

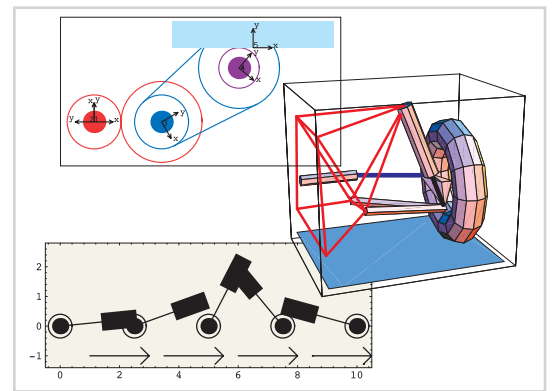


# MATHEMATICA<sup>®</sup>

## MECHANICAL SYSTEMS

KINEMATIC AND DYNAMIC ANALYSIS IN *MATHEMATICA*

Minimize your rigid body system design time and explore more design options with *MechanicalSystems*. This powerful package speeds up your prototyping and simulation tasks, helping you develop and modify complex models, plus instantly visualize and analyze your design changes. Using the complete library of over 50 two- and three-dimensional geometric constraints in *MechanicalSystems*, you can easily model complex mechanical relationships and define custom algebraic constraints to model nongeometric or control relationships. The object-oriented, model-building commands let you assemble constraints into a complete mechanism that can be solved for component position, velocity, and acceleration.



*MechanicalSystems* includes extensive graphics functions that let you locate and animate complex images to reflect mechanism motion.

### KEY BENEFITS

- Contains a comprehensive library of two- and three-dimensional geometric constraints that can be used to model mechanical relationships.
- Returns mathematical components of a model in symbolic form, if desired, including equations of motion, algebraic constraints, inertia matrices, and Coriolis forces.
- Custom algebraic constraints can be defined to model nongeometric or control relationships.
- *MechanicalSystems*' cam constraints support both analytic and mapped cam profiles.
- Performs motion analysis of underconstrained systems including static equilibrium analysis as well as velocity equilibrium analysis.
- Includes advanced methods of kinematic modeling such as multistage mechanisms.

For more information, visit [www.wolfram.com/mechsystems](http://www.wolfram.com/mechsystems).

# MATHEMATICA MECHANICAL SYSTEMS

Use *MechanicalSystems* and *Mathematica* to shorten your design time and explore more design options for two- and three-dimensional rigid body mechanisms.

## MechanicalSystems Features

### Kinematic Modeling of Fully Constrained Systems

Planar and Spatial Modeling - Open, Closed, and Multiloop Mechanisms - Multistage Mechanisms - Velocity and Acceleration Analysis - Large Library of Kinematic Constraint Objects - User-Programmable Constraints - Nominal Gear Motion Constraints - Involute Gear Motion Analysis - Cam Constraints Support Analytic and Mapped Cam Profiles

### Statics and Dynamics of Fully Constrained Systems

User-Programmable Forces and Moments - Supports Nonlinear and Nonconservative Loading - Damping and Friction Modeling - Static Reaction Analysis (Kineostatics) - Dynamic Reaction Analysis (Inverse Dynamics)

### Motion Analysis of Underconstrained Systems

Static Equilibrium Analysis - Velocity Equilibrium Analysis - Time-Domain Dynamic Motion Synthesis - Specialized Quaternion-Based Adams-Bashforth Integrator

### Mechanism Design Tools

Multiconfiguration Parametric Design Synthesis - Tolerance Sensitivity Analysis - Vector Algebra Library - Extended Graphics Functions - Mechanism Motion Animation

## General Mathematica Features

Over 1900 built-in functions, including the world's largest collection of advanced algorithms for numeric and symbolic computation, discrete mathematics, statistics, data analysis, graphics, visualization, and general programming

Multiparadigm symbolic programming language with support for procedural, functional, list-based, object-oriented, and symbolic programming constructs

Automatic precision control and support for exact integers of arbitrary length, rationals, floating-point real and complex numbers, and arbitrary-precision real and complex numbers

User-defined or automatic algorithm selection for optimal performance

Fully programmable 2D and 3D visualization with over 50 built-in plot types

Fully integrated piecewise functions

High-speed numerical linear algebra with performance equal to specialized numeric libraries

High-performance optimization and linear programming functions

Wide-ranging support for sparse matrices

Flexible import and export of over 70 data, image, and sparse matrix formats

Industrial-strength string manipulation

Highly optimized binary data I/O

Built-in universal database connectivity

Integrated web services support

Language bindings to C, Java, .NET, and scripting languages

All-platform support for 64-bit addressing

Multicore support on major platforms

*MathematicaMark*<sup>™</sup> 5.2 benchmark now covering grids and clusters

Toolkit for creating graphical user interfaces

## Technical Requirements

*MechanicalSystems* requires *Mathematica* 5.0 or higher and is available for Windows, Mac OS X, Linux, Unix, and compatible systems. For a more detailed list, see [www.wolfram.com/mathematica/platforms](http://www.wolfram.com/mathematica/platforms).

## Related Products

The *Mathematica* Applications Library is a continually expanding collection of software used in conjunction with *Mathematica* to quickly handle specific tasks in engineering, finance, data analysis, and many other technical areas.

Some of the software packages available are:

*Neural Networks* - *Control System Professional* - *Advanced Numerical Methods* - *Wavelet Explorer* - *Time Series* - *Experimental Data Analyst* - *Digital Image Processing*

Find the latest products and buy online throughout the world at [store.wolfram.com](http://store.wolfram.com). Choose from over 50 technical software products, more than 200 books, *Mathematica* posters, T-shirts, and other items.

For more information, visit [www.wolfram.com/mechsystems](http://www.wolfram.com/mechsystems).

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