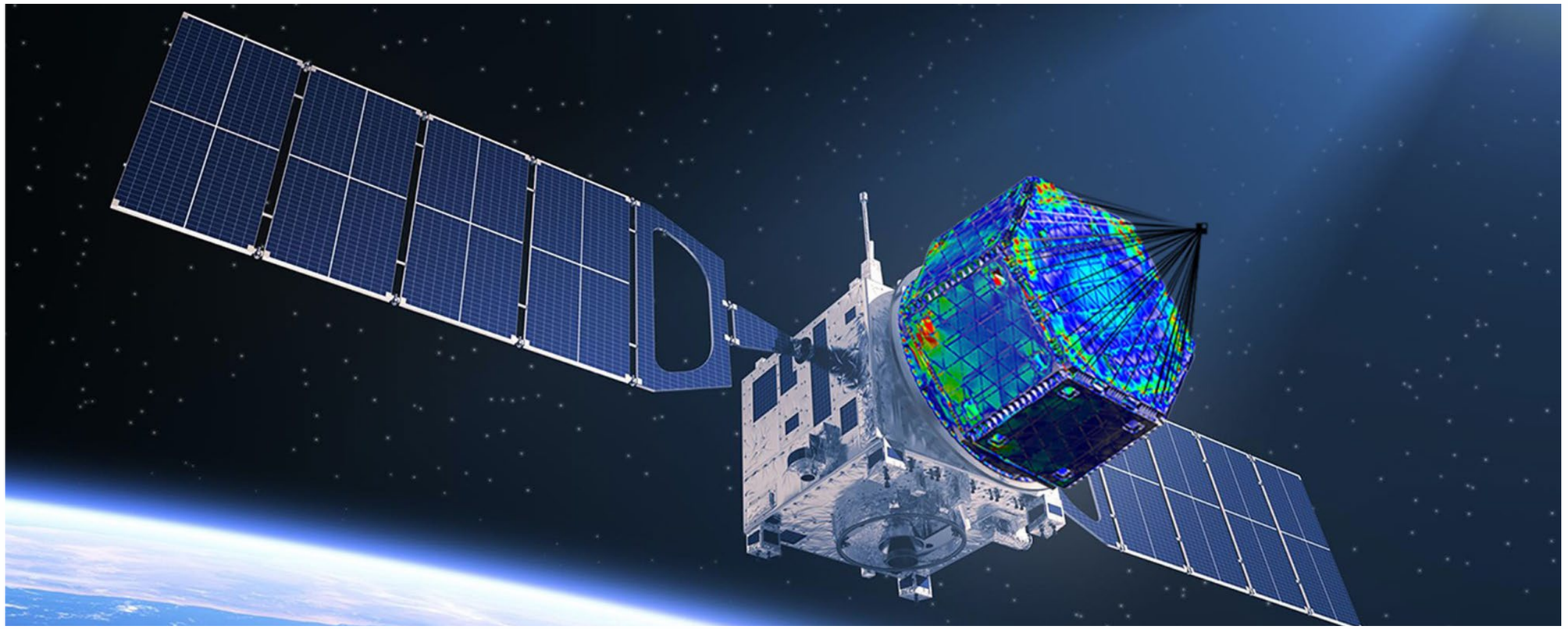


Finite Element Analysis

Idealization of Structures and Systems into Predictive Digital Prototypes

info@predictiveengineering.com
www.predictiveengineering.com
(503) 206-5571

FINITE ELEMENT ANALYSIS PredictiveEngineering

Predictive Engineering brings to bear more than 20 years of FEA consulting experience in solving the most difficult mechanical engineering analysis challenges. We are experts in composite analysis from design to progressive ply failure to fracture.

Stress and Fatigue

- Stress analysis of structures and systems where a high degree of idealization is required to obtain accurate results;
- Fatigue analysis of transmissions, gear cases, tooth and sprocket systems, rotating equipment from low-cycle to high-cycle;
- Fluid-Structure-Interaction (FSI) physics in composite structures (pressurization/depressurization).

Vibration

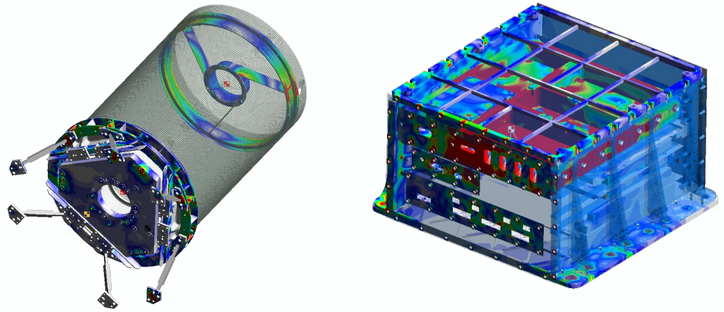
- Vibration analysis of vibratory equipment (e.g., screens and transport shakers);
- PSD analysis of satellites, electronic and automotive components, medical, etc.;
- MIL-STD-810E for vibration qualification with aerospace composite structures to military electronics.

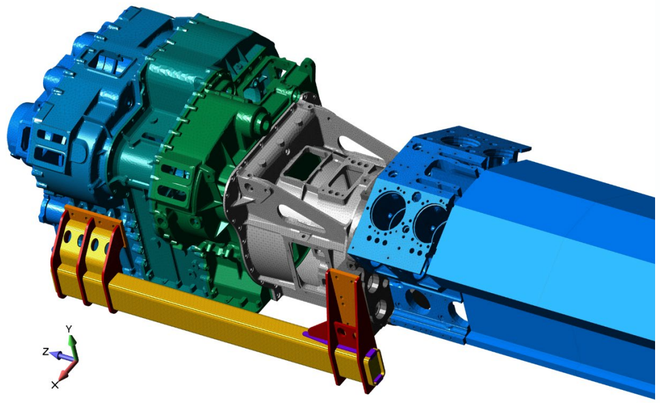
Thermal-Stress

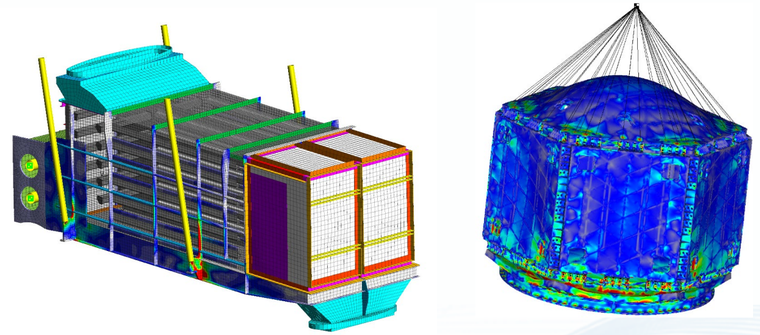
- Coupled thermal-stress analysis of aviation and space-based instrument packages including digital switches, optical devices and composite systems to small satellites;
- Generators and compact turbine housings subjected to transient thermal cycles and fatigue damage;
- Thermal damage analysis due to welding, large castings and forgings, metallurgical based interpretation of transient thermal time (TTT) response.

Fracture and Low-Cycle Fatigue Material Science Expertise (Forensic FEA Engineering)

- Practical, material science-based fracture mechanics analysis coupled with fatigue analysis of damaged components from upset conditions to accidents.



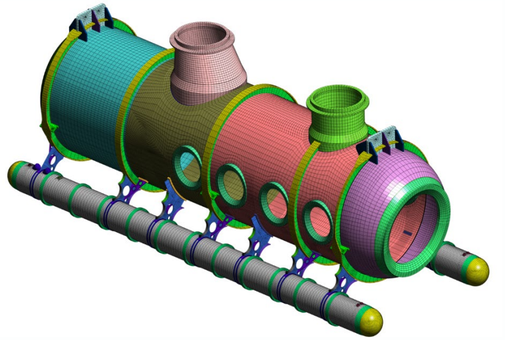




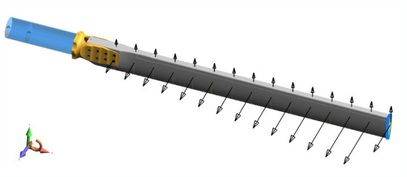
FINITE ELEMENT ANALYSIS PredictiveEngineering

Stress Analysis: Sea to Sky

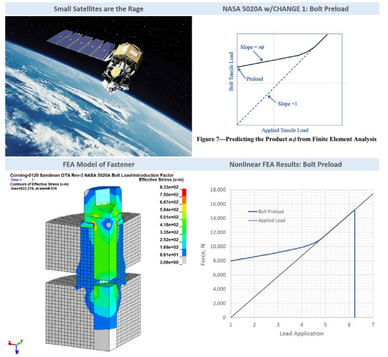
Deep-Diving Luxury Submarine (ASME and ABS Certified)



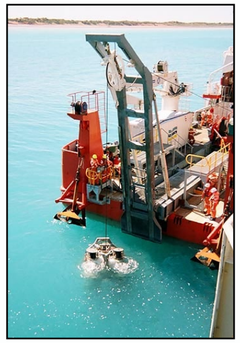
Rotating Wing Structures

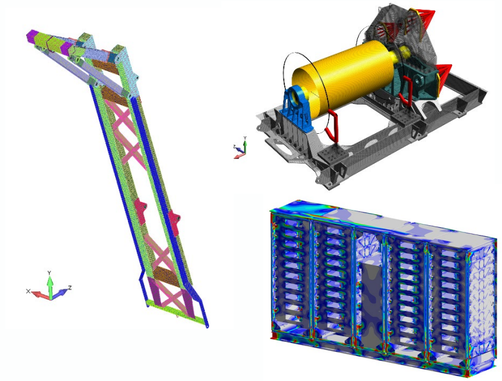


NASA 5020A Bolt Calculations

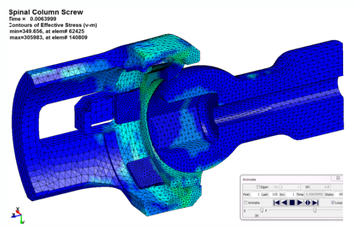


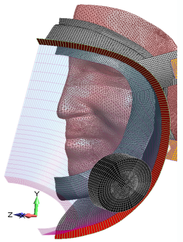
Ship-Mounted Cranes, Winches, Electronics Gear



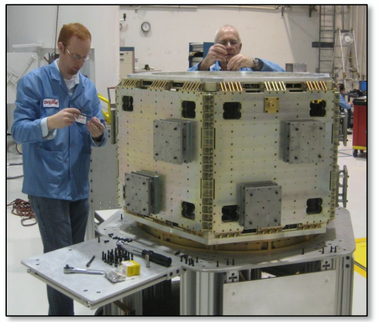


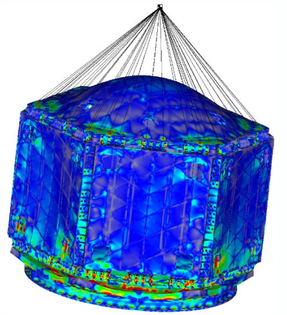
Medical Simulations: Spines to Syringes

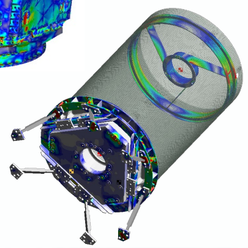




Satellite Analysis: Stress, Vibration, PSD and Thermal





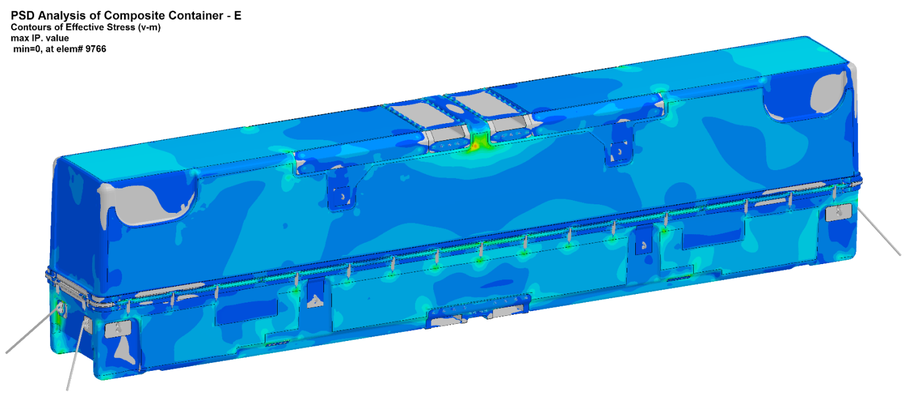


Our experience in stress analysis has been earned over the years through hundreds of projects using most major engineering codes from DNV, API, ASCE, NASA and ASME. We have analyzed structures and systems from most major industries.

FINITE ELEMENT ANALYSIS PredictiveEngineering

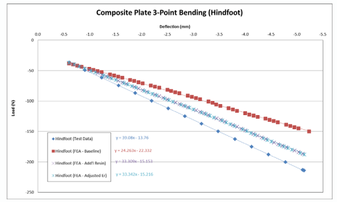
Composite Analysis: Design to Ultimate Load Analysis

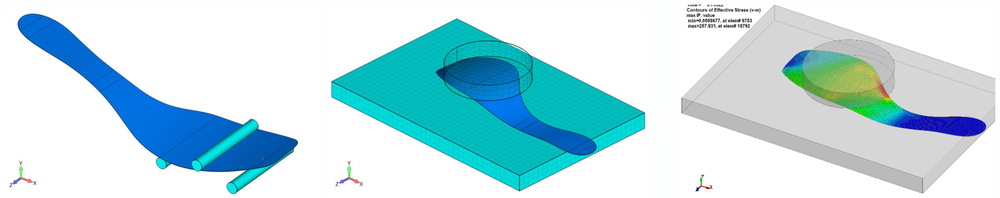
Mobility Testing of Composite Containers: Lift, Rail Impact, Drop Test and Transportation Loading



Broad composite experience in aerospace, consumer to military applications. We understand the material science and the mechanics of composite materials, and our work has been validated in the field and in the laboratory.

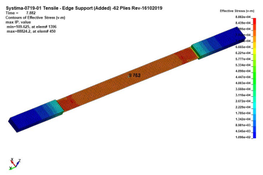
Consumer Composite Analysis: Carbon-Epoxy

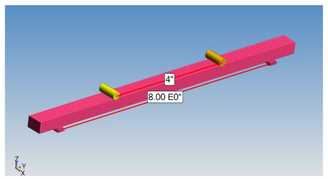




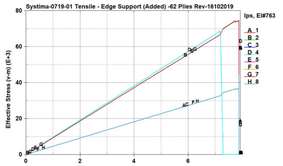
Advanced Composite Analysis with Progressive Ply Failure

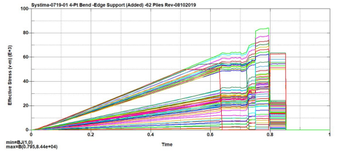
You Get the Idea	Composite Tensile Test Analysis	Composite Property Development Against Testing





Progressive Ply Failure under Tension	Progressive Ply Failure under 4-Pt Bend Testing

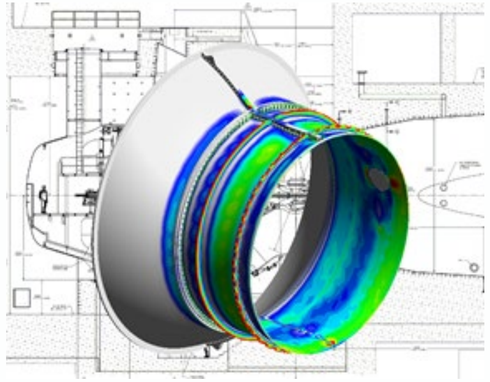


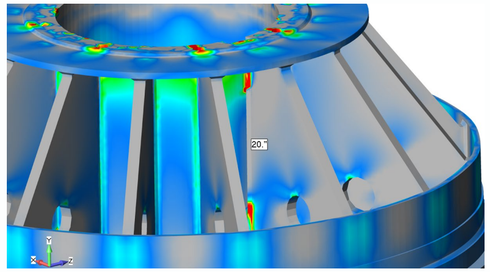


FINITE ELEMENT ANALYSIS PredictiveEngineering

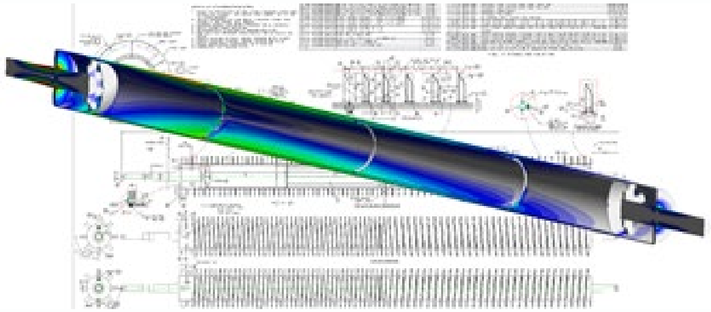
Fatigue and Fracture Analysis

Large Welded and Bolted Structures: ASME Part 5.5 Protection Against Failure from Cyclic Loading

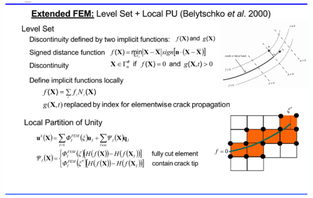


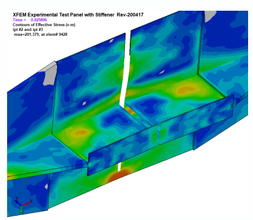


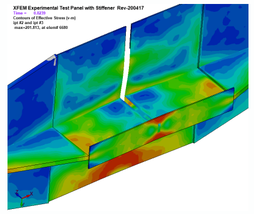
Large, Rotating Machinery



Fracture Mechanics: LEFM to X-FEM

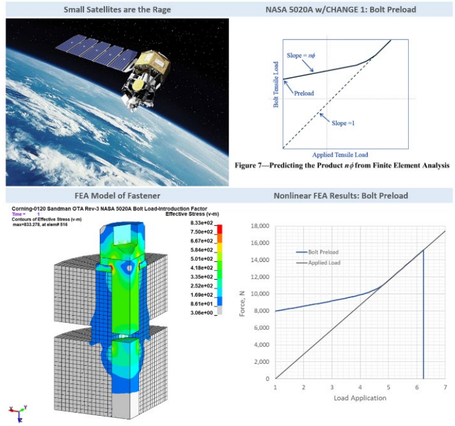




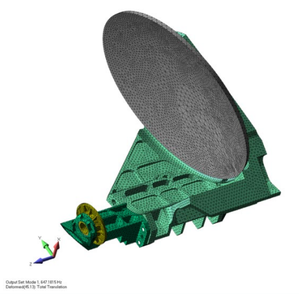


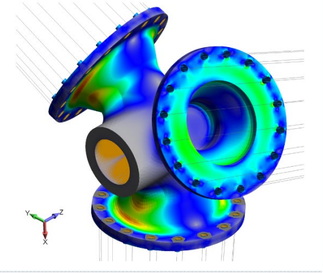
NASA 5020A Bolt Calculations

Summary of NASA 5020A: Use lots of Shear Pins and Low Bolt Preload (If Possible)



Low- to High-Cycle Fatigue

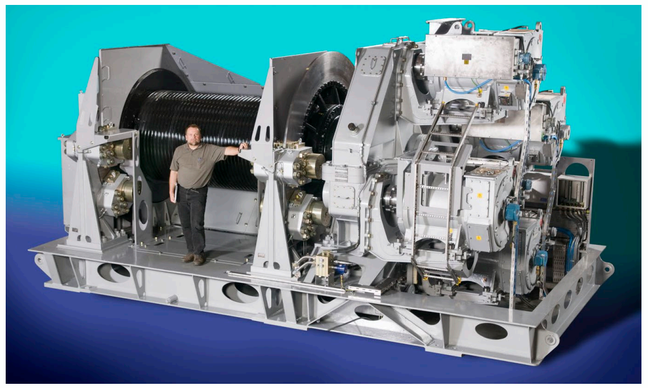


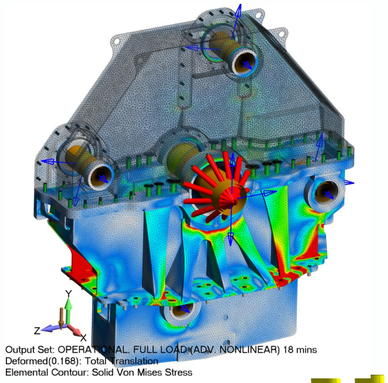


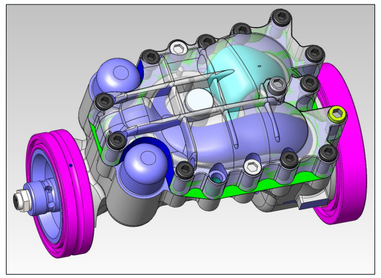
Our work speaks for itself. We are practical experts in fatigue and fracture analysis with academic, scientific and in-the-field experience.

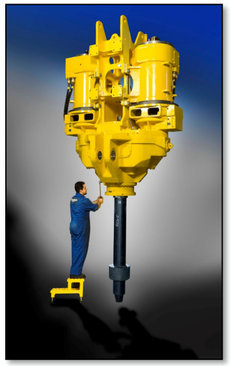
Transmission: Stress and Vibration Analysis

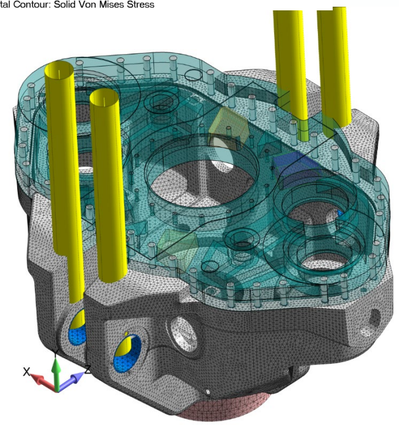
Gearboxes, Winches, Etc. – Off-Shore / On-Shore



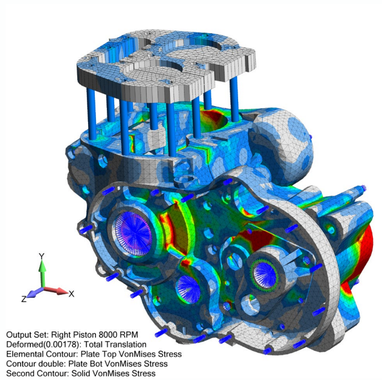


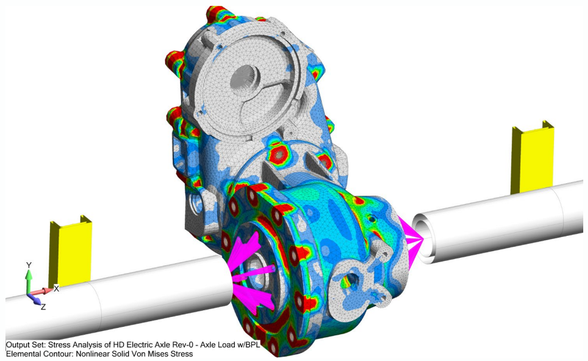




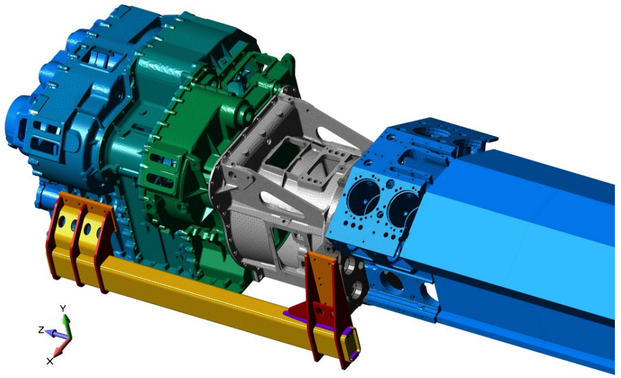


Motors to Differential Gearboxes





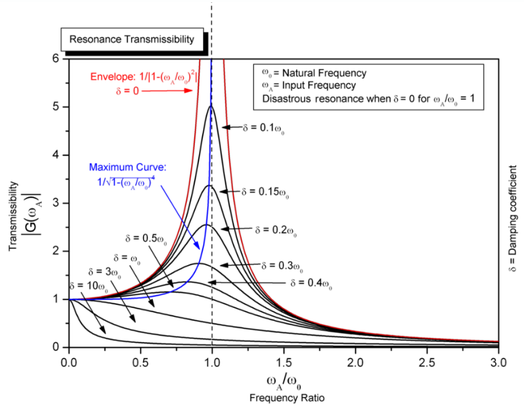
8-Speed, Dual-Shaft Transmission Pump

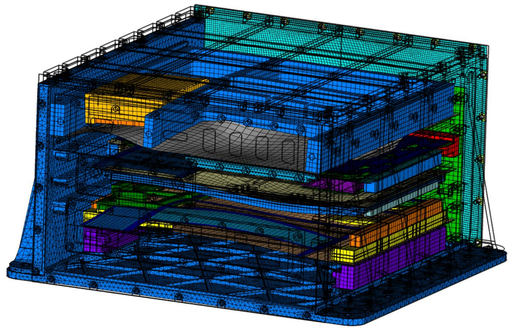


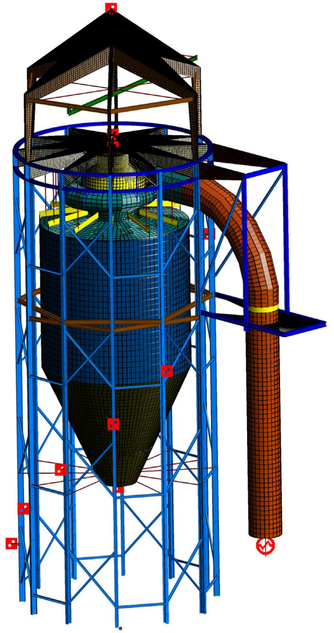
We have analyzed dozens of gearboxes, transmissions, motors, and other mechanical power generation and transfer equipment. As simulation engineers, one of the joys of our work is to see these structures built and operating “as designed and as analyzed”.

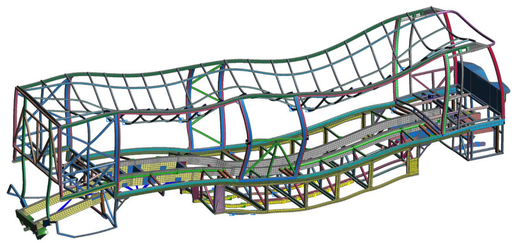
Engineering Dynamics: Our Fundamental Skill Set

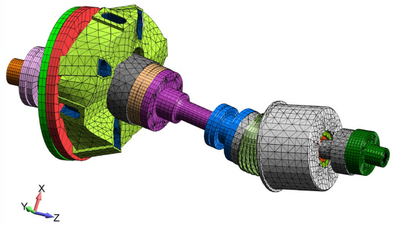
Experienced in the Design Theory behind: Flight Electronics, Transportation to Seismic Analyses



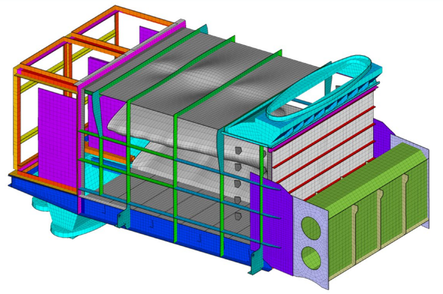


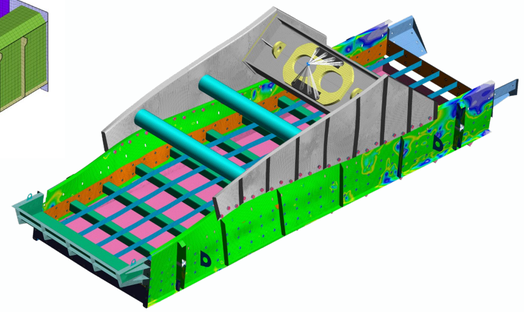


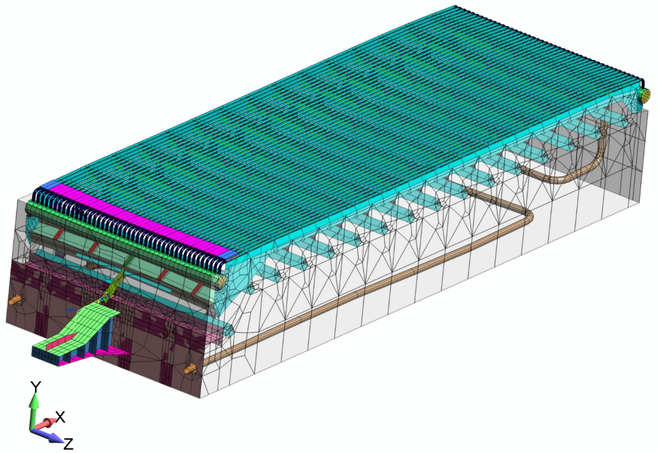




Decades of Experience with Shakers and Vibratory Equipment



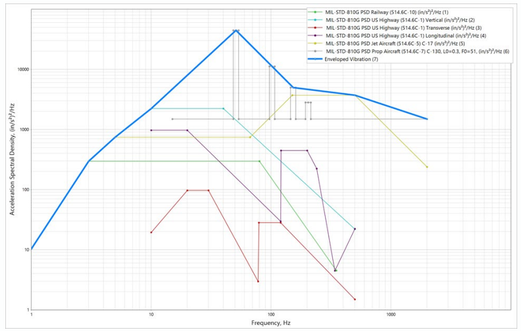


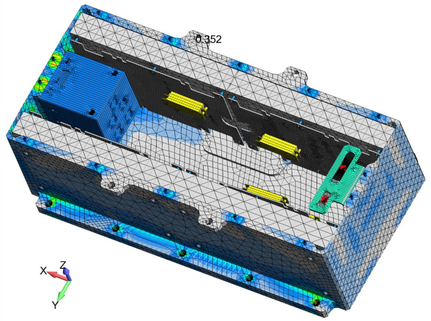


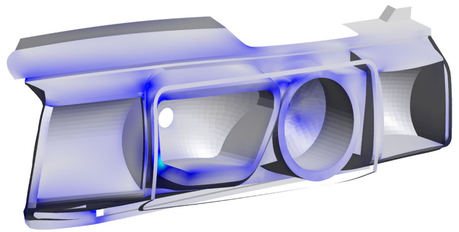
Vibration analysis can be simple or complex, but it is all based on three fundamentals: i) Its natural frequencies (eigenvalues); ii) the mass participation of these frequencies and iii) their shapes and directions. We know how to interpret vibration results and help our clients design around harmonics or drivers that could lead to catastrophic resonance.

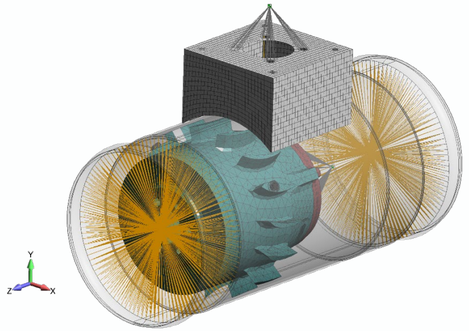
Engineering Dynamics: PSD

PSD Experience Validated on Shaker Tables and In-Service: Electronics, Automotive, Marine



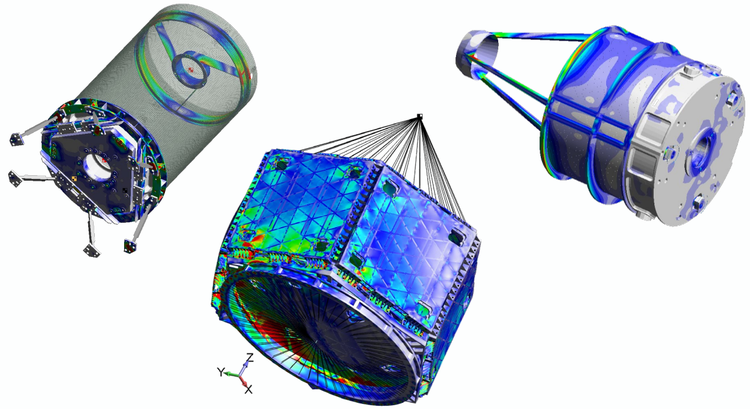




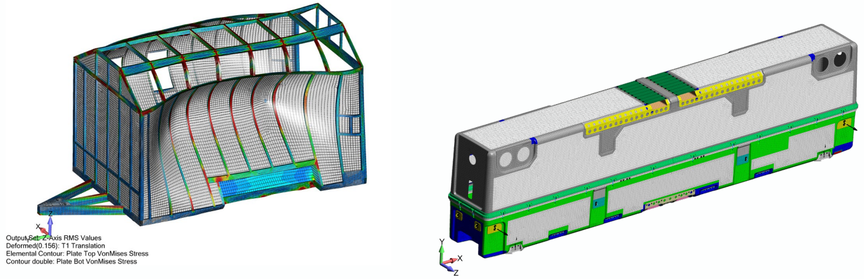


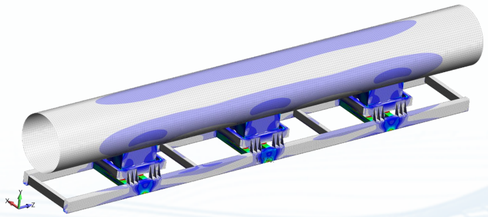
Power Spectral Density (PSD) analysis is a widely used vibration analysis technique that is easily implemented but difficult to interpret in a rational engineering manner. We are experienced in PSD theory and its practice. We know how to notch PSD curves, and if necessary, use force limiting techniques (NASA HDBK-7004C). We also understand the limits of PSD analysis and when to recommend a nonlinear, transient dynamic analysis.

PSD Launch (Satellites and Electronics)



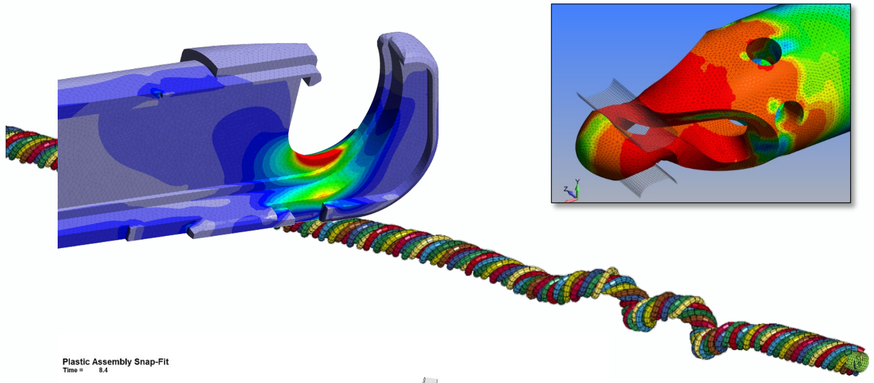
PSD Transportation: Highway, Rail and Flight

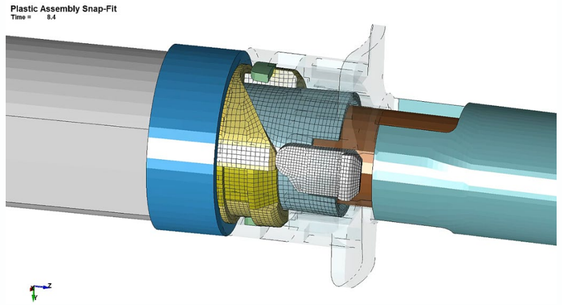


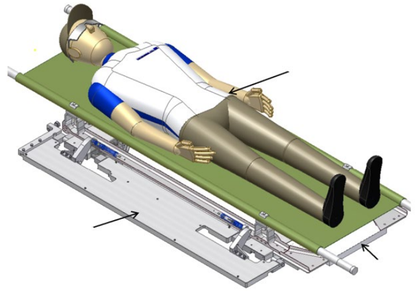


Medical Equipment, Devices, and Tissue

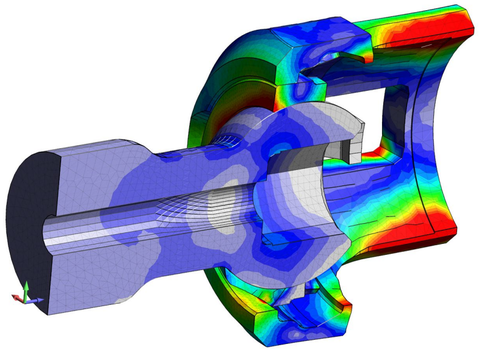
Simulation Work from Endoscopic to External to Transport



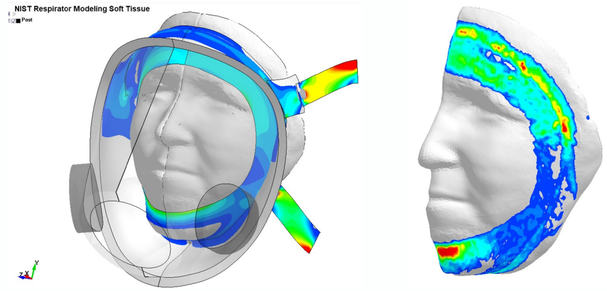




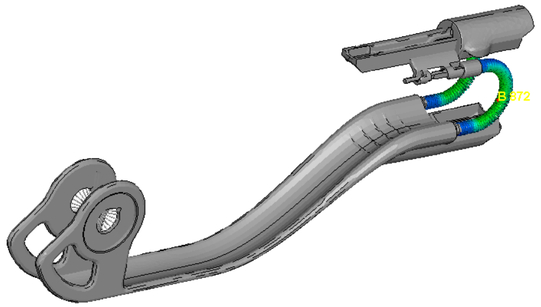
Orthopedic Devices



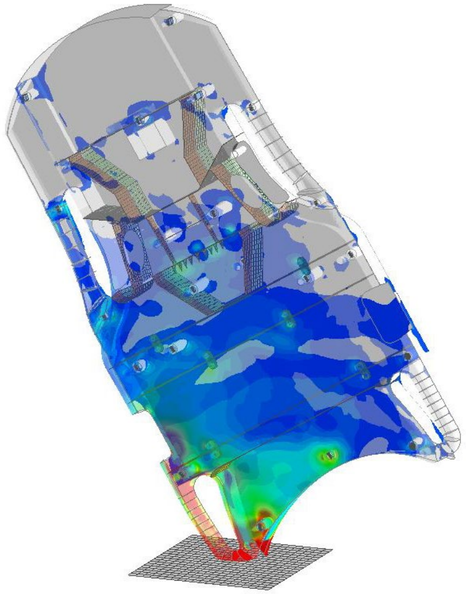
Tissue Modeling



Spring Loaded Dental Cabling System



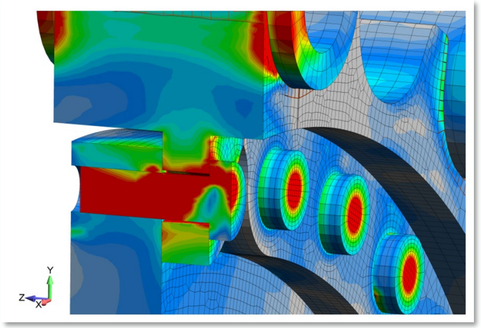
Composite / Plastic Medical “Drop-Test”

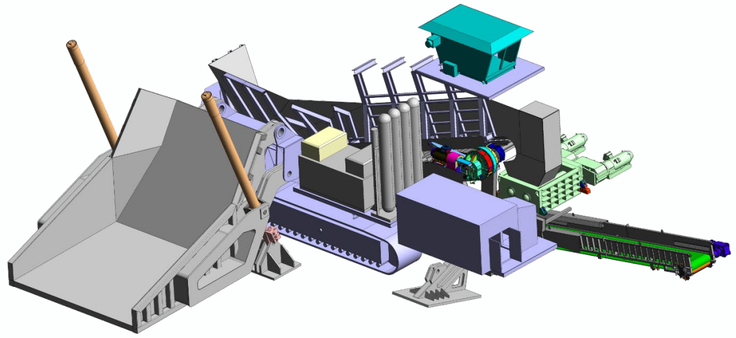


We have worked with some of the largest medical device designers/manufacturers to help them improve and optimize their devices and to assist with “corrective action” to improve upon a product that has already been delivered. Digital prototyping offers insight into the best possible design: quickly and economically.

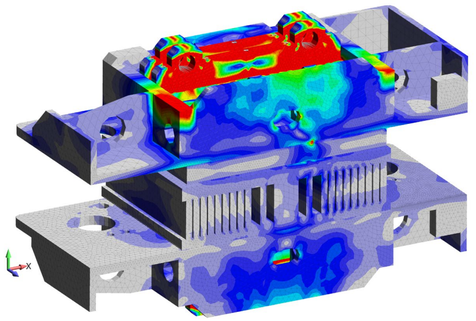
Large Machinery Analysis: Sprockets, Bolts, Presses, Forging Equipment

Large Machinery is Expensive, and the Wrong Analysis is Even More Expensive

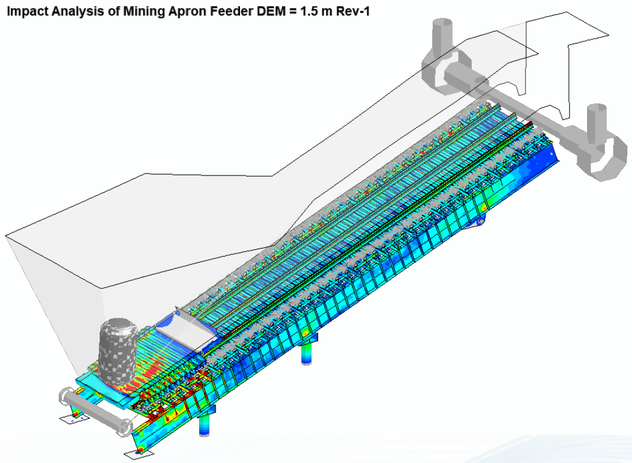




Validated “Press” Experience – Strain Gauged



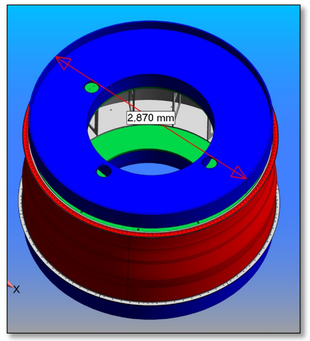
Open Pit Mining Apron Feeder

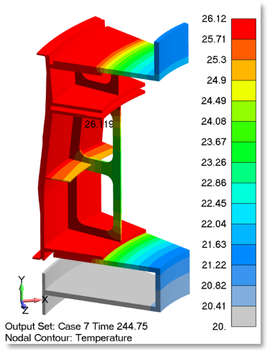


Working on large structures is exciting and nerve racking, since any simulation “slip-up” can be costly to the client. Besides the usual design verification work, we are often involved in emergency failure analysis where sometimes the cost to our client in machinery downtime can be hundreds of thousands of dollars per day. We like to say that our clients contact Predictive Engineering when they need the right answer quickly.

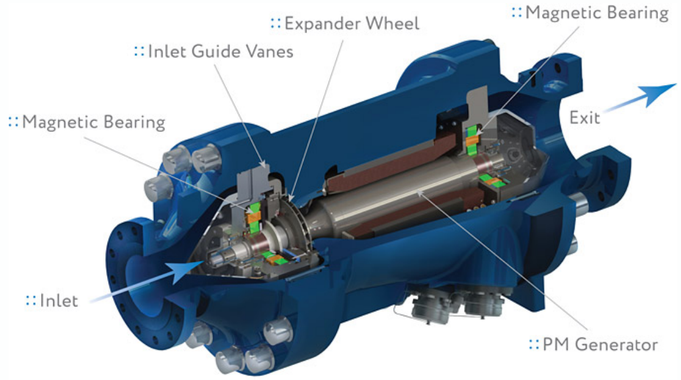
Thermal-Stress Analysis

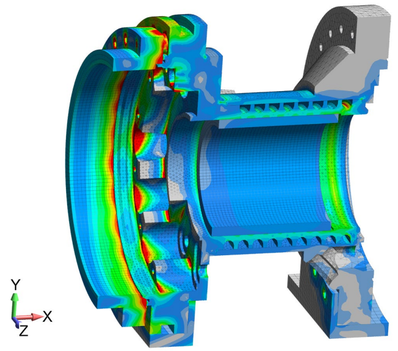
Curing Analysis of Large Composite Structures





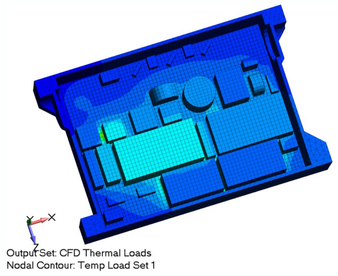
High-Speed, Water-Cooled Generator

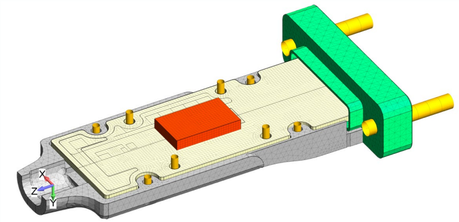




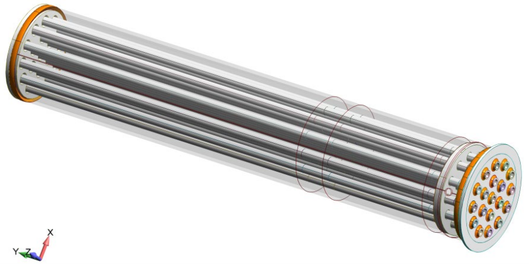
Output Set: Thermal-Stress in 500kW Turbine Generator
Nodal Contour: Nonlinear Solid Von Mises Stress

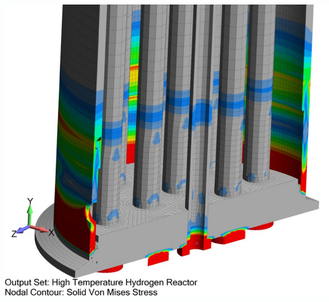
Thermal-Stress and Thermal Fatigue in Electrical Components





Reactors and Heat Exchangers





Thermal-stress is a common theme in many mechanical and electrical systems. We have worked on composites, advanced materials, reactors and a variety of electrical systems over the years. Our experience is based on a theoretical understanding of the mechanics and a practical understanding of how systems work.

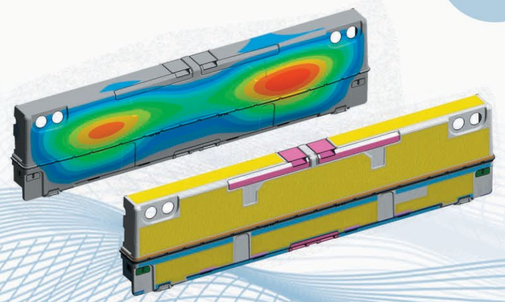
FINITE ELEMENT ANALYSIS
PredictiveEngineering

FINITE ELEMENT ANALYSIS
PredictiveEngineering

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

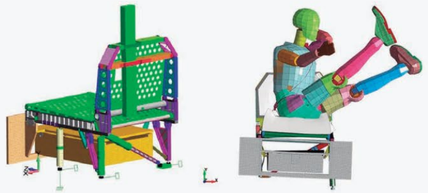
- Composites, Pressure Vessels, Vibration.
- **NASTRAN:** Linear Dynamics.
- **LS-DYNA:** Drop-test, Impact, Burst Analysis.
- **STAR-CCM+:** CFD Thermal/Flow Analysis.

+20 years experience

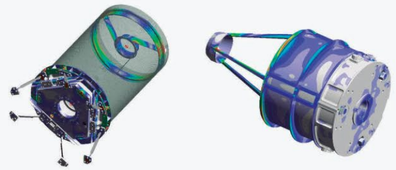


Project Examples

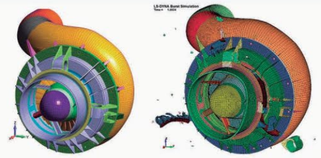
FAA 16G SLED TEST VERIFICATION



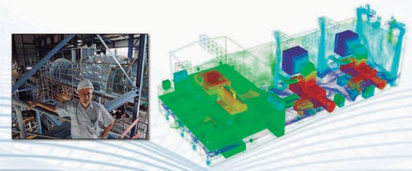
STRESS AND VIBRATION ANALYSIS OF SATELLITES



LS-DYNA TURBINE BURST SIMULATION



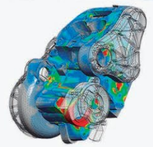
CFD STUDY ON CO-GENERATION POWER PLANT BUILDING



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.