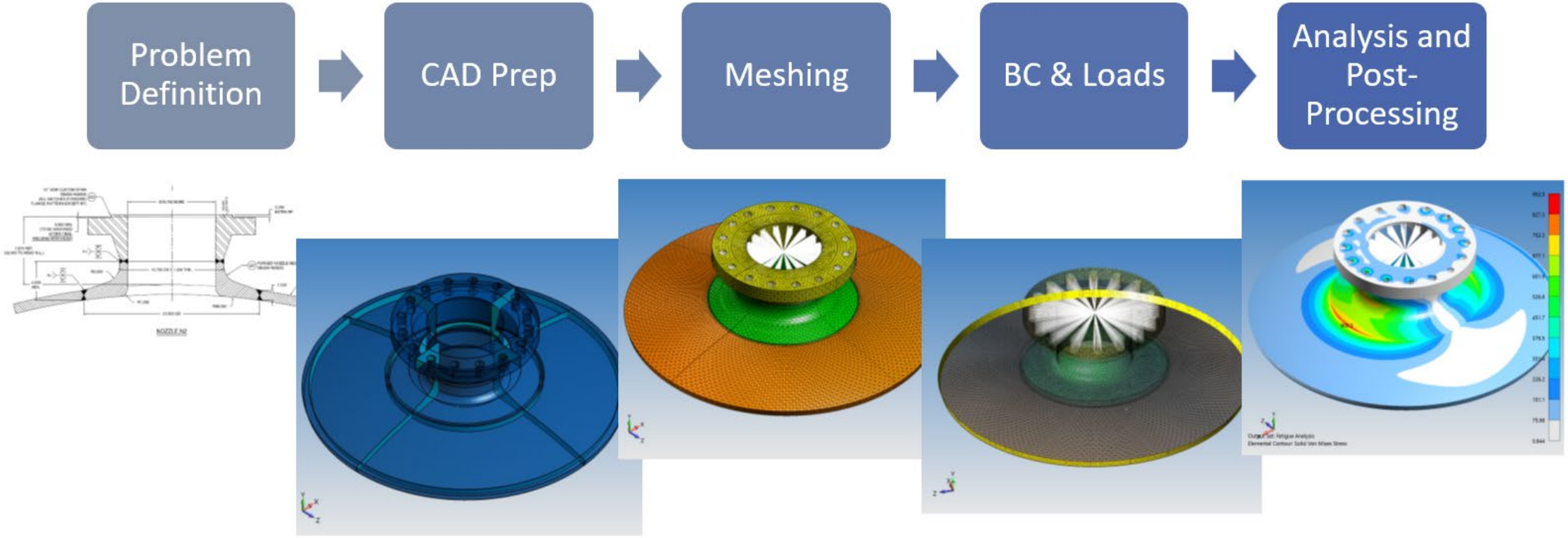
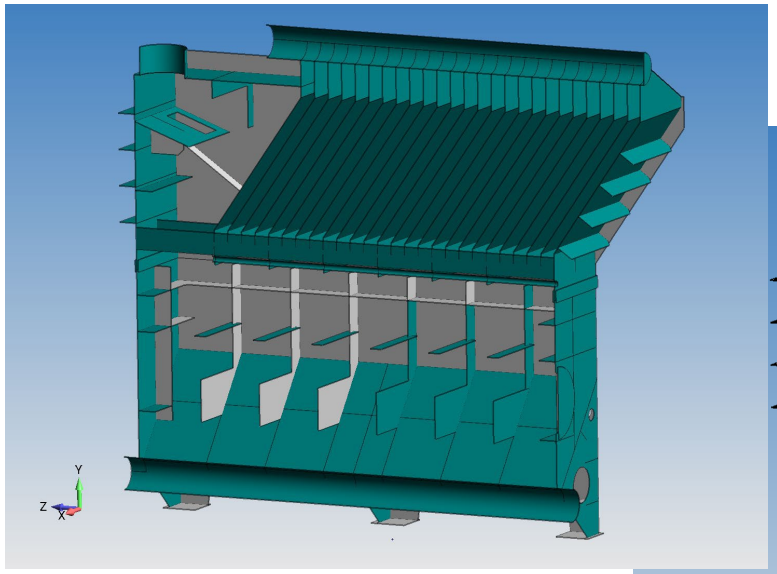
FEA Application for Industrial Equipment

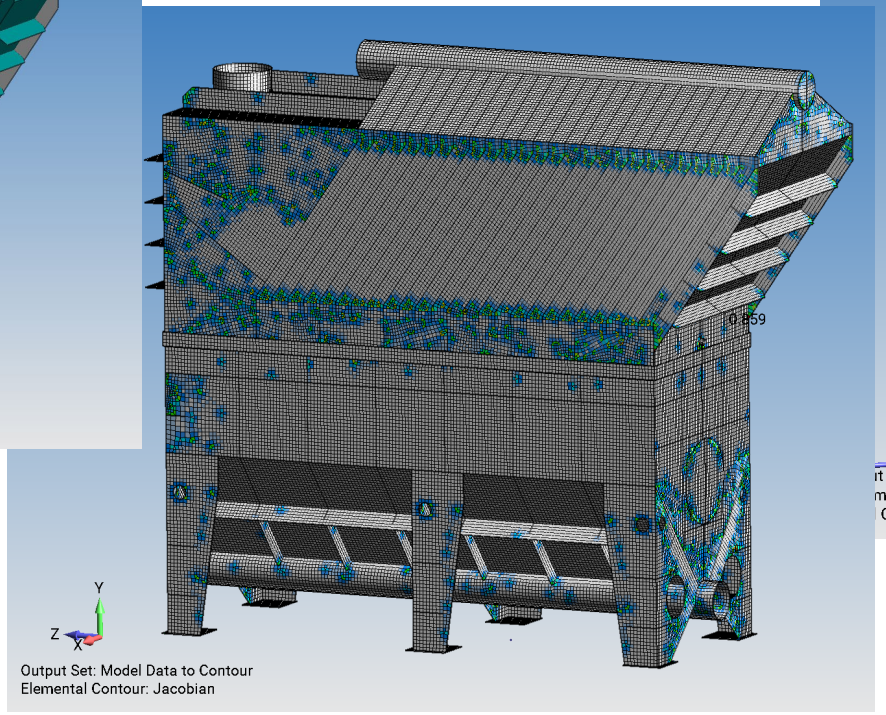
Introduction

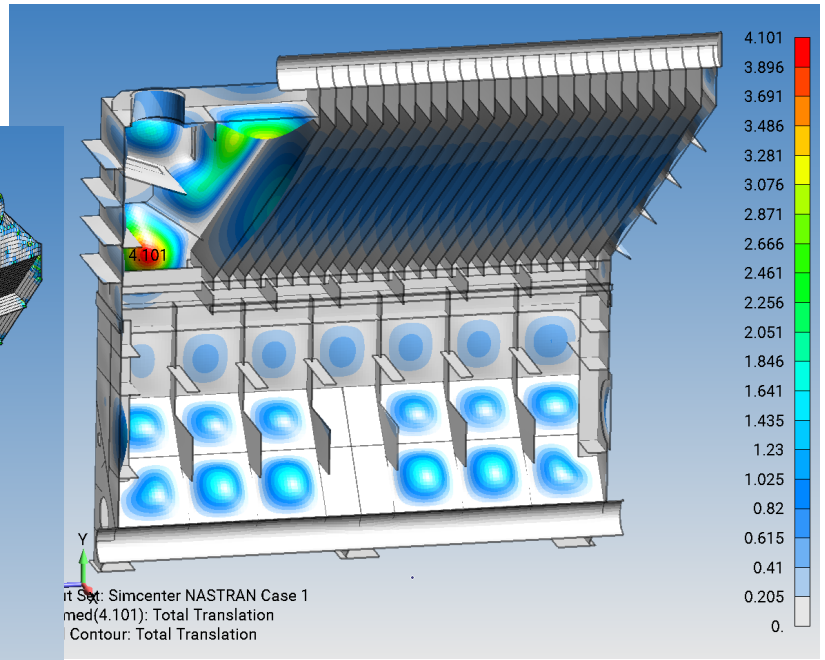
Finite element analysis, or FEA, is a powerful tool for evaluating structural performance under realistic operating conditions. At Predictive Engineering, we use FEA to simulate stress, vibration, and fatigue across a wide range of industrial equipment to determine potential weak points, longevity, and reliability, sometimes before the initial prototype is even made. This FEA-driven approach helps us catch design flaws early, avoid over-engineering, and confirm compliance with ASME and customer specs before fabrication.



Mass Optimization and Structural Analysis of Separators

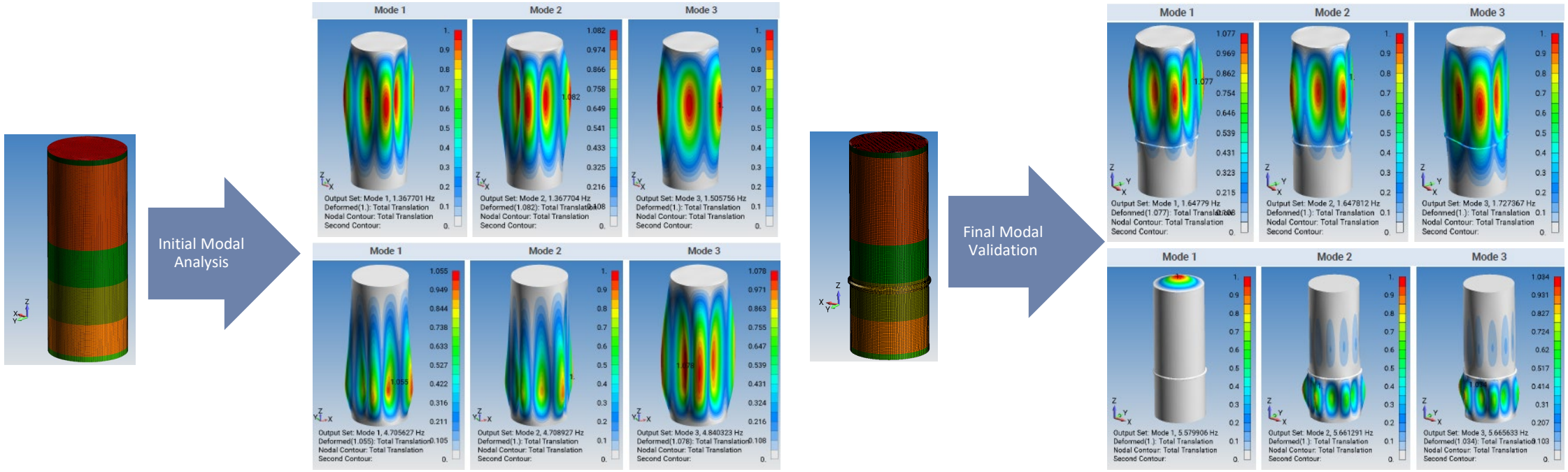






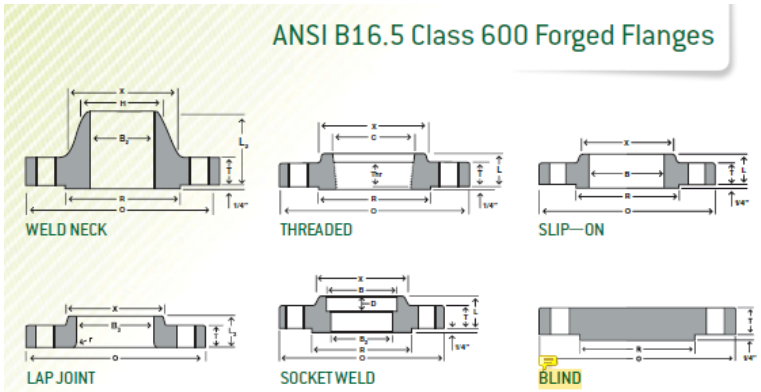
In this project, we ran a structural FEA to evaluate weight reduction strategies for a separator. We modeled both the baseline and modified designs using Simcenter Femap and solved them with Nastran. To improve efficiency, we used quad shell meshing and tested multiple plate thicknesses. We benchmarked the results against material yield limits to ensure structural safety. In the end, the optimized configuration achieved meaningful weight savings without compromising mechanical integrity.

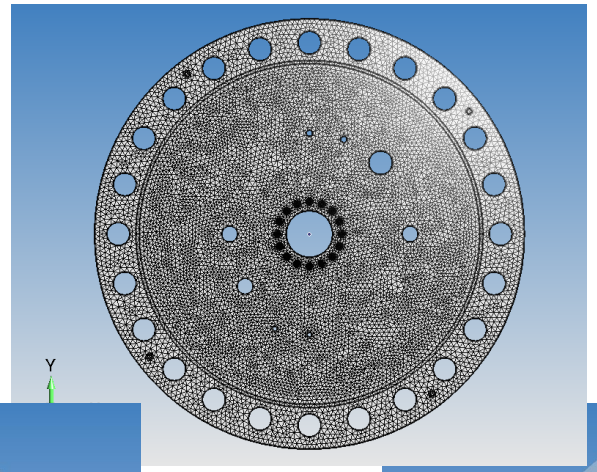
Modal Analysis of Water Storage Tanks

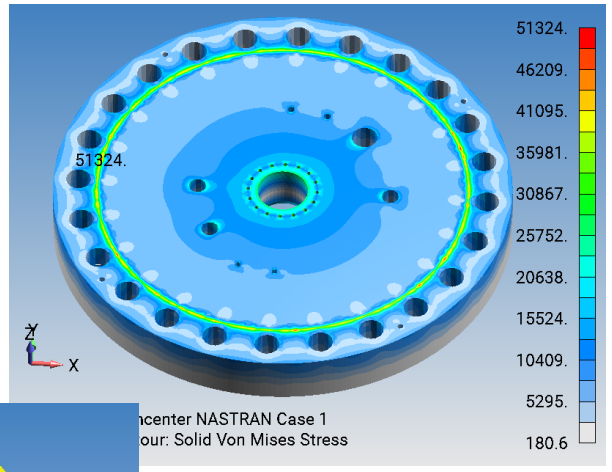


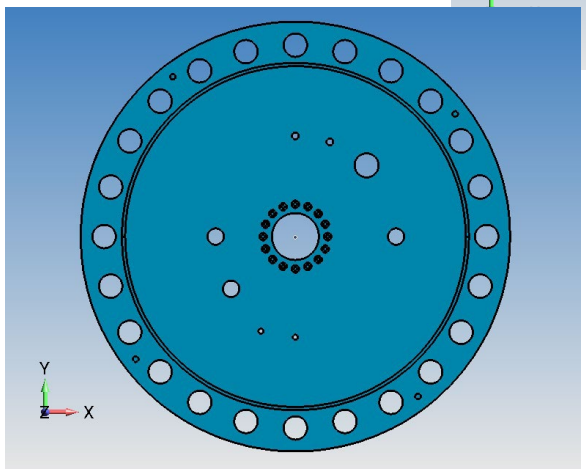
We performed a modal analysis to assess the vibration characteristics of water storage tanks. Using Simcenter Femap and Nastran, we modeled the tanks at multiple fill levels to identify natural frequencies and mode shapes. The initial analysis revealed modes that could align with operational excitation. We then refined the design by adding stiffening rings, which shifted the critical frequencies. A final validation confirmed that the updated design would reduce resonance risk and ensure reliable long-term operation.

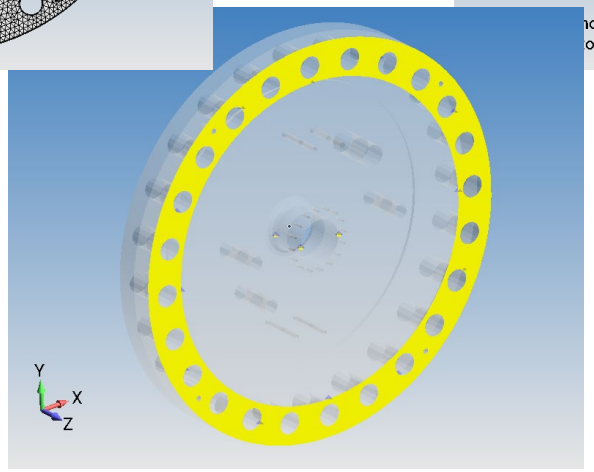
Stress Analysis of Blind Flange





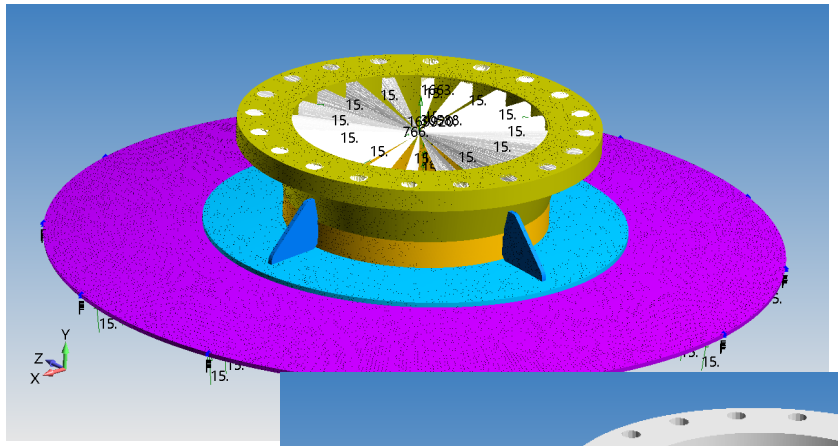


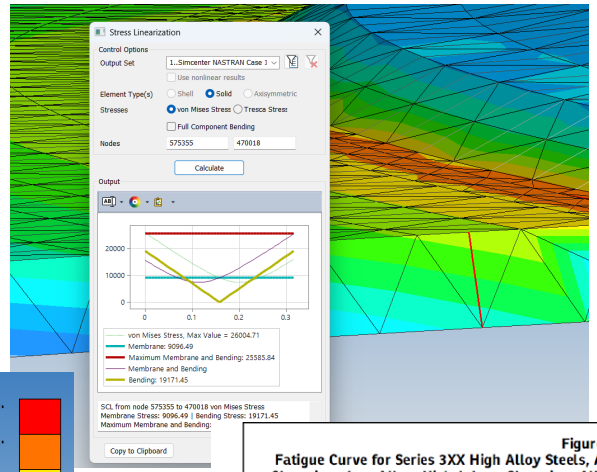


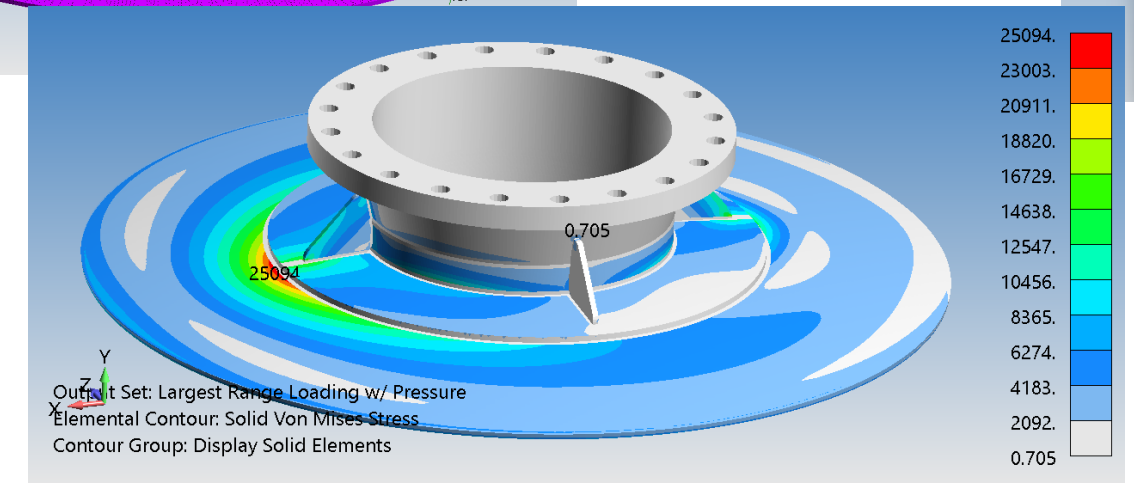


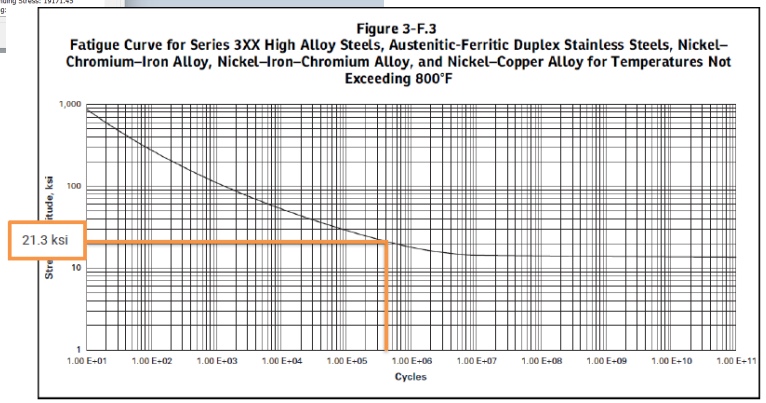
We performed a detailed stress analysis on a blind flange to ensure compliance with ASME Section VIII, Division 2. The model was built in Simcenter Femap using a high-fidelity tetrahedral mesh. We applied internal pressure, hydrostatic test conditions, and bolt preload as contact pressure on the gasket surface. We then evaluated membrane, surface, and peak stresses against ASME code limits. All results passed with adequate safety margins. This analysis gave the client confidence in the flange's reliability and helped streamline fabrication and code approval.

Stress and Fatigue Verification of Industrial Agitator Supports









We conducted a finite element analysis on industrial agitator supports to evaluate stress and fatigue under combined mechanical and pressure loading. The model was built in Simcenter Femap using 10-node parabolic tetrahedral elements. We applied pressure, axial, bending, and torsional loads and evaluated the results against ASME Section VIII, Division 2 criteria. Fatigue life was assessed using smooth bar design curves. The analysis confirmed compliance with all allowable limits and helped reduce design cycles, giving the client a fast, cost-effective path to verification.

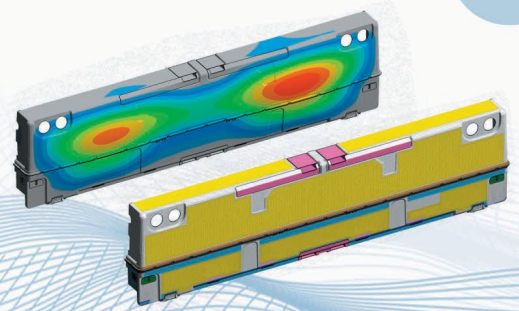
Predictive Engineering – The Advantage of Getting it Right the First Time

FINITE ELEMENT ANALYSIS
Predictive Engineering

Finite element analysis consulting services, software, training and technical support.

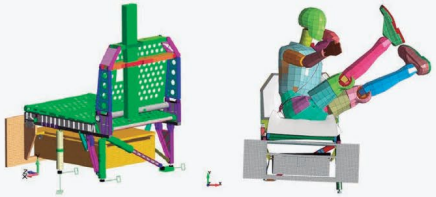
- Composites, Pressure Vessels, Vibration.
- **NASTRAN:** Linear Dynamics.
- **LS-DYNA:** Drop-test, Impact, Burst Analysis.
- **STAR-CCM+:** CFD Thermal/Flow Analysis.

+20 years experience

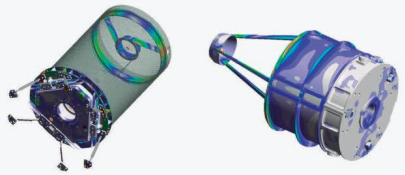


Project Examples

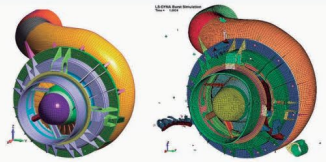
FAA 16G SLED TEST VERIFICATION



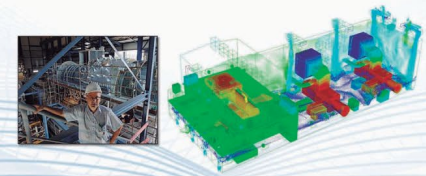
STRESS AND VIBRATION ANALYSIS OF SATELLITES



LS-DYNA TURBINE BURST SIMULATION



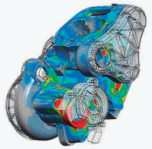
CFD STUDY ON CO-GENERATION POWER PLANT BUILDING



Our Services

FEA

Predictive Engineering brings to bear more than 20 years of finite element analysis FEA consulting experience in solving the most difficult mechanical engineering analysis challenges.
Our validated experience ranges from transmissions to submarines to satellites.



TRANSIENT NONLINEAR

At Predictive Engineering, we pride ourselves on the ability to idealize complex structures and systems into predictive numerical models. Our nonlinear, static and transient dynamic work has been validated against strain-gauges, drop and sled test results, accelerometers, crack growth and fracture and in extreme service environments.

ASME-BPVC

From seismic to buckling to cyclic service (fatigue), Predictive can assist in verifying the most challenging pressure vessel designs. Our hard-earned experience allows us to safely classify tanks and vessels as "fit-for-service" that would typically have required extensive redesign or re-work.

CFD

Our expertise in computational fluid dynamics (CFD) comes from hundreds of thermal-fluid projects in medical, aerospace, marine, HVAC (data centers), civil and automotive. This experience gives us the capability to quickly optimize and provide accurate digital prototypes.