

# ABAQUS/EXPLICIT DATA SHEET

## 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

# ABAQUS/EXPLICIT DATA SHEET

- 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

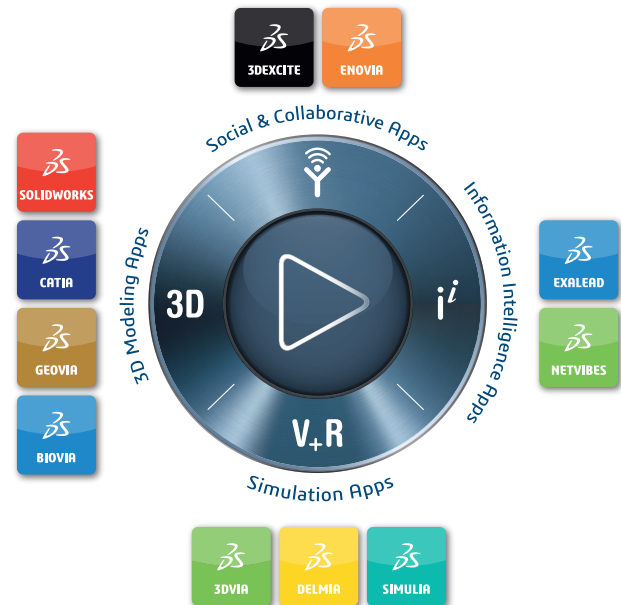
- Surrounding medium
  - Fluid profile
  - Wave profile
  - Wind profile
- Loading
  - Drag
  - Buoyancy
  - Inertia

### Interface Products

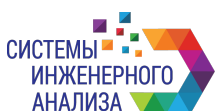
- Enable the use of Abaqus/Explicit with complementary software from third-party suppliers in areas such as plastics injection molding

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