

Abaqus/Standard 6.9 Extended Functionality

Analysis Types

General, Linear, and Nonlinear Analyses

- Static stress/displacement
- Direct cyclic
- Low-cycle fatigue
- Viscoelastic/viscoplastic response
- Dynamic stress/displacement
- Steady-state transport
- Heat transfer (transient and steady-state)
- Mass diffusion (transient and steady-state)
- Acoustics
- Multiphysics
 - Thermo-mechanical
 - Thermo-electrical
 - Piezoelectric
 - Pore fluid flow-mechanical
 - Shock and structural-acoustic

Linear Perturbation Analyses

- Static stress/displacement
 - Linear static
 - Eigenvalue buckling
- Dynamic stress/displacement
 - Natural frequency extraction
 - Complex eigenvalue extraction
 - Steady-state dynamics (direct and mode-based)
 - Transient modal dynamics
 - Response spectrum
 - Random response

Analysis and Modeling Techniques

- Import
- Restart
- Substructuring
- Submodeling
- Material removal and addition
- Mesh-to-mesh solution mapping
- Adaptive remeshing
- Fracture mechanics (including VCCT)
- Symmetric model generation and results transfer
- Cyclic symmetry
- Inertia relief
- Nonstructural mass
- Direct matrix input
- Cosimulation
- Automatic resolution of overconstraints
- Data parameterization and parametric studies
- Automatic perturbation of geometry
- Local degrees of freedom
- Hydrostatic fluid cavities
- Annealing
- Reinforcements
- Embedded elements
- Elastic formulation
- Meshed beam cross-sections
- Rigid, display, and isothermal bodies

Solution Techniques

- Parallel execution on both shared memory and distributed memory parallel (cluster) systems
- Parallel direct sparse solver with dynamic load balancing
- Parallel iterative solver
- Parallel Lanczos eigenvalue solution
- Parallel element operations
- Multiple load cases
- Full Newton and quasi-Newton methods

Material Definitions

Elastic Mechanical Properties

- Linear elasticity
- Orthotropic and anisotropic linear elasticity
- Porous elasticity
- Hypoelasticity
- Hyperelasticity (including permanent set)
- Anisotropic hyperelasticity
- Elastomeric foam
- Mullins effect
- Viscoelasticity
- Hysteresis

Inelastic Mechanical Properties

- Metal plasticity
 - Isotropic and anisotropic yield criteria
 - Isotropic, kinematic, and ORNL hardening
 - Porous metal plasticity
 - Cast iron
 - Two-layer viscoplasticity
 - Creep
 - Volumetric swelling
 - Deformation plasticity
- Extended Drucker-Prager plasticity
- Capped Drucker-Prager plasticity
- Cam-Clay plasticity
- Mohr-Coulomb plasticity
- Crushable foam plasticity
- Jointed materials
- Concrete
 - Progressive damage and failure
 - Ductile
 - Shear
 - Forming limit diagram (FLD)
 - Forming limit stress diagram (FLSD)
 - Mueschenborn-Sonne forming limit diagram (MSFLD)
 - Hashin unidirectional composite

Additional Material Properties

- Density
- Material damping
- Thermal expansion
- Thermal and electrical conductivity
- Specific heat

- Latent heat
- Damage and failure for fiber-reinforced composites
- Piezoelectric properties
- Acoustic medium properties
 - Bulk modulus
 - Volumetric drag
- Porous acoustic medium
 - Delany-Bazley
 - Miki
- Hydrostatic fluid properties
 - Hydraulic fluids
 - Pneumatic fluids
- Mass diffusion properties
 - Diffusivity
 - Solubility
- Pore fluid flow properties
 - Permeability
 - Porous bulk moduli
 - Absorption/exsorption
 - Swelling gel
 - Moisture swelling
- User materials

Element Library

Continuum

- Stress analysis
 - 2-D (plane stress, plane strain, and generalized plane strain)
 - 3-D (regular and variable node)
 - Cylindrical
 - Axisymmetric (with and without twist)
 - Axisymmetric with nonlinear, asymmetric deformation
 - Infinite
 - Warping
- Heat transfer
 - 1-D
 - 2-D
 - 3-D
 - Axisymmetric
- Mass diffusion
 - 2-D
 - 3-D
 - Axisymmetric
- Temperature-displacement
 - 2-D (plane stress, plane strain, and generalized plane strain)
 - 3-D
 - Axisymmetric (with and without twist)
- Pore pressure
 - 2-D (plane strain)
 - 3-D
 - Axisymmetric
 - Axisymmetric with nonlinear, asymmetric deformation
- Piezoelectric
 - 2-D (plane stress and plane strain)
 - 3-D
 - Axisymmetric
 - Axisymmetric with nonlinear, asymmetric deformation



- Thermal-electrical
 - 1-D
 - 2-D
 - 3-D
 - Axisymmetric
- Acoustic
 - 1-D
 - 2-D
 - 3-D
 - Axisymmetric
 - Infinite

Shells

- Stress analysis
 - 3-D
 - Continuum shell
 - Axisymmetric
 - Axisymmetric with nonlinear, asymmetric deformation
- Heat transfer
 - 3-D
 - Axisymmetric
- Temperature-displacement
 - 3-D
 - Axisymmetric

Membranes

- Stress analysis
 - 3-D
 - Cylindrical
 - Axisymmetric (with and without twist)

Beams

- Stress analysis
 - 2-D
 - 3-D (regular and open section)

Pipes

- Stress analysis
 - 2-D
 - 3-D

Elbows

- Stress analysis
 - 3-D

Frame Elements

- Stress analysis
 - 2-D
 - 3-D

Trusses

- Stress analysis
 - 2-D
 - 3-D
- Temperature-displacement
 - 2-D
 - 3-D
- Piezoelectric
 - 2-D
 - 3-D

Gasket Elements

- Stress analysis
 - 2-D (plane stress and plane strain)
 - 3-D
 - Axisymmetric

Inertial Elements

- Stress analysis
 - Point mass
 - Rotary inertia

Rigid Elements

- Stress analysis
 - 2-D
 - 3-D

Capacitance Elements

- Heat transfer point heat capacitance

Connector Elements

- Stress analysis
 - 2-D
 - 3-D

Cohesive Elements

- Stress analysis
 - 2-D
 - 3-D

Springs, Dashpots, and Flexible Joints

- Stress analysis
 - 2-D
 - 3-D
- Pore pressure
 - 2-D
 - 3-D

Distributing Coupling

- Stress analysis
 - 2-D
 - 3-D

Special-Purpose Elements

- Surface elements
- Hydrostatic fluid elements
- Tube support elements
- Line spring elements
- Pipe-soil interaction elements
- Acoustic interface elements

User-Defined Elements

- Provides the ability to define custom elements

Prescribed Conditions

- Amplitude curves
- Initial conditions
- Boundary conditions
- Loads
 - Distributed

- Surface tractions
- Concentrated forces and moments
- Follower forces
- Thermal
- Electrical
- Acoustic
- Pore fluid flow
- Prescribed assembly loads
- Predefined fields
- User-defined
- Sensors and actuators

Constraints and Interactions

Kinematic Constraints

- Linear constraint equations
- General multi-point constraints
- Kinematic coupling
- Surface-based constraints
 - Mesh ties
 - Kinematic and distributing couplings
 - Shell-to-solid couplings
 - Mesh-independent fasteners
- Embedded elements
- Element end release

Surface-Based Contact Modeling

- General (“automatic”) contact
- Contact interactions
 - 2-D, 3-D
 - Deformable-deformable contact
 - Rigid-rigid contact
 - Self-contact
- Contact formulations
 - Balanced or pure master-slave contact
 - Finite, small, and infinitesimal sliding
- Mechanical contact properties
 - Penalty contact
 - Hard contact with classical Lagrange multiplier method
 - Hard contact with augmented Lagrangian method
 - Contact damping
 - Static and kinetic Coulomb friction
 - Anisotropic friction
 - User-defined friction models
 - Pressure penetration
 - Debonding
 - Cohesive behavior
 - Thermal conductance and radiation contact properties
- Electrical contact properties
- Pore fluid contact properties
- User-defined interfacial constitutive behavior

Element-Based Contact Modeling

- Gap contact elements
 - Mechanical and thermal

Cavity Radiation

- 2-D, 3-D, axisymmetric



- Closed and open cavities
- Symmetry and surface blocking
- Surface motion with automatic viewfactor computations
- Surface radiation properties

User Subroutines

- Over 40 user-defined subroutines

Additional Features

- Drag chains
- “Spud can” joint elements
- Tube-in-tube slide lines

Input

- Keywords
- Set concept
- Multiple coordinate systems
- Parts and assemblies
- Nastran bulk data

Output

- Interactive graphical postprocessing
- Platform-neutral output database
- Printed output
- External file output
- Restart output
- Diagnostic messages
- Nastran Output2
- Scripting interface

Supported Platforms

- Windows/x86-32
- Windows/x86-64
- Linux/x86-32
- Linux/x86-64
- Linux/Itanium
- HP-UX/Itanium
- AIX/Power

Documentation

- Analysis User’s Manual
- Keywords Manual
- Getting Started Manual
- Example Problems Manual
- Benchmarks Manual
- Verification Manual
- Theory Manual
- Interfaces User’s Manuals
- Release Notes

Product Support

- Maintenance and support
- Quality Monitoring Service
- Installation
- Training and users’ meetings

Related Products

Abaqus/AMS

- High-performance automatic multi-level substructuring eigensolver

Abaqus/Design

- Design sensitivity analysis
- Sensitivities with respect to shape and material parameters
- Nonlinear geometric effects

Abaqus/Aqua

- Surrounding medium
 - Fluid profile
 - Wave profile
 - Wind profile
- Loading
 - Drag
 - Buoyancy
 - Inertia

DDAM for Abaqus

- Naval shock design procedure

Interface Products

- Enable the use of Abaqus/Standard with complementary software from third-party suppliers in areas such as plastics injection molding and multibody dynamics

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