SIMULIA

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)
  - Müschenborn-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

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- 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

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- 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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