

# Adams/Machinery

A powerful simulation suite for mechanical drive systems

## Overview

Adams/Machinery is a new Adams software solution that allows engineers to efficiently build functional virtual prototypes of their mechanical components and systems early in the design cycle, prior to committing to building physical prototypes. With this new solution, companies will reduce their volume of prototypes, decrease their design cycle times, and meet their functional specifications more reliably. All of these benefits drive costs down significantly.

Adams/Machinery is fully incorporated inside the Adams/View environment. With productivity tools for modeling and pre-processing gear, bearing, cable, chain and belt components, Adams/Machinery provides an extremely approachable, easy-to-use interface with in-line help and useful information about the components, their connections, and the applicability of various modeling fidelity options. Wizards help guide users through the model setup process and provide the ability to manipulate model parameters and modeling options with ease.

## Value proposition

- **Improve Engineering Productivity:** Enable direct, high-fidelity simulation of common mechanical parts and systems, such as gears, bearings, cable systems, pulley-belt systems and sprocket-chain systems, reduce dependency on macro-creation skills, and improve analyst efficiency
- **Accelerate Time-To-Market:** Gain faster, better insight into overall system design performance.
- **Reduce Manufacturing Costs:** Accurately predict and adjust design behavior much earlier in the design cycle; achieve an optimal design by analyzing multiple design variants faster
- **Achieve Lower Warranty Costs:** Predict system-level functional performance and accurately assess lifecycle service (safety, fatigue, durability); reduce risk by having better information at every stage of development

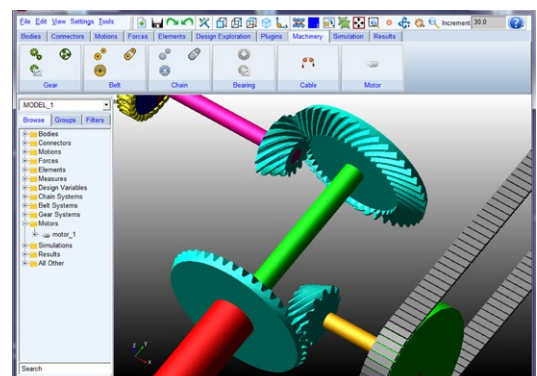
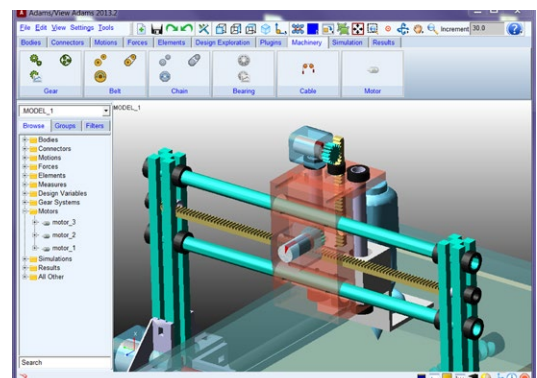
## Product attributes and capabilities

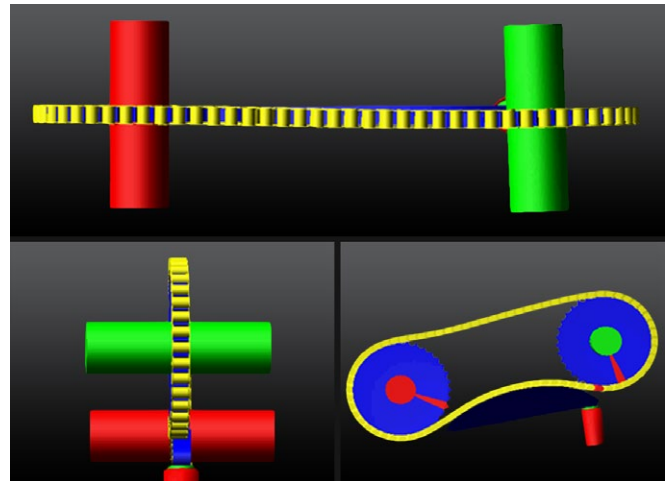
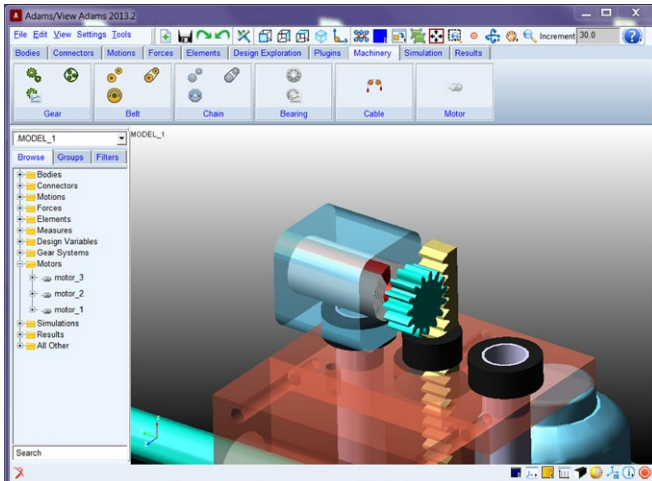
Adams/Machinery comprises a suite of modules as described below:

### Gear

This module is for engineers who need to predict the impact on system behavior of gear attributes, such as ratio, backlash, helix angle, etc. A variety of gear types are supported in the Adams/Machinery environment, and these include spur, helical, straight bevel, and spiral bevel configurations.

- Choose gear type with the selection of Spur Gear (Internal/External), Helical Gear (Internal/External), Bevel Gear Straight and Bevel Gear Spiral





- Apply Detailed modeling method when friction is considered and study the backlash based
  - on actual working center distance and tooth thickness
- Apply Contact modeling method to use geometry-based contact and to support shell-to-shell 3D geometry contact
- Use Geometry settings to define the location and geometric parameters of gears
- Choose the materials of gears by defining mass or density
- Create a planetary gear set by using the planetary gear wizard
- Generate gear-specific output in the postprocessor
- Use automated model parameterization as reference to perform design exploration

This module is for engineers who need to predict performance of belt-pulley systems; attributes of interest could include transmission ratio, tension and load prediction, compliance, and general belt dynamics. One can examine planar dynamic behavior of belt-pulley systems for a range of belt types, including smooth, poly-V grooved, and trapezoidal-toothed variants.

- Choose belt type with the selection of poly-V grooved belt, trapezoidal-toothed belt, and smooth belt
- Use Geometry settings to define the location and geometric parameters of pulleys
- Choose the materials of pulleys by defining mass or density
- Apply tensioner pulley to the belt system to take up extra slack and control the routing of the belt
- Specify belt properties

- Generate belt-specific output in the postprocessor
- Use actuation wizard to apply force or motion to any pulley in the belt system

### Chain

This module is for engineers who need to evaluate chain system attributes including drive ratio, tension, contact force, and general dynamics. One can model and evaluate the dynamics for both roller and involute, i.e., silent, chain types.

- Choose chain type with the selection of roller chain or silent chain
- Apply Linear, Nonlinear, or Advanced compliance to the roller chain
- Apply Linear compliance to a silent chain
- Use Geometry settings to define the location and geometric parameters of your sprockets
- Choose the materials of your sprockets by defining mass or density
- Apply Pivot, Translational, or Fixed guides to the chain system
- Specify chain properties
- Generate chain-specific output in the post-processor
- Use actuation wizard to apply force or motion to any sprocket in the chain system

### Bearing

This module is for engineers who need to predict the impact of the design and behavior of rolling-element bearings on overall system performance. This includes an accurate representation of the bearing stiffness, sensitive to internal dimensions, offsets, misalignments,

and clearances. Engineers can predict more accurately how bearing compliance influences the overall motion and loading of the system, as well as perform basic life predictions based on widely-adopted standards that consider bearing loading, lubrication, and speed. Module highlights are as follows.

- Choose from 14 different rolling-element bearing types
- Look up bearing parameter values from a library of over 24,000 off-the-shelf bearings and/or input values directly
- Calculate bearing reaction forces, optionally leveraging a nonlinear stiffness response from embedded technology delivered by KISSsoft, an MSC Software partner
- Select from over 120 oil- and grease-based bearing lubricants
- Predict the bearing service life (under the specified simulation conditions) based on industry standards sensitive to the loading, lubrication, speed, and bearing geometry

### **Cable**

This module is designed for engineers to easily model and analyze cable based transmission systems. Module highlights are as follows.

- Precisely compute the cable vibration and cable tension
- Predict the load history of pulleys to perform fatigue analysis

- Analyze the impact of cable slippage on system load performance
- Study the effect of cable compliance on the system output speed
- Study the winching effects in terms of the addition and removal of cable length from the system
- Define the pulley properties in terms of dimensions, contact parameters and materials
- Define the preloading, density, Young's Modulus, stiffness coefficient and damping coefficient to get the accurate cable outputs

### **Electric motors**

The new Adams/Machinery Electric Motor Module enables engineers to represent electric motors with more sophistication and ease than via simple kinematic motions or via potentially complicated self-authored torque functions or subroutines.

- Choose different modeling method for different applications
- Select from DDC (Shunt or Series), DC Brushless, Stepper and AC Synchronous motors using analytical method
- Apply external method by which the motor torque is defined by either Easy5 or MATLAB Simulink
- Calculate necessary motor sizing

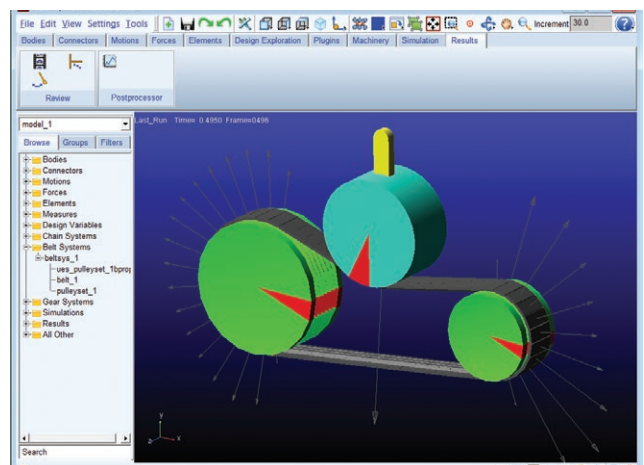
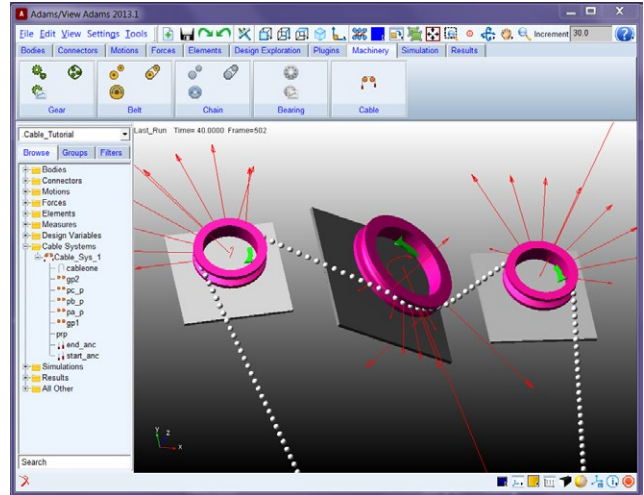


- Predict impact of motor torque on system
- Perform precise position control
- Get a realistic drive signal for the rest of the machine components

### Cam module

The new Adams/Machinery Cam module contains features to aid the creation of cam-follower systems. These systems may comprise various combinations of cam shapes, follower motions, follower arrangements and follower geometry. The detailed fidelity options include:

- Create cam model much faster than before
- Make mechanism motion and cam profile design changes more easily
- Choose different cam shapes: disk, cylindrical (barrel) and single sided grooved
- Generate cam profile using existing follower motion
- Create a follower motion that is either time based or cam angle based
- Optimize the motion function to minimize or maximize acceleration or jerk in a more automated way.



### Adams/Machinery license options

#### (Token and standalone availability)

- Adams/Machinery Add-on Module (requires Adams Studio, i.e., Adams/View and Adams/Solver)
- Adams/Machinery Studio (includes Adams/Studio and the Adams/Machinery Add-on Module)
- Individual Feature Modules (requires Adams Studio, i.e., Adams/View and Adams/Solver)

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