

ABAQUS/CAE 2016 DATA SHEET

GEOMETRY

Geometry Creation Tools

- Solid features
 - Extrude
 - Loft
 - Revolve
 - Sweep
 - Draft, twist, and pitch
 - Fillet/chamfer
- Cut features
 - Extrude
 - Loft
 - Revolve
 - Sweep
 - Circular hole
- Shell features
 - Planar surface
 - Extrude
 - Loft
 - Revolve
 - Sweep
 - Fillet/chamfer
- Wire features
 - Planar
 - Poly line
 - Spline
 - Fillet
 - From edge
- Mirror feature
- Datum geometry
- Partitioning tools
 - Edge
 - Face
 - Cell

2-D Sketcher

- Point
- Line
- Circle
- Rectangle
- Arc
- Fillet
- Spline
- Ellipse

Sketch Tools and Options

- Constraints
- Parameters
- Translate/rotate/mirror/scale
- Trim/extend/break/merge
- Project edges

- Offset entities
- Linear/radial pattern
- Dimensioning
- Construction geometry
- Sketch origin placement
- Sketch cleanup
- Sketch import/export

Geometry Import/Export

- CAD Associative Interfaces (add-on modules)
 - CATIA V6
 - CATIA V5
 - SolidWorks
 - Pro/ENGINEER
 - CAD feature parameter update
- CAD geometry translators (add-on modules)
 - CATIA V4
 - I-deas NX
 - Parasolid
- Assembly import
- Neutral format import
 - SAT, IGES, STEP, or VDA
- Import of parts from Abaqus files
 - Input (.inp)
 - Output database (.odb)
 - Linear dynamics (substructure) data (.sim)
- Geometry export
 - SAT, IGES, STEP, or VDA

Model Import/Export

- Model database (.cae) files
- Models from Abaqus input (.inp) files
- Nastran bulk data files
- Ansys input file import
- Wavefront (.obj) export

Geometry Edit Tools

- Automated repair during import
- Stitch edges
- Repair small/invalid edges
- Merge edges
- Remove redundant entities
- Remove wire edges
- Remove/cover/replace faces
- Repair small faces/slivers/face normals

- Offset faces
- Extend faces
- Blend faces
- Solid from shell
- Convert to analytical
- Convert to precise
- Faces from element faces

Midsurfacing

- Offset/extend/blend faces (geometry edit tools)
- Assign thickness and offset

ASSEMBLY

Instance Tools

- Create/suppress/resume/delete
- Linear/radial pattern
- Translate/rotate
- Replace
- Model instancing

Merge/Cut Tools

- Geometric parts
- Merge orphan mesh
- Merge geometric and orphan mesh parts

Sets and Surfaces

- Geometric sets containing vertices, edges, faces, skins, or cells
- Orphan mesh sets containing nodes or elements
- Native mesh sets and surfaces
- Surface regions
- Merge sets/surfaces
 - Union
 - Intersection
 - Difference

Model Display

- Display groups
- Selection tools
- Pick filters
- Translucency control
- View cuts
- View center setting

Color Coding

- Display model geometry and mesh elements in configurable colors
- Color by attribute

PROPERTIES

Material Models

- General
- Elasticity
- Electrical properties
- Mass diffusion
- Magnetic properties
- Plasticity
- Electromagnetic properties
- Pore fluid properties
- Thermal properties
- Gasket
- Acoustic medium
- Damage initiation criteria and evolution
- Brittle cracking
- Equation of state (EOS) materials
- User materials
- Hyperelastic/viscoelastic material evaluation
- Anisotropic hyperelasticity

Materials Management and Calibration

- User libraries
- Import/process test data and define calibration behaviors

Sections

- Solid
 - Homogeneous
 - Composite
 - Eulerian
 - Generalized plane strain
- Shell
 - Homogeneous
 - Composite
 - Membrane
 - Surface (rebar layers)
 - Shell offset
- Beam
 - Beam
 - Truss
 - Other
 - Gasket
 - Cohesive
- Gasket
- Beam section profiles
 - Profile library
 - Arbitrary
 - Generalized
 - Tapered

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- Fluid section
- Beam profile and shell thickness rendering
- Electromagnetic, solid section

Composites

- Ply layup definition and management
- Layer orientation and thickness distributions
- Ply stack plots
- Classic laminate theory
- Nonlinear progressive damage and failure
- Ply-based output request

Orientations

- Beam section
- Material
- Rebar
- Shell normal
- Surface- and direction-based

Special Engineering Features

- Fasteners
 - Point-based
 - Discrete
 - Assembled
 - Points import and definition
 - Projection, offset, and patterning tools
- Skins and stringers
- Inertia
 - Point mass/inertia
 - Nonstructural mass
 - Heat capacitance
- Springs/dashpots

Queries

- Point/node/distance/angle
- Geometry diagnostics
- Section assignment

ANALYSIS FEATURES

General, Linear, and Nonlinear Analyses

- Static stress/displacement analysis
- Viscoelastic/viscoplastic response
- Dynamic stress/displacement analysis
- Heat transfer analysis (transient and steady-state)
- Mass diffusion analysis (transient and steady-state)
- Direct cyclic
 - Low-cycle fatigue
- Acoustic analysis
- Coupled problems
 - Thermo-mechanical
 - Thermo-electrical
 - Piezoelectric

- Coupled thermal-electrical-structural
- Pore fluid flow-mechanical
- Thermo-mechanical mass diffusion
- Shock and acoustic structural
- Cosimulation
 - Abaqus/Standard to Abaqus/Explicit cosimulation
 - Abaqus/CFD to Abaqus/Standard or Abaqus/Explicit
 - Fluid structure interaction (FSI)
 - Conjugate heat transfer (CHT)
- Flow analysis (incompressible)
 - Laminar and turbulent

Linear Perturbation Analyses

- Static stress/displacement analysis
 - Linear static stress/displacement analysis
 - Eigenvalue buckling estimates
- Dynamic stress/displacement analysis
 - Natural frequency extraction
 - Complex eigenvalue extraction
 - Transient response via modal superposition
 - Steady-state response to harmonic loading
 - Response spectrum analysis
 - Random response analysis
- Substructure Generation
- Electromagnetic, time harmonic

Multi-Step Setup

- Step suppression

Analysis Controls

- General solution controls
- Solver controls
- Adaptive mesh domain
- Adaptive mesh controls

Output Requests

- Field output
- History output
- Integrated output sections
- Contact status output
- Restart, diagnostic, and monitor output
- Sensors

CONSTRAINTS AND INTERACTIONS

Contact

- Automatic contact detection and setup

- General contact (Abaqus/Standard and Abaqus/Explicit)
- Surface-to-surface contact
- Self-contact
- Contact deactivation/reactivation

Contact Properties

- Mechanical
 - Normal
 - Tangent
 - Damping
 - Clearance-dependent
 - Surface-based cohesive contact and damage
 - VCCT for Abaqus/Standard
- Thermal
 - Conductance
 - Heat generation
 - Boundary radiation
- Film coefficient

Interactions

- Cyclic symmetry
- Cavity/surface radiation
- Surface/concentrated film condition
- Elastic foundations
- Acoustic impedance
- Actuator/sensor
- XFEM crack growth
- Model change
- Pressure penetration
- Abaqus/Standard-Abaqus/Explicit co-simulation boundary
- Fluid-Structure co-simulation boundary
- Fluid cavity

Constraints

- Tied surfaces
- Equations
- Display body
- Rigid and isothermal bodies
- Coupling
- Multi-point constraints
- Shell-to-solid coupling
- Embedded regions

Connectors

- Basic
 - Translational
 - Rotational
- Assembled/complex
- Connector and coincident builder

Boundary Conditions

- Nodal
- Velocity
- Acceleration
- Velocity/angular velocity
- Submodel
- Pore pressure

- Electric potential
- Temperatures
- Fluid inlet/outlet
- Fluid wall condition
- Spatially varying boundary conditions
- Eulerian (inflow/outflow/motion)
- Magnetic
- Electromagnetic loads

Predefined fields

- Velocity/Temperature/Hardening
- Initial state (from previous analysis)
- Material assignment
- Fluid density/thermal energy/turbulence/velocity
- Initial stress
- Geostatic stress/void ratio/saturation/pore pressure

Loads

- Mechanical
- Bolt load
- Thermal
- Acoustic
- Fluid
- Electrical
- Mass diffusion
- Fields
- Multiple load cases
- Spatially varying loads
- Electromagnetic properties

Analytical and Discrete Fields

- Analytical fields for prescribed conditions
- Mapped fields
- Discrete fields for prescribed conditions, orientations, offset, and shell thicknesses
 - Volume fraction discrete field

Amplitude Curves

- Tabular
- Equally-spaced
- Periodic
- Modulated
- Decay
- Solution-dependent
- Smooth-step
- Actuator
- User

Fracture Mechanics

- Contour integral
- Extended finite element method (XFEM)
- Seams and cracks

MESHING

Mesh Seeding

- Global seed size

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- Curvature-based refinement
- Minimum element size
- Edge seed
 - Uniform
 - Biased
 - By size
 - By number

Structured Meshing

- 1-D
- 2-D regions
- 3-D solid regions

Surface Meshing

- Automatic quadrilateral meshing Medial axis
 - Advancing front
- Automatic triangular meshing
- Mapped meshing
- Mesh pattern copying

Solid Meshing

- Fully automatic tetrahedral meshing
- Fully automatic swept meshing
 - Medial axis
- Bottom-up hexahedral meshing
- Boundary layer meshing

Virtual Topology

- Combine faces/edges
- Automatic creation/restore tools

Element Quality

- Statistical and analysis checks
- Stable time increment
- Maximum allowable frequency
- Mesh deviation computation

Queries

- Mass and mesh
- Stable time increment
- Maximum allowable frequency
- Mesh stack orientation
- Mesh gap/intersections
- Free/non-manifold edges
- Unmeshed regions

Mesh Edit

- Node
 - Create
 - Edit
 - Drag
 - Delete
 - Merge
 - Adjust midside
 - Project
 - Renumber
- Element
 - Create

- Delete
- Flip surface normal
- Orient stack direction
- Collapse/split edge
- Swap diagonal
- Split/combine elements
- Renumber
- Merge/subdivide layers
- Offset (create shell/solid layers)
- Automatic collapse of sliver edges
- Convert triangular elements to tetrahedral elements
- Refine 2-D planar meshes

Adaptive Remeshing

- Automatic and manual

Element Library

- Beam
- Truss
- Connector
- Shell
- Membrane
- Cohesive
- Continuum shell
- Continuum
- Elbow
- Gasket
- Pipe
- Eulerian
- Cylindrical
- Fluid
- Electromagnetic

JOB MANAGEMENT

- Submission
- Parallel computing options
- Restart
- Monitor and view job files
- Co-execution
 - Abaqus/Standard to Abaqus/Explicit
 - Abaqus/CFD to Abaqus/Standard or Abaqus/Explicit

VISUALIZATION OF MODEL AND OUTPUT DATA

- Model plotting
- Model and results data
- Deformed, contour, vector/tensor, path, extreme value, ply-stack, through thickness, tick mark, overlay, material orientation, and X-Y plots
- Loads display
- View manipulation, linked viewports, view center setting and camera options
- Multiple viewports and view synchronization
- Automatic color coding

- View cuts
 - Planar/cylindrical/spherical
 - Isosurface
 - Resultant force/moment output
 - Multiple cuts
 - Free bodies at all view cuts
- Beam profile and shell thickness display
- Results display on beam sections
- Free-body cuts
- Nodal force plot, history plot and multiple free-body display
- Animations
 - Movie import/export and overlay
- Mirroring and patterning of symmetric models
- Failed element removal
- Stress linearization
- Streamlines
- X-Y data operators and data filtering
- Tabular data reports
- Probe/query tools and annotations
- Network connection to remote output databases
- Diagnostics and constraints visualization
- Automatic report generation
- Abaqus/Aqua gravity wave visualization
- DEM visualization

PROCESS AUTOMATION

- Python scripting
- GUI toolkit
- Macro manager
- Plug-ins architecture
- Python Development Environment (PDE)

PLUG-INS

- Examples
- Interactive plug-in GUI builder (RSG)
- Script upgrade
- Excel utilities
- NVH postprocessing
- Adaptivity plotter
- ODB combine tool
- STL import/export

PRINTING AND OUTPUT

- PS/EPS/PNG/TIFF/SVG
- 3D XML/VRML
- Hardcopy

DOCUMENTATION AND ONLINE HELP

- User's Manual

- Getting Started Manual
- Release Notes

SUPPORTED PLATFORMS

- Windows/x86-64
- Linux/x86-64

PRODUCT SUPPORT

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

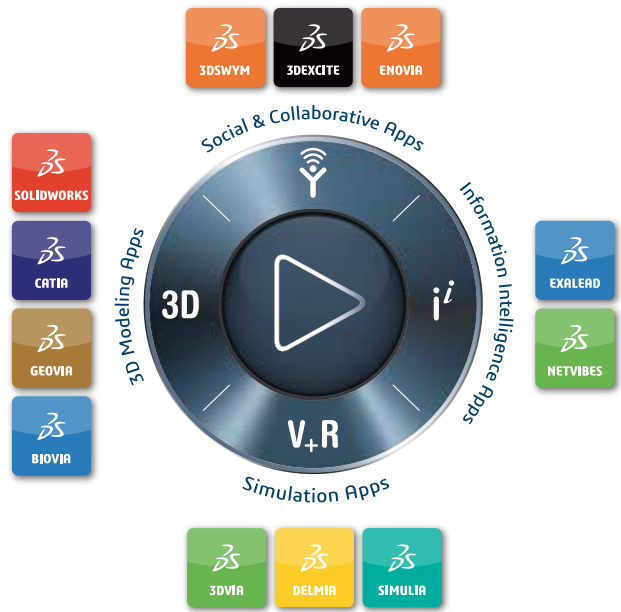
RELATED PRODUCTS

Abaqus/CAE Topology Optimization Module (ATOM), CAD Associative Interfaces, and Geometry Translators

- CAD Associative interfaces for CATIA V6, CATIA V5, SolidWorks, and Pro/ENGINEER
 - Enables synchronization of CAD and CAE assemblies and seamless updates
- Geometry translators for CATIA V4, I-deas NX, and Parasolid

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ABAQUS/STANDARD 2016 DATA SHEET

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-electrical-structural
 - Pore-fluid flow-mechanical-thermal
 - Magnetostatic
 - Transient low frequency electromagnetic

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
- Time-harmonic low frequency electromagnetic

ANALYSIS AND MODELING TECHNIQUES

- Import
- Restart
- Substructuring
- Flexible Body Generation
- 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 AMS eigenvalue solution
- Parallel element operations
- Multiple load cases
- Full Newton and quasi-Newton methods
- GPGPU accelerated sparse solver

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
- Nonlinear 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
 - Johnson-Cook 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)
 - Mûschenborn-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
- 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
- Electromagnetic properties
 - Piezoelectric behavior
 - Magnetic permeability (with nonlinear B-H behavior)
 - Permanent magnet
 - Electrical conductivity

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

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- 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
- Electromagnetic
 - 2-D
 - 3-D
- **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, open section, and tapered)

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
 - Anisotropic 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 (2-D & 3-D)
 - 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 view factor 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

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- Diagnostic messages
- Nastran Output2
- Scripting interface

SUPPORTED PLATFORMS AND HARDWARE

- Windows/x86-32
- Windows/x86-64
- Linux/x86-64
- GPU support

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

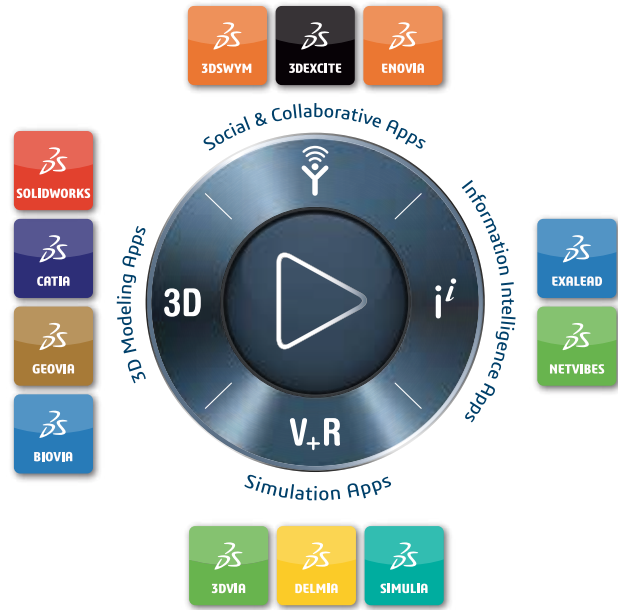
- Surrounding medium
 - Fluid profile
 - Wave profile
 - Wind profile
- Loading
 - Drag
 - Buoyancy
 - Inertia

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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ANALYSIS TYPES

- Nonlinear dynamic stress/displacement
- Acoustics
- Adiabatic stress
- Coupled Eulerian-Lagrangian
- Coupled field
 - Thermo-mechanical
 - Shock and acoustic-structural

ANALYSIS AND MODELING TECHNIQUES

- Import
- Restart
- Recover
- Automated mass scaling
- Nonstructural mass
- Adaptive remeshing
- Tracer particles
- Steady-state detection
- Submodeling
- Parameterization and parametric studies
- Cosimulation
- Subcycling
- Hydrostatic fluid modeling
- Surface-based fluid cavities
- Meshed beam cross-sections
- Annealing
- Automatic perturbation of geometry
- Local degrees of freedom
- Reinforcements
- Embedded elements
- Display bodies
- User subroutines
- Coupled Eulerian-Lagrangian automated mesh refinement

PARALLEL EXECUTION

- Domain decomposition-based parallel processing
- Available on both shared memory and distributed memory parallel (cluster) systems
- User Controllable Domain Decomposition

MATERIAL DEFINITIONS

Elastic Mechanical Properties

- Linear elasticity
- Orthotropic and anisotropic linear elasticity
- Hyperelasticity (including permanent set)
- Anisotropic hyperelasticity
- Elastomeric foam
- Low-density foam
- Fabric
- Mullins effect
- Time-domain viscoelasticity
- Equation of state
- Nonlinear viscoelasticity

Inelastic Mechanical Properties

- Metal plasticity
 - Isotropic and anisotropic yield
 - Isotropic and kinematic hardening
 - Rate-dependent yield
 - Porous metal plasticity
 - Annealing or melting
 - Johnson-Cook plasticity
 - Cast Iron
- Progressive damage and failure
 - Ductile
 - Shear
 - Forming limit diagram (FLD)
 - Forming limit stress diagram (FLSD)
 - M \ddot{u} schenborn-Sonne forming limit diagram (MSFLD)
 - Marciniak-Kuczynski (M-K) criteria
 - Hashin unidirectional composite
- Extended Drucker-Prager plasticity
- Modified Drucker-Prager/Cap plasticity
- Cam-Clay plasticity
- Mohr-Coulomb plasticity
- Crushable foam plasticity
- Concrete

- Brittle cracking
- Damaged plasticity

Additional Material Properties

- Density
- Equations of State:
 - Mie-Gr \ddot{u} neisen
 - Tabulated
 - P-alpha compaction
 - JWL
 - Ignition and growth
 - Ideal gas
 - User defined
- Material damping
- Thermal expansion
- Heat transfer properties
 - Thermal conductivity
 - Specific heat
 - Latent heat
- Acoustic medium properties
 - Bulk modulus
 - Volumetric drag
 - Cavitation limit
- Hydrostatic fluid properties
 - Hydraulic fluids
 - Pneumatic fluids
- Viscous shear behavior for fluids
- User materials

ELEMENT LIBRARY

Continuum

- Stress analysis
 - 2-D (plane stress and plane strain)
 - 3-D
 - Axisymmetric
 - Infinite
- Acoustic
 - 2-D
 - 3-D
 - Axisymmetric
 - Infinite
- Coupled temperature-displacement
 - 2-D (plane stress and plane strain)
 - 3-D
 - Axisymmetric

Particles

- Smoothed particle hydrodynamics

- DEM (Discrete Element Method)

Structural

- Stress analysis
 - Membrane (3-D)
 - Truss (2-D and 3-D)
 - Beams (2-D and 3-D)
 - Shells (3-D, 3-D continuum, and axisymmetric)
 - Coupled temperature-displacement shells (3-D, 3-D continuum)

Inertial Elements

- Stress analysis
 - Point mass (2-D and 3-D)
 - Anisotropic point mass
 - Rotary inertia (2-D and 3-D)

Special-Purpose Elements

- Surface elements
- Hydrostatic fluid elements
- Rigid elements
- User elements
- Capacitance elements
- Connector elements
- Cohesive elements
- Springs and dashpots

Prescribed Conditions

- Amplitude curves
- Initial conditions
- Boundary conditions
- Loads
 - Distributed
 - Surface tractions
 - Concentrated forces and moments
 - Air blast
 - Follower forces
 - Thermal
 - Acoustic
 - Predefined fields
 - User-defined
- Sensors and actuators

CONSTRAINTS AND INTERACTIONS

Kinematic Constraints

- Linear constraint equations
- General multi-point constraints
- Surface-based constraints
 - Mesh ties
 - Kinematic and distributing couplings

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- Shell-to-solid couplings
 - Mesh-independent fasteners
 - Embedded elements
- Contact Modeling**
- General (“automatic”) contact
 - Surface-based contact pairs
 - Contact interactions
 - 2-D and 3-D
 - Deformable-deformable contact
 - Deformable-rigid contact
 - Rigid-rigid contact
 - Self-contact
 - Eroding contact
 - Edge-to-edge contact
 - Mechanical contact properties
 - Hard contact
 - Soft contact
 - Contact damping
 - Static and kinetic Coulomb friction
 - User-defined friction models
 - Breakable bonds
 - Cohesive behavior
 - Thermal contact properties
 - User-defined interfacial constitutive behavior
 - Surface property definitions
 - Surface thickness
 - Feature edges
 - Offsets
 - Contact formulations
 - Penalty and kinematic contact
 - Balanced or pure master-slave contact
- Input**
- Keywords
 - Set concept
 - Multiple coordinate systems
 - Parts and assemblies
- OUTPUT**
- Interactive graphical postprocessing
 - Platform-neutral output database
 - Restart output
 - Diagnostic messages
 - Scripting interface

SUPPORTED PLATFORMS

- Windows/x86-32
- Windows/x86-64
- Linux/x86-64

DOCUMENTATION

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

PRODUCT SUPPORT

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

RELATED PRODUCTS

CZone

Dummy Models

- Crash test dummy models for use in crashworthiness and occupant safety simulations

- The models are in SI units and include accelerometers (nodes), load cells (beams), and transducers (connectors) for extraction of occupant injury criteria

Abaqus/Aqua

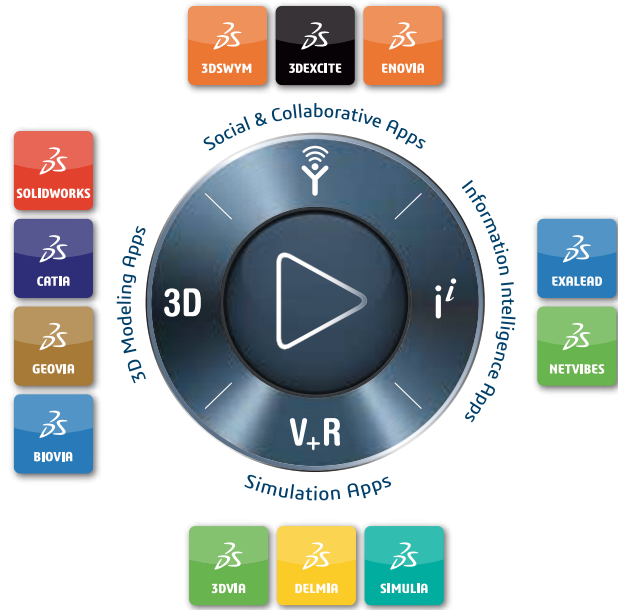
- Surrounding medium
 - Fluid profile
 - Wave profile
 - Wind profile
- Loading
 - Drag
 - Buoyancy
 - Inertia

Interface Products

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

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Dassault Systèmes, the **3DEXPERIENCE®** Company, provides business and people with virtual universes to imagine sustainable innovations. Its world-leading solutions transform the way products are designed, produced, and supported. Dassault Systèmes’ collaborative solutions foster social innovation, expanding possibilities for the virtual world to improve the real world. The group brings value to over 190,000 customers of all sizes in all industries in more than 140 countries. For more information, visit www.3ds.com.



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ANALYSIS TYPES

- Incompressible fluid dynamics
- Transient and Steady State solutions
- Fluid and/or Solid heat transfer
- Buoyancy driven natural convection
- Laminar and turbulent flows

ANALYSIS AND MODELING TECHNIQUES

- Algebraic multi-grid (AMG) pre-conditioned Krylov solvers
- Parallel processing
- Restart
- Arbitrary Eulerian-Lagrangian method

TURBULENCE MODELS

- Realizable K-epsilon
- Spalart-Allmaras
- SST k-omega
- RNG k-epsilon
- Hybrid wall functions

MATERIAL DEFINITIONS

- Newtonian and Non-Newtonian viscosity
- Porous Media
- Specific heat
- Conductivity
- Density

ELEMENT LIBRARY

- 3-D hex
- 3-D pyramid
- 3-D tet
- 3-D triangular prism

PRESCRIBED CONDITIONS

- Inlet/outlet conditions
- User-defined conditions
- Pressure-volume conditions
- Wall conditions
- Infiltration
- Moving boundary

INTERACTIONS

- Fluid-structure interaction co-simulation
- Conjugate heat transfer interaction co-simulation

INPUT

- Set concept
- Parts and assemblies
- Keyword input file

OUTPUT

- Interactive graphical postprocessing
- Platform-neutral output database
- Diagnostic messages

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