

Altair MotionSolve is an integrated solution to analyze and optimize multi-body systems. MotionSolve offers powerful modeling, analysis, visualization, and optimization capabilities for simulating complex systems. You can perform kinematic, dynamic, static, quasi-static, linear, and vibration analyses. MotionSolve helps you to understand and improve the performance of your product.

### Product Highlights

- Comprehensive multi-body solution to optimize mechanical system performance
- Easily model, analyze, evaluate, and optimize your mechanical system
- Validated across several automotive, aerospace, and general machinery applications
- Extensively correlated to test data through partnership with customers

### Benefits

#### Reduce Product Development Time

Build simple models early in the design phase and add complexity as the design evolves. MotionSolve supports a large set of modeling elements and a variety of analysis methods to facilitate this. Through simulation you avoid time consuming physical testing and get to the right answer earlier.

#### Improve Product Quality

Build multi-body models that have the fidelity to capture phenomena of interest to you and accurately solve the underlying equations to characterize product behavior. Examine the product behavior to determine if the design meets your need.

#### Accelerate Product Innovation

Evaluate the behavior of complex systems in realistic settings. Perform design of experiments (DOE) and stochastic simulation to characterize and optimize product performance. Use the loads computed by MotionSolve for component weight, strength and other performance optimization.

#### Reduce Design and Manufacturing Risk

Through simulation evaluate a wide variety of alternative concepts and designs very quickly and choose the best design. Moreover, as the design evolves easily validate updated designs with models that have already been built.

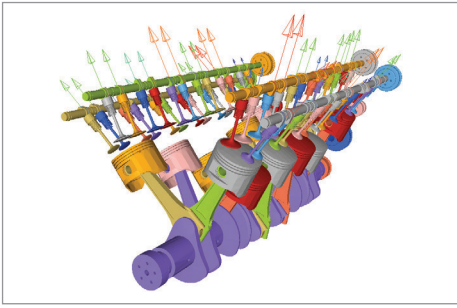
#### Modeling Capabilities

MotionSolve supports a rich set of modeling elements that allows you to build multi-body systems with the desired degree of complexity. MotionSolve is an open platform that offers built-in integration with CAD, FE, Controls, 1D simulation, CFD, and Optimization.

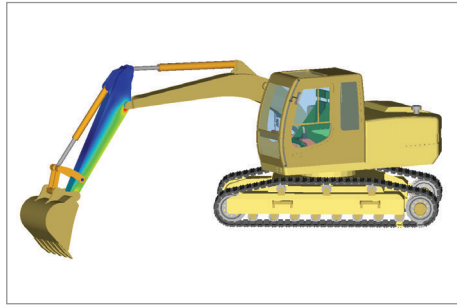
MotionSolve models routinely include:

- 2D and 3D rigid bodies
- Linear and nonlinear flexible bodies
- Lower- and higher-pair constraints
- Linear and nonlinear force connectors
- General 2D and 3D contact based on CAD geometry
- Contact between deformable curves / surfaces
- Joint friction, limits and slope

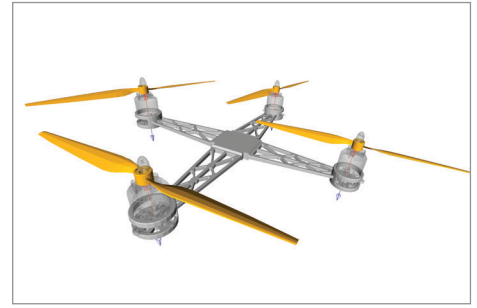
Learn more:  
[altair.com/motionsolve](http://altair.com/motionsolve)



2D contact between cam and follower



Excavator flexbody simulation



Unmanned Aerial Vehicle dynamics analysis

- Motion inputs
- Transfer functions and state matrices
- Splines for inputting test data
- Event sensors
- Generic nonlinear algebraic and differential equations
- User-defined elements to model non-standard phenomena

### Analysis Capabilities

With MotionSolve, you can determine whether a system meets its desired requirements. You can study the dynamic behavior of a system, compute its vibration characteristics, assess the performance of control systems in the system, perform packaging studies and generate realistic loads to predict component life and damage. If these built-in analyses are not adequate, you can create and use your own analysis scripts.

MotionSolve provides many options for analyzing system behavior:

- Implicit/explicit, stiff/non-stiff and DAE/ODE based methods of numerical integration
- Static/quasi-static solvers to compute static equilibrium configurations and loads
- Automatic detection and removal of redundant constraints
- Kinematic analysis for motion driven systems
- Linear analysis with ABCD export, eigenvalue computation and modal energy distribution tables
- Co-simulation to solve multi-physics problems
- Custom analyses specified in user-subroutines

### Vehicle Dynamics, Durability & NVH Solutions

MotionSolve provides a comprehensive solution for the automotive market. For a complete description, please see the automotive brochure. MotionSolve contains a library of parametric automotive

components that help you build subsystems. With support for TNO Delft-Tyre, FTire, CD Tire and the OpenCRG standard, MotionSolve provides tires and roads of varying fidelity for your applications. Templates for common subsystems such as suspensions, steering and leaf springs are available. Wizards guide you step-by-step to quickly assemble a car or truck. Simple user interfaces permit you to define and run static, dynamic or steady state events. Automated reports allow you to quickly assess system performance. You can extend all of the above to facilitate workflows specific to your organization. For instance, you can have Excel drive the Model-Analyze-Evaluate-Improve workflow. With these core capabilities you can perform suspension design and analysis, evaluate vehicle dynamics, assess controller behavior, conduct rough road simulations for estimating component durability and study the NVH characteristics of your vehicle.

### General Machinery & Mechanism Solutions

Mechanisms are used in all industries. MotionSolve provides comprehensive contact capabilities that enable you to quickly build and accurately analyze complex systems that may contain thousands of contacts. As with automotive solutions, you can also create a library of parametric components, templates for systems and use wizards to build models and run simulations. For more information about general machinery and mechanism solutions, please see the general machinery brochure.

### 1D, Controls and Mechatronics Solutions

MotionSolve provides state-of-the-art integration to 1D and controls software so you can reuse validated MotionSolve models in this context also.

- Early in the design phase, you can import linearized multibody models from MotionSolve as state matrices (ABCD) into your controls package and perform the control design.

- Later, in the evaluation phase, you can import high fidelity MotionSolve models into Matlab, Simulink or Altair Activate® to evaluate the controller. In the 1D or controls environment you connect the systems so they can exchange signals at run time. Then you run a simulation of the entire system to evaluate how well the system is performing. Alternatively, MotionSolve can import Simulink Coder C code as user subroutines and perform the same simulation.
- MotionSolve supports the FMI/FMU 2.0 protocol so you can include a wide variety of models that have been developed elsewhere.

### Altair HyperWorks™ Integration

With MotionSolve, HyperWorks delivers a complete multibody simulation environment. You can:

- Easily build multi-body models in MotionView as well as in Altair HyperMesh™
- Review system results as animations and plots with Altair HyperView™ and Altair HyperGraph™
- Run custom scripts for complex post-processing with Altair Compose™
- Improve system fidelity by generating reduced flex-bodies with the Altair OptiStruct™
- Perform component optimization in OptiStruct with loads computed by MotionSolve
- Couple with Altair AcuSolve™ to analyze multi-body systems where fluid effects are important
- Connect to Altair Activate® to design and validate mechatronics systems
- Use Altair HyperStudy™ to perform system level DOE, optimization and stochastic studies



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