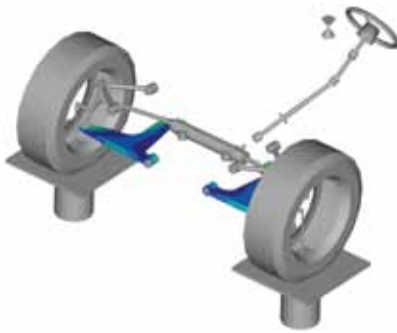


# Altair® MotionSolve®

## Optimize System Performance

Altair® MotionSolve® is an integrated solution to analyze and optimize multi-body system performance. Through extensive customer partnership, MotionSolve is thoroughly validated for quality, robustness and speed. MotionSolve offers powerful modeling, analysis, visualization and optimization capabilities for multi-disciplinary simulations that include kinematics and dynamics, statics and quasi-statics, linear and vibration studies, stress and durability, loads extraction, co-simulation, effort estimation and packaging synthesis.



Flexbody Analysis



Proximity and Clearance Analysis

### Benefits

#### Reduce Time to Market

Bring the products to market faster using MotionSolve. MotionSolve is very fast and maintains accuracy even while solving stiff problems including flexible multibodies, complex contact and long-duration durability.

#### Comprehensive Solution for any Multibody Dynamics Simulation

- Create complex, nonlinear systems
  - Evaluate the dynamic behavior of systems
  - Study vibration isolation
  - Design control systems
  - Perform packaging studies
  - Generate realistic loads to predict component life and damage
- Assess system design and performance
  - Nonlinear dynamic studies
  - Kinematics studies
  - Linear studies
  - Static studies
  - Quasi-static studies

#### Innovative Solver Functionality

- Continuing to introduce innovative modeling elements and methods to handle even the most complex multibody systems.
- Modern solver formulations and modeling capabilities such as deformable curves and flexbody contact further differentiate MotionSolve from other mechanical systems solvers.

#### Robust and Accurate Solutions

MotionSolve is used in a wide variety of industries and is rigorously tested for specific classes of problems. As core technology in the HyperWorks CAE suite

and deep integration with Altair's FEA solvers, MotionSolve delivers the flexibility, robustness and quality required by the multibody dynamics community.

#### Perform System-level Analysis Through Co-simulation

Streamlined processes for working with detailed hydraulic, pneumatic and control models.

#### Capture Your Corporate Standards Through Customization

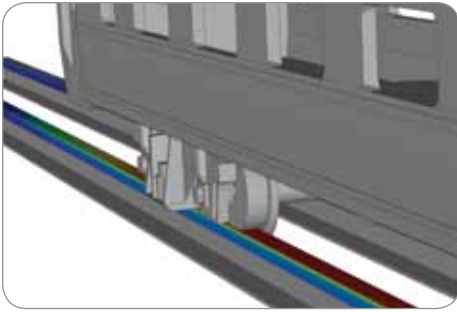
MotionSolve delivers the unique capability to customize your mechanical systems simulation environment to fit your needs. From writing custom functions and subroutines to custom messages and creating custom outputs, MotionSolve helps to set corporate standards by tailoring the solver to fit any environment.

### Capabilities

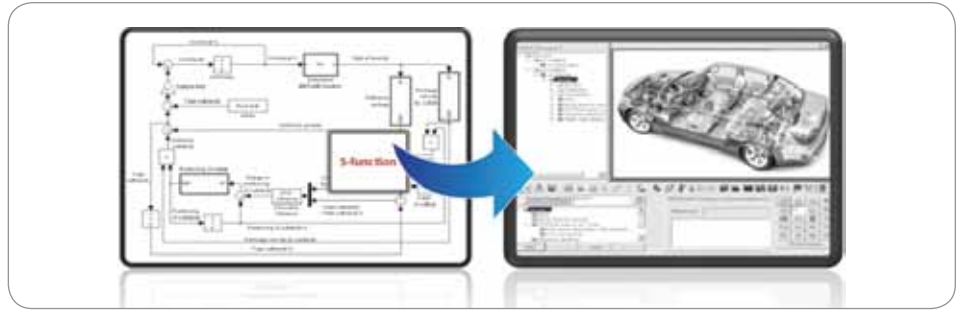
#### Powerful Analysis Techniques

Through a broad and varied array of analysis techniques, MotionSolve provides new and advanced options for studying mechanical system behavior.

- Six integrators to solve a large variety of dynamics problems. The integrators include implicit/explicit, stiff/nonstiff and DAE/ODE based algorithms.
- Four static/quasi-static solvers to predict static equilibrium configurations and loads. The algorithms together cover force imbalance, energy and DAE-based methods.



*Flexible Contact Simulation*



*Co-simulation for Hydraulics, Pneumatics, and Control Systems*

- Kinematic analysis with automatic redundant constraint detection and removal
- Linear analysis with state matrix export and eigenvalue computation.

#### **Solver Customization Tools**

While most solvers do not support customization, MotionSolve offers a truly customizable and flexible solution.

- Custom functions to support industry or domain-specific terminology
- User-defined statements for incorporating multiple elements into a single entity
- Customized messaging to extract meaningful solver information and statistics
- Tailoring the solver output format to fit any CAE environment

#### **Rich Library of Modeling Elements**

A key enabler for simulating complex mechanisms is the availability of advanced modeling elements. MotionSolve supports a comprehensive set of modeling elements that allows users to build complex mechanisms.

- Common system-modeling entities
  - Mass- and inertia-bearing rigid elements
  - Flexible bodies
  - Constraint connectors
  - Force connectors
  - Non-mechanical modeling elements
  - Commonly used lower-pair constraints, forces and motions
- Advanced modeling elements
  - Deformable curve

- Deformable surfaces
- 3D contact between faceted and primitive graphics of any shape
- Flexbody contact using deformable surfaces
- Interpreted language-based user subroutines to capture complex functions or extend the solver capabilities

#### **Open and Flexible Architecture**

Often users performing a system-level analysis must exchange data with various CAE applications. MotionSolve's open-architecture design allows it to be easily deployed within heterogeneous CAE environments and is highly compatible with third-party mechanical systems simulation products.

- Unmatched integration between FE and MBD domains through support of the bulk data files (BDF)
- Legacy support for models such as ADAMS® (ADM & ACF)
- Co-simulation interface with Simulink
- Embedded co-simulation with hydraulic or pneumatic models from DSHPlus
  - Use MotionSolve as S-function
  - Support for native RTW code

#### **Direct Integration with HyperWorks**

With MotionSolve, HyperWorks delivers a complete mechanical systems simulation solution: from best-in-class pre- and post-processing to optimization and robustness studies.

- Easily build multibody models in MotionView® as well as in HyperMesh®

- Perform DOE, optimization and stochastic studies through MotionSolve's direct integration with HyperStudy®
- Increase design efficiency and insight with HyperWorks' world-class post-processing solutions, HyperView® and HyperGraph®, for mechanical systems simulation
- Improve results accuracy by generating CMS flexbodies using OptiStruct – HyperWorks' structural analysis and optimization solver
- Take advantage of HyperWorks' industry-leading system and component optimization technology, OptiStruct®, to quickly achieve program requirements



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