

## **Engineering Design Analysis by Finite Element Analysis**

AEG has expanded its capabilities and services to accommodate short and long term design, engineering and prototype manufacturing programs for automotive, military, government, aerospace, medical, pharmaceutical, commercial and industrial clients. AEG is using FEA for prototype development, engineering design, design analysis, failure analysis and product manufacturing.

Finite element analysis (FEA) is a numerical technique used to solve mathematical models of solid structural components, heat transfer, and fluid flow. FEA can be used to determine strains, stresses, deflections and natural frequencies of engineered components as well as velocities and pressures in fluid flow analysis. AEG offers FEA modeling services which include the effects of residual stresses and part design analysis for pre-production approval.

AEG provide Finite Element Analysis (FEA) services using the latest state-of-the-art ABAQUS finite element software and other software to design, manufacturing, and product development companies requiring its special capabilities. This involves primarily the process of failure analysis in the case of current designs and the generation of design options for improving new parts or assemblies that are subject to a service load environment.

AEG can perform stress analysis, finite element modeling and analysis (FEM & FEA) for your product. Using a method appropriate to customer systems requirements, AEG can design, verify or perform diagnosis of structural components.

### **Finite Element Analysis (FEA)**

AEG has extensive experience in Finite Element Modeling of all types of structures. Static, dynamic, modal, random vibration analyses are all available. Often these analyses are used to compare to strain gage measurements during structural tests. AEG use the solid models to create the FEA or can create the FEA from .step files or from paper drawings.

### **Thermal Modeling**

AEG can support thermal analysis needs through thermal finite element modeling. The analysis can be performed concurrently with structural modeling and analysis.

### **Computational Fluid Dynamics (CFD)**

CFD includes analysis of laminar or turbulent flow, thermal or adiabatic and compressible or incompressible flow

### **Fatigue Life Prediction**

Using S-N life methods, stress life or load life methods AEG can analyze your product, develop a loading spectrum and make fatigue life predictions for system. The strain information can come from test data or from finite element modeling predictions. AEG can support field strain gage and load measurement to provide data for these analyses.

### **Failure Mode Effects Analysis (FMEA)**

AEG can perform a Failure Modes and Effects Analysis during the design development process to identify potential failure modes, determine their effect, and determine what steps have to be taken to eliminate the failures. By performing a FMEA early in the design development cycle, AEG can design quality and reliability into your product/system to minimize potential problems. AEG can also develop detailed test plans/procedures to ensure that the potential failure modes have been eliminated.

### **Geometric Dimensioning and Tolerancing (GD and T)**

AEG analysis includes Geometric Dimensioning and Tolerancing per ASME Y14.5.

## **A Sampling of Our FEA Projects:**

- Wire-less Pressure Transducer Packaging Design for Hostile Environments used in Military Systems
- Performance Test Equipment Development for High Impact for Military and Commercial Applications
- FEA Failure Analysis and Remediation of an Bonded Composite Assembly Joint with Exhibiting Elastic/Plastic Behavior that led to Failure of a Seal
- Stiffness Design of Military Vehicle Suspension
- High Impact Ballistic Armor Design for Commercial/Industrial Application
- Failure Analysis and Design Optimization of an Epoxy Ceramic/Metal Bond for Military Application
- Thermal Strain Analysis of a composite assembly Exhibiting Plastic Deformation
- Feasibility Study Involving Design Parameterization of Medical Drug Pump
- Spin Implant Replacements where Loads from Normal Walking and Sitting
- Static Stress/Displacement Analyses
- Static and quasi-static stress analyses
- Axisymmetric analysis of bolted pipe flange connections
- Aircraft Honeycomb Wing Analysis(Static and Dynamic)
- Army shelter analysis
- Static analysis(Solid tires)
- Elastic-plastic collapse of a thin-walled elbow under in-plane bending and internal pressure
- Parametric study of a linear elastic pipeline under in-plane bending
- Indentation of an elastomeric foam specimen with a hemispherical punch
- Collapse of a concrete slab
- Jointed rock slope stability
- Notched beam under cyclic loading
- Hydrostatic fluid elements: modeling an airspring

- Shell-to-solid submodeling and shell-to-solid coupling of a pipe joint
- Stress-free element reactivation
- Transient loading of a viscoelastic bushing
- Indentation of a thick plate
- Damage and failure of a laminated composite plate
- Analysis of an automotive boot seal
- Pressure penetration analysis of an air duct kiss seal
- Self-contact in rubber/foam components: jounce bumper
- Self-contact in rubber/foam components: rubber gasket
- Submodeling of a stacked sheet metal assembly
- Axisymmetric analysis of a threaded connection
- Direct cyclic analysis of a cylinder head under cyclic thermal-mechanical loadings
- Erosion of material (sand production) in an oil wellbore
- Submodel stress analysis of pressure vessel closure hardware
- Using a composite layup to model a yacht hull
- Snap-through buckling analysis of circular arches
- Laminated composite shells: buckling of a cylindrical panel with a circular hole
- Buckling of a column with spot welds
- Elastic-plastic K-frame structure
- Unstable static problem: reinforced plate under compressive loads
- Buckling of an imperfection-sensitive cylindrical shell
- Upsetting of a cylindrical billet: quasi-static analysis with mesh-to-mesh solution mapping (Abaqus/Standard)
- Superplastic forming of a rectangular box
- Stretching of a thin sheet with a hemispherical punch
- Deep drawing of a cylindrical cup
- Extrusion of a cylindrical metal bar with frictional heat generation
- Rolling of thick plates
- Axisymmetric forming of a circular cup

- Cup/trough forming
- Forging with sinusoidal dies
- Forging with multiple complex dies
- Flat rolling: transient and steady-state
- Section rolling
- Ring rolling
- Axisymmetric extrusion: steady-state
- Two-step forming simulation
- Upsetting of a cylindrical billet: coupled temperature-displacement and adiabatic analysis
- Unstable static problem: thermal forming of a metal sheet
- A plate with a part-through crack: elastic line spring modeling
- Contour integrals for a conical crack in a linear elastic infinite half space
- Elastic-plastic line spring modeling of a finite length cylinder with a part-through axial flaw
- Crack growth in a three-point bend specimen
- Analysis of skin-stiffener debonding under tension
- Failure of blunt notched fiber metal laminates
- Springback of two-dimensional draw bending
- Deep drawing of a square box
- Dynamic Stress/Displacement Analyses
- Nonlinear dynamic analysis of a structure with local inelastic collapse
- Hydraulic pipe whip experiment
- Rigid projectile impacting eroding plate
- Eroding projectile impacting eroding plate
- Tennis racket and ball
- Golf ball and club analysis
- Pressurized fuel tank with variable shell thickness
- Modeling of an automobile suspension
- Explosive pipe closure
- Knee bolster impact with general contact

- Crimp forming with general contact
- Collapse of a stack of blocks with general contact
- Cask drop with foam impact limiter
- Oblique impact of a copper rod
- Water sloshing in a baffled tank
- Seismic analysis of a concrete gravity dam
- Progressive failure analysis of thin-wall aluminum extrusion under quasi-static and dynamic load
- Analysis of a rotating fan using substructures and cyclic symmetry
- Linear analysis of the Indian Point reactor feedwater line
- Response spectra of a three-dimensional frame building
- Eigen value analysis of a structure using the parallel Lanczos eigen solver
- Brake squeal analysis
- Dynamic analysis of antenna structure utilizing residual modes
- Steady-state dynamic analysis of a vehicle body-in-white model
- Co-simulation analyses
- Closure of an air-filled door seal
- Symmetric results transfer for a static tire analysis
- Steady-state rolling analysis of a tire
- Subspace-based steady-state dynamic tire analysis
- Steady-state dynamic analysis of a tire substructure
- Coupled acoustic-structural analysis of a tire filled with air
- Import of a steady-state rolling tire
- Analysis of a solid disc with Mullins effect
- Tread wear simulation using adaptive meshing in Abaqus/Standard
- Dynamic analysis of an air-filled tire with rolling transport effects
- Acoustics in a circular duct with flow
- Inertia relief in a pick-up truck
- Substructure analysis of a pick-up truck model
- Display body analysis of a pick-up truck model
- Continuum modeling of automotive spot welds

- Seat belt analysis of a simplified crash dummy
- Side curtain airbag impactor test
- Resolving overconstraints in a multi-body mechanism model
- Crank mechanism
- Snubber-arm mechanism
- Flap mechanism
- Tail-skid mechanism
- Cylinder-cam mechanism
- Driveshaft mechanism
- Geneva mechanism
- Trailing edge flap mechanism
- Substructure analysis of a one-piston engine model
- Application of bushing connectors in the analysis of a three-point linkage
- Thermal-stress analysis of a disc brake
- A sequentially coupled thermal-mechanical analysis of a disc brake with an Eulerian approach
- Exhaust manifold assemblage
- Coolant manifold cover gasketed joint
- Radiation analysis of a plane finned surface
- Thermal-stress analysis of a reactor pressure vessel bolted closure
- Eigenvalue analysis of a piezoelectric transducer
- Transient dynamic nonlinear response of a piezoelectric transducer
- Thermal-electrical modeling of an automotive fuse
- Hydrogen diffusion in a vessel wall section
- Diffusion toward an elastic crack tip
- Fully and sequentially coupled acoustic-structural analysis of a muffler
- Coupled acoustic-structural analysis of a speaker
- Response of a submerged cylinder to an underwater explosion shock wave
- Convergence studies for shock analyses using shell elements
- UNDEX analysis of a detailed submarine model
- Coupled acoustic-structural analysis of a pick-up truck

- Long-duration response of a submerged cylinder to an underwater explosion
- Plane strain consolidation
- Calculation of phreatic surface in an earth dam
- Axisymmetric simulation of an oil well
- Analysis of a pipeline buried in soil
- Hydraulically induced fracture in a well bore
- Jack-up foundation analyses
- Riser dynamics
- Design sensitivity analysis of a composite centrifuge
- Design sensitivities for tire inflation, footprint, and natural frequency analysis
- Design sensitivity analysis of a windshield wiper
- Design sensitivity analysis of a rubber bushing
- Calculate the gas pressure and temperature distributions in an engine exhaust manifold
- Study the thermal stratification and breakup in piping systems
- Conduct natural convection analyses to evaluate the thermal performance of chips in electronic enclosures
- Conducting heat exchanger studies involving different fluids separated by solid regions
- Laminar or turbulent flow
- Thermal or adiabatic analyses