MSC.ADAMS
Release Guide

MSC.ADAMS 2005 r2

ADAM*V2005R2*Z*Z*Z*DC-REL

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Contents

Welcome to MSC.ADAMS

Thank you for purchasing MSC.ADAMS products. The MSC.ADAMS® suite of software is the world's most widely used mechanical system simulation software. It enables users to produce virtual prototypes, realistically simulating the full-motion behavior of complex mechanical systems on their computers and quickly analyzing multiple design variations until an optimal design is achieved. This reduces the number of costly physical prototypes, improves design quality, and dramatically reduces product development time.

MSC.ADAMS is part of SimOffice™, MSC's stand-alone VPD environment. SimOffice provides a unified framework for simulation of integrated virtual prototypes and includes other major MSC product families, such as MSC.Nastran.

This guide introduces you to MSC.Software, what's new in this release of MSC.ADAMS, and how to run the products. It also explains how to use the MSC.ADAMS online help. At the beginning of the guide, you'll find lots of resources for learning more about MSC.Software and MSC.ADAMS, attending training, and obtaining consulting services.

1 About MSC.Software

Overview

MSC.Software Corporation is the leading global provider of virtual product development (VPD) tools, including simulation software and professional services. MSC.Software helps companies make money, save time, and reduce costs associated with designing, testing, producing, and supporting manufactured products.

MSC.Software works with thousands of companies worldwide, in hundreds of industries, to develop better products faster by using information technology, software, and services to enhance and automate the product design and manufacturing process. Simulating your product performance reduces development costs, time to market, and warranty costs.

About Virtual Product Development and MSC.ADAMS

You've heard it before: manufacturing companies today face intense global competition, demanding customers, fragmented markets, increasing product complexity, compressed product cycles, price and profit pressures, strict regulatory and liability environments, systems integration and supply chain issues, skyrocketing costs of testing and physical prototyping, and on and on…

What you don't often hear, though, is a strategy for enabling your company to improve your new product development process to meet these challenges.

Whether you are delivering airplanes, automobiles, ships, biomedical devices, golf clubs or children’s toys to your customers, MSC.Software’s goal is to help you improve your new product development process, allowing you to be significantly better at your concept development, design, testing, and production activities through the application of VPD.

VPD is an environment that uses an integrated combination of both simulation software technology and traditional techniques to design, test, manufacture, and support products. The result is that cost-effective designs that meet all performance, safety, durability, and reliability requirements can be brought to market in less time and for less cost.

MSC.ADAMS, as part of VPD, is focused on enhancing your ability to make better product development decisions, explore innovative design alternatives, and consistently get the product right. It is the world's most widely used mechanical system simulation software. It enables you to produce virtual prototypes, realistically simulating the full-motion behavior of complex mechanical systems on your computers and quickly analyzing multiple design variations until an optimal design is achieved. This reduces the number of costly physical prototypes, improves design quality, and dramatically reduces product development time.

About Licensing MSC.ADAMS

MSC.Software offers you two methods of providing software: traditional (per seat) and token-based (MSC.MasterKey):

- **Traditional Method:** In the traditional method, purchasing one product results in one license (or seat) of that product; two purchases allows for two simultaneous users. If a different software item is needed, you must purchase new seats of the new software.
- **MSC.MasterKey:** With the MSC.MasterKey method, you purchase a pool of tokens. Users in your company check out tokens from the pool and use them to access and run the solutions available under MSC.MasterKey. Each individual software requires a certain number of tokens to run. There are roughly 250 different software options available under MSC.MasterKey.

To learn more, go to:

http://www.mscsoftware.com/products/products_detail.cfm?PI=556

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For additional information, such as phone numbers for specific departments, maps, and driving directions, go to:

http://www.mscsoftware.com/about/

Sales and Service Offices

MSC.Software has sales and service offices throughout North America, as well as throughout the world. Sales and service of MSC.ADAMS products are also handled by selected distributors and value-added resellers (VARs) in various areas of the world.

For information about the sales and service offices, go to:

http://www.mscsoftware.com/about/locate/?Q=131&Z=140

and then select a region.

Need Technical Support?

At the MSC.ADAMS support Web page (http://www.mscsoftware.com/support/prod_support/adams/), you can read the latest release notes and known issues and get information about available technical support. To find your support center, go to:

http://www.mscsoftware.com/support/contacts/index.cfm.

In addition, we provide several excellent sources of online information:

- **Knowledge Base** - Find solutions to problems in this repository of troubleshooting tips, examples, and frequently asked questions. To access the knowledge base, go to:

  http://support.mscsoftware.com/kb/

- **VPD Community** - The VPD community is where to go when you are looking for peer support, as well as technical expertise. Many of our consultants, developers, and technical support staff monitor the forums. To sign up for the forums, go to:

  http://forums.mscsoftware.com

  Then:

  - To view the MSC.ADAMS discussions, select **MSC.ADAMS**.
  - To view product alerts and company news and events, select **MSC News**.

Need Training?

Throughout the year, MSC.Software offers many training options at locations throughout the world. For training schedules, locations, and registration information, go to:

http://www.mscsoftware.com/support/msc_institute/

Using Consulting Services

MSC.Software offers a wide range of cost-effective engineering services, on both a short- and long-term basis, when you need them, at your site or from our offices.

For information about the available consulting services, go to:

http://www.mscsoftware.com/services/.

2 What's New

Overview

The MSC.ADAMS 2005 r2 release is the most advanced version of MSC.ADAMS. It contains over 100 enhancements and many corrections to the software. It introduces the new product, ADAMS/SmartDriver, an advanced driver simulator.

Learn more about this new release:

Highlights of Product Improvements

There are many reasons why you should use MSC.ADAMS 2005 r2, including:

Product Integration

- Improved durability simulations in MSC.ADAMS through MSC.Nastran integration
- Common solver for multi-body, controls, and hydraulics applications
- Validated MSC.ADAMS models reused in MSC.Nastran for NVH analysis
- Improved connection between MSC.ADAMS and controls-systems software
- ADAMS/SmartDriver (new product) support in ADAMS/Car
- Road Builder (ADAMS/3D Road feature) support in ADAMS/Car and ADAMS/Chassis

New Capabilities

- Technology for analyzing rotating systems
- Significantly faster contact simulations
- Rudimentary flexible-body contact
- Ability to view stress hot spots
- Accurate modeling of distributed forces
- Right turns for open loop and quasi-static cornering events in ADAMS/Car
- Support for abort conditions in the Driving Machine and Event Editor for ADAMS/Car and ADAMS/Chassis
- Road Builder interface for ADAMS/3D Road

Other Additions

- Continued migration of MSC.ADAMS applications to ADAMS/Solver (C++)
- Improved ease-of-use in ADAMS/Vibration, ADAMS/Durability, and ADAMS/Flex

Platforms Supported

For MSC.ADAMS 2005 r2, we continue to provide MSC.ADAMS on the latest platforms. For more information, see the Hardware and Software specifications in the printed *MSC.ADAMS Installation and Operations Guide* or available online at:

http://www.mscsoftware.com/support/prod_support/adams/

Supported Versions of Integrated Products

Many MSC.ADAMS 2005 r2 products work with other products, such as ADAMS/Controls with MSC.EASY5. For a table that lists the integrated products and their compatible versions, see Supported Versions of Integrated Products on page 73.

New Products

For MSC.ADAMS 2005 r2, we've provided the new product:

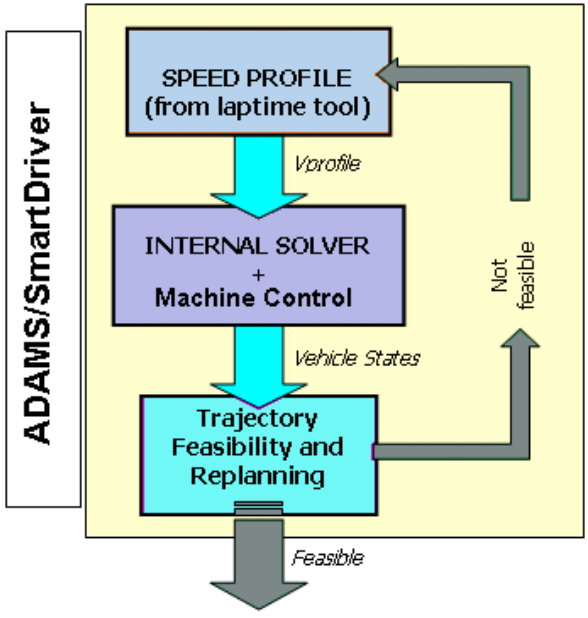
ADAMS/SmartDriver

ADAMS/SmartDriver is an advanced driver simulator that can bring a vehicle to its dynamic limits or near targets you define. You must supply a path over which the vehicle will be driven and a target (either vehicle limits or user-defined limits). The typical ADAMS/SmartDriver application is for a single mini-maneuver for which you require maximum or target performance.

ADAMS/SmartDriver lets you improve handling, durability, or ride performance of the vehicle model based on predicted performance that ADAMS/SmartDriver computes. It gives you the ability to investigate system-level dynamics of the vehicle model, while requiring minimal setup.

The Figure 1 summarizes the ADAMS/SmartDriver internal architecture:

Figure 1. ADAMS/SmartDriver Internal Architecture



ADAMS/SmartDriver calculates the *speed profile* using a built-in, quasi-static solver. This solver can take into account tire limits, engine and brake system limits, as well as full load transfer and aerodynamics.

The *internal solver* is a fast simplified vehicle model, with rigid suspensions. It inherits all vehicle data (initial conditions, geometry, inertial values, tires, and so on) from the full model, and integrates forward in time dynamics, taking into account inertial effects, load transfer, aerodynamics, and driver demands. Powertrain and tires are fully compliant with MSC.ADAMS (PAC2002 and PAC96 tire models are fully compliant; PAC94 and PAC89 are supported for compatibility).

Additions to Existing Products

The following are highlights of additions to existing products. For the latest information, as well as changes, issues resolved, and known issues, go to:

http://www.mscsoftware.com/support/prod_support/adams/

ADAMS/Aircraft

New Linear Point Aircraft Aerodynamics Entity

We added a second point aerodynamics entity for use with rigid airframes. This new entity complements the existing aircraft aerodynamics entity, which you can use to model nonlinear aerodynamics. This added a new property file in shared database:

AA_zero_aero.lpt

New Capability to Change Runway Orientation in Landing Simulations

You can now change the orientation of the runway for landing simulations by entering runway yaw, pitch, and roll values, which are independent of the aircraft yaw, pitch, and roll orientations. We updated the shared database landing loadcase files from version 1 to version 2.

landing_drop.llc

landing.llc

Added Pressure Relief Valve to Equation-Based Damper

Some landing gear shock struts contain pressure relief valves, which are also known as blow-off valves. The valves serve to limit the maximum pressure that can develop inside the strut due to high stroke rates. The equation-based, incompressible damper now has an optional pressure relief valve. Additionally, to improve solver performance, we collapsed the modeling entity's internal functions to reduce the number of functions that recursively reference each other. We updated the shared database equation-based damper file from version 1 to version 2:

AA_any_damping.eqd

New Simulation Type: Gear Taxi

You can simulate the straight-ahead taxi behavior of a single gear with the new gear taxi simulation. You can use this if a full aircraft model is unavailable. You can also use this simulation to focus on the shimmy behavior of a single gear. We added a new directory and input file to the shared database:

loadcases_geartaxi.tbl/gear_taxi.gtx

ADAMS/Car

- ADAMS/SmartDriver (new product) support
- Road Builder (ADAMS/3D Road feature) support
- Right turns for open loop and quasi-static cornering events
- Support for abort conditions in the Driving Machine and Event Editor

ADAMS/Car Ride

Enhanced ADAMS/Vibration Integration

We enhanced ADAMS/Vibration integration by adding support for tire contact patches actuators (displacement, velocity, acceleration) and wheel center actuators (force) in ADAMS/Car Ride four-post, test rig frequency analyses. You can define vibration actuators by swept sine, PSD, or user function.

Enhanced MSC.ADAMS to MSC.Nastran Integration

You can now export MSC.ADAMS models to MSC.Nastran. A direct mapping between MSC.ADAMS and MSC.Nastran elements is available. Using this option makes it possible to export models in design condition or after static equilibrium.

ADAMS/Chassis

- Road Builder (ADAMS/3D Road feature) support
- Support for abort conditions in the Driving Machine and Event Editor

ADAMS/Controls

New Controls Plant for Input/Output Signal Visibility

The Controls → Plant Export feature has been modified and repackaged to allow visibility of the input and output signals specified for the MSC.ADAMS plant. This new Controls Plant will reside in your model as an assembly, and can be referenced as such. This will helps bring more clarity when you are working with multiple plant configurations. For example, once you have created several new plant UDEs, you can quickly locate a given plant configuration by browsing for it. For ease-of-use, any of your existing Plant_Input and Plant_Output entities can also be readily accessed to create or modify a new Controls Plant.

Additionally, we have added support for an initialization command for specifying non-time advancing commands that you want executed before the co-simulation or function evaluation starts. For example:

```
file/command=setup_controls.acf
```

For more details on using the new Plant Export dialog box, refer to the guide, *Getting Started Using ADAMS/Controls*.

For an example, see Knowledge Base Article 12678:

http://support.adams.com/kb/faq.asp?ID=kb12678.dasp

Usability Improvements for TCP/IP Co-simulation

The 2005 r1 release introduced TCP/IP as a new communication mechanism for ADAMS/Controls. With 2005 r2, we have made some usability improvements so the MSC.ADAMS Server now runs as a daemon (adams_daemon.py). This means that it only needs to be started once, allowing you to send it co-simulation jobs repeatedly. These jobs can be of either type, interactive or batch (vcontrols and scontrols, respectively), and can include solver jobs from vertical applications, such as ADAMS/Car.

Example:

```
adams05r2 python adams_daemon.py exit
```

Usage:

You can invoke this script in the following ways:

- On UNIX/Linux:

  ```
  adams05r2 -c python topdir/controls/utils/adams_daemon.py [-h] exit
  ```

- On Windows:

  ```
  adams05r2 python topdir/controls/utils/adams_daemon.py [-h] [-p port] exit
  ```

  where:

  - **-h** prints the help message.
  - **-p port** specifies the port number. The default value is 30001.
  - ***topdir*** is the installation directory of MSC.ADAMS and can be determined by issuing **adams05r2 -top**.

When the daemon starts, an informational message appears, notifying you that TCP/IP mode is ready and operational.

The ADAMS/Controls server daemon is now operational for TCP/IP communication with MSC.EASY5 or MATLAB client(s). This server daemon will remain in the send/receive mode until this window is closed.

For more details on TCP/IP, refer to the ADAMS/Controls online help.

Thin Client Packaging of MSC.ADAMS Server for TCP/IP Co-simulation

The installation files for the MSC.ADAMS server have been packaged separately, allowing you to install a minimal set of files on the controls application machine (the machine running MSC.EASY5 or MATLAB), instead of a full MSC.ADAMS installation, which was required in past releases.

For more details, refer to the *MSC.ADAMS Installation and Operations Guide*.

For a related example, see Knowledge Base Article 12679:

http://support.adams.com/kb/faq.asp?ID=kb12679.dasp

C++ Solver Support in MSC.EASY5 2005

ADAMS/Solver (C++) is now available as an experimental feature within MSC.EASY5 Solver. This is another step forward in the integration of the two products and allows MSC.EASY5 users to seamlessly run their models with ADAMS/Solver (C++) while staying in the familiar MSC.EASY5 modeling environment. ADAMS/Solver (C++) has been enhanced with switch-state technology (see the BISECTION and TERROR keywords on SENSOR) for the handling of discontinuous events prevalent in many MSC.EASY5 models.

For an example, see Knowledge Base Article 12699:

http://support.adams.com/kb/faq.asp?ID=kb12699.dasp

ADAMS/Durability

Hot Spot Identification

Critical stresses can now be identified more easily from animation contour displays in ADAMS/PostProcessor. A new Hot Spots tab is available in the Animation dashboard when the ADAMS/Durability plugin is loaded. This tab allows you to control the definition, display, and labeling of hot-spot data. You can display hot spots for flexible bodies that contain stress or strain, or for rigid stress objects (with quasi-static stress recovery). The hot-spot identification options include:

- Filter (Count, Threshold, Percentage)
- Radius

Caching is used to maintain hot-spot data, so once stress or strain data has been computed and cached, the control and display of hot spots during animation can be adjusted interactively (with no delays in processing). The hot-spot graphics can be labeled with Rank, Value, Frame, and Node ID.

Sort Order of Hot Spots

A Sort Order option has been added to the Hot Spot Information dialog box. This option is included in the header of the hot spot table. Three settings are available:

- **Absolute** - Sorts hot spots based on their magnitudes. The Absolute setting is useful when the value and not the sign is important for selecting hot spots. For example, in the case of stress, you might consider both compressive (negative) and tensile (positive) stresses to be equally important.
- **Maximum** - Sorts hot spots from high to low. The Maximum setting considers sign and magnitude when sorting hot spots. For example, a value of +100 would be considered hotter than -200. Until this release, this was the default action for hot-spot computations.
- **Minimum** - Sorts hot spots from low to high. The Minimum setting also considers sign, but sorts the hot spots in reverse order of Maximum. For example, a value of -100.0 would be considered hotter than a value of 200.

FEMDATA Improvements

Pinpointing critical stresses is easier with FEMDATA due to the following improvements:

- Annotated FE load file, supplemented with hard-point labels
- Minimum peak loads from FEMDATA

Annotated FE Load File

Additional information on load points, such as MSC.ADAMS marker ID and global coordinates, is now listed in the FEA Loads Export or FEMDATA loads file.

Minimum Peak Loads from FEMDATA

Both maximum and minimum loads are output with the FEMDATA PEAK_SLICE option for the FX, FY, FZ, TX, TY, and TZ designations. When a minimum load occurred in the simulation, the loads are now output to the load file. When the PEAK_SLICE option is specified on the FEMDATA statement, the maximum peak loads are also output to the load file.

For example:

```
FEMDATA/1
, LOADS
, FLEX_BODY = 1
, START = 0.3
, END = 0.4
, FILE = peak
, PEAK_SLICE = FX:FY:FZ:FMAG
OUTPUT/
, LOADS = ANSYS
```

Then, peak.dat load has new header:

```
! Load Point Information  (Global Reference Frame):
! Node ID  ADAMS ID      X            Y            Z        Marker Label
! -------- -------- ------------ ------------ ------------ ------------
!     1035        6  0.0000e+000  0.0000e+000  0.0000e+000 MARKER_6
!     1031       24  1.5000e+002  1.0000e+002  0.0000e+000 TAB1
!     1032       25  2.5000e+002  5.0000e+001  0.0000e+000 TAB2
!     1033       26  3.2500e+002  3.0000e+001  0.0000e+000 TAB3
```

For an example, see Knowledge Base Article 12654:

http://support.adams.com/kb/faq.asp?ID=kb12654.dasp

Hot-spot Time Range (51657)

Two new optional text boxes have been added to the Hot Spots Information dialog box: Start and End times. When specified, the computation of hot spots are limited to that time range. This time range is included in the header of the hot-spot table. Similarly, the FEMDATA statement also supports time range with START and END arguments, as shown here:

```
FEMDATA/1
, STRESS
, FLEX_BODY = 5
, START = 0.5, END = 1.0
, FILE = windowed_stress.tab
, HOTSPOTS = 10
, RADIUS = 25
, CRITERION = VON_MISES
```

Pre-Stress and Pre-Strain Support

Modal stress recovery (MSR) in ADAMS/Durability will now take into account pre-stress and pre-strain in flexible bodies. A block to store the stress and/or strain state due to a preload has been added to the MNF. MSC.Nastran 2006 will support the output of these blocks when a preload is included and stress (or strain) is requested.

For an example, see Knowledge Base Article 12655:

http://support.adams.com/kb/faq.asp?ID=kb12655.dasp

XDB Support for MSC.Fatigue Export

A new XDB option has been added to the MSC.Fatigue Export dialog box. With this option, you can import the modal data from an XDB file instead of an OP2. Unlike an OP2 file, XDB does not have any file size limitations and uses less memory when importing data.

ADAMS/Engine—powered by FEV

ADAMS/Solver (C++) Supports ADAMS/Linear and ADAMS/Vibration

You can now use ADAMS/Solver (C++), which is the default solver in ADAMS/Engine, to run eigen value solutions by selecting Perform Linear Analysis in analysis dialog boxes. You can now also run ADAMS/Vibration with ADAMS/Solver (C++). In particular, this means that 2D chains and belts can now be used for eigenvalue solutions and vibration studies.

For more details, see the Release Notes for ADAMS/Solver on page 41 and ADAMS/Linear on page 33.

Modal Force Hydrodynamic Bearing

A new bearing component has been added to ADAMS/Engine Advanced Cranktrain to improve the analysis of hydrodynamic bearings. The modal force hydrodynamic bearing is only supported with ADAMS/Solver (C++).

Utility to Generate MSC.Nastran Input File

You can now automatically write the MSC.Nastran input file needed to generate the .mnf file of a crankshaft or engine block from within ADAMS/Engine.

Torsional Vibration Train

You can now perform a linear torsional vibration analysis of a dynamically loaded cranktrain system through the Haffner-Maass method from within ADAMS/Engine.

ADAMS/Flex

Generalized Modal Damping (C++ Solver Only)

You can now obtain the generalized damping matrix from MSC.Nastran and apply it to a flexible body. This is another step forward in our MSC.Nastran-MSC.ADAMS integration efforts and will help improve life prediction estimates and correlation with finite element analyses.

Like the generalized mass and stiffness matrix, the MNF will contain a generalized damping matrix if any form of damping is defined in the MSC.Nastran data deck. The generalized damping matrix can optionally be applied to the flexible body in

MSC.ADAMS. Furthermore, you can choose whether to include damping effects on the FLEX_BODY rigid body degrees of freedom. Generalized damping and modal damping are **not** mutually exclusive. That is, their effects are additive.

For an example, see Knowledge Base Article 12660:

http://support.adams.com/kb/faq.asp?ID=kb12660.dasp

ADAMS Dataset Language

To apply the generalized damping to a flexible body, add the gdamp option to the FLEX_BODY statement, for example:

```
FLEX_BODY/1, MATRICES = 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13
, CRATIO = 0.0/ GDAMP=FULL, MNF_FILE = my.mnf
```

You can also instruct MSC.ADAMS to ignore damping forces on the rigid body degrees of freedom by specifying GDAMP=INTERNAL_ONLY:

```
FLEX_BODY/1, MATRICES = 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13
, CRATIO = 0.0/ GDAMP=INTERNAL_ONLY, MNF_FILE = my.mnf
```

Access in ADAMS/View

Generalized modal damping can be accessed in the Flexible Body Modify and Create a Flexible Body dialog boxes.

State-dependent Modal Force (MFORCE)

Target applications, such as sophisticated damping models, crosswind vehicle loading, and other aerodynamics loading, will benefit from our new state-dependent modal force. We now support independent scaling of each load vector by a state-dependent factor. We have observed some significant performance improvements in some engine applications where 300 independent MFORCEs were replaced by a single state-dependent modal force.

For an example, see Knowledge Base Article 12659:

http://support.adams.com/kb/faq.asp?ID=kb12659.dasp

Introduction

Before MSC.ADAMS 2005 r2, the most general construct of the MFORCE was:

$$mf(q,t) = s(q,t) * [g\_1(t) * f\_1 + ... + g\_n(t) * f\_n] \quad (1)$$

where:

- mf(q,t) - 6 + m vector dependent on solver state and time
- s(q,t) - Scalar function dependent on solver state and time
- g_i(t) - Scalar function dependent only on time
- f_i - 6 + m constant load vector
- m - Number of active modes in the flexible body
- n - Number of superimposed load vectors

Most users will only consider a single load case per MFORCE, (that is, n = 1), in which case, (1) reduces to:

$$mf(q,t) = s(q,t) * f\_i \quad (2)$$

The user defines an MFORCE given by (2) by specifying the load case i and scale factor s(q,t). Both the MSC.ADAMS dataset language and the ADAMS/View command language facilitate this type of definition. Users interested in defining the more general MFORCE given by (1) are required to use the MFOSUB user-written subroutine interface.

Note that (1) does not allow individual load cases or components of the load vectors to be independently scaled by functions of solver state. This restriction allows a very efficient implementation of the MFORCE, and for most applications it is not limiting. Users interested in scaling each load vector by a function of state could work around the restriction by creating multiple MFORCEs. For example:

$$mf(q,t) = mf\_1(q,t) + mf\_2(q,t) + ... + mf\_n(q,t) \quad (3)$$

where:

- mf_i(q,t) = s_i(q,t) * f_i

In ADAMS/Solver (C++) 2005 r2, the MFORCE supports the very general form:

mf(q,t) = f(q,t) (4)

where:

- f(q,t) = 6 + m vector with each component varying independently on solver state and time.

This more general form facilitates applications in aeroelasticity, material damping, and vehicle cross-wing loading. You can only specify an MFORCE of form (4) using an MFOSUB. It is important to note that generality comes at a price. Solving an MFORCE of type (4) is more expensive than (1). Because most users will not require this general form and because it is more expensive to solve, the old form (1) is still supported and should be used if it satisfies the application.

ADAMS Dataset Language

In the ADM file, you would define a traditional MFORCE of type (1) as follows:

```
MFORCE/id, FLEX_BODY = id, [JFLOAT = id]
,FUNCTION = USER(r1, [r2, ... r30]
,[ROUTINE = libname::subname]
```

In this case, an MFOSUB is required and returns the scale function s(q,t) and the summation of load vectors:

g_1(t) * f_1 + ... + g_n(t) * f_n

In MSC.ADAMS 2005 r2, an MFORCE of type (4) is similarly defined as:

```
MFORCE/id, FLEX BODY = id, [JFLOAT = id]
,FORCE = USER(r1, [r2, ... r30], [NOSCALE]
,[ROUTINE = libname::subname]
```

The only difference is that FUNCTION = USER(...) has been replaced with FORCE = USER(...).

User-written Interface

The same MFOSUB interface is used for MFORCEs of type (1) and (4):

```
 SUBROUTINE MFOSUB(ID, TIME, PAR, NPAR, DFLAG, IFLAG,
+                  MODLOADS, NMODES, NCASES, SCALE,
+                  CASE, LOADVEC)
```

For type (4), the user returns the modal force function f(q,t) in the LOADVEC array. If the user tries to modify CASE or SCALE, a warning is issued.

Accessing in ADAMS/View

To build an MFORCE in ADAMS/View, select the Distributed Load tool from the Connector palette. In the Create Modal Force dialog box, create an MFORCE of type (1) by selecting Subroutine in the Define Using pull-down menu. An MFORCE of type (4) is created by selecting Force in the Define Using pull-down menu.

MNF Generated from Experimental Data

Capability of creating an MNF from experimental data is now available. A utility has been developed that creates a constant-coupling MNF from experimental measurements on a component. Required measurements include:

- Global mass/inertia properties
- Natural frequencies
- Deformations at attachment points

We accept Universal files generated from I-DEAS Test and others. A new MNF translator utility is accessible from the MDI script. For example:

```
adams -c flextk unv2mnf myfile.unv [option1] [option2] [option3] ....
```

The utility and options are similar to mnf2mtx.exe.

For an example, see Knowledge Base Article 12661:

http://support.adams.com/kb/faq.asp?ID=kb12661.dasp

Point-to-Plane and Curve-to-Plane Contact Support For Flexible Bodies

By supporting points on flexible bodies in MSC.ADAMS 2005 r2, you can now enforce simple point-to-plane and point-to-curve contact conditions on flexible bodies. The point can exist on the flexible body, but the plane or curve cannot. ADAMS/Solver (C++) supports several points defined in a single contact; ADAMS/Solver (FORTRAN) only supports a single point per contact.

For an example, see Knowledge Base Article 12658:

http://support.adams.com/kb/faq.asp?ID=kb12658.dasp

On-demand Purge of Animation Flexible-body Cache Files

In response to user request, we have added features for clearing flexible-body cache files in the working directory. You can use the file cache purge command and or menu buttons on the Tools menu in ADAMS/View and ADAMS/PostProcessor:

Tools → Purge Cache Files

MNF Generation Available in MSC.Nastran SOL 600

You can now create modal neutral files (MNF) directly in SOL 600 when using MSC.Nastran 2006.

ADAMS/Insight

Improved Factor Form

The form for setting Factor attributes has been modified to include tabs for the various attributes. There are four tabs: Settings, Variation, Tie, and Description. The Settings tab is used to specify the factor type (discrete or continuous), delta type, settings, and tolerance. There is also a new option called Settings Details that provides information on the lower limit, nominal, and upper limit for the settings.

A new Variation tab is used for specifying variation information for Monte Carlo and Latin Hypercube investigations. In addition to Normal and Uniform, the supported distributions now include Lognormal, Weibull, Discrete, and user supplied. A small graphic displays an example of the distribution type. Additional information on the current settings of the selected distribution is available by selecting Variation Details. You can specify Coefficient of Variation, Percent, or Tolerance and ADAMS/Insight will automatically compute the standard deviation, one of the required inputs for the distribution. Similarly, you can specify the cutoff limits in terms of Number of Standard Deviations, Percent, or Absolute Value of limits.

Enhanced Response Form

The response form has a new tab for specifying optimization information. At the time of response selection, you have the option of specifying optimization criteria, such as target value, optimization weight, and the objective (for example, greater than, less than, and so on).

Enhanced Design Specification Form

The Design Specification form now has a new Modified Latin Hypercube option available under the Investigation Strategies. This provides an alternative to the Monte Carlo sampling technique for variation studies.

Improved Workspace Correlation

Performance enhancements have been made for the computation of correlation values. Both Pearson and Spearman Rank correlations are computed. Various filters can be applied to the correlation matrix to simplify the view.

Enhanced Optimization Form

There is a new option that saves the current factor and response settings as defaults. ADAMS/Insight uses the default settings to fill in the Optimization Form when you display it. If you make changes to the settings and close the Optimization Form without saving them, they will be lost.

In addition, a new optimization solver called Stochastic Design Improvement (SDI) is now available. SDI is a stochastic solver. At each step (iteration), SDI randomly generates a set of trials around the current design point. It then selects the best trial, generates a new set of trials around that point, and continues.

Conduit Enhancements

New conduits that allow ADAMS/Insight to be used with MSC.Patran and MSC.Robust Design are now available. These options are accessed through **Simulation → Add Simulation**.

Using the MSC.Patran option, you can specify an MSC.Patran session file or a parametric output file that ADAMS/Insight will read and interpret. You can then build the experiment with the various factors and responses.

Using the MSC.Robust Design option, you can specify an MSC.Robust Design experiment (.xml file). ADAMS/Insight will then read and interpret the file, including results. You can then use ADAMS/Insight's postprocessing capabilities to explore the experiment results.

New Direct Optimization

ADAMS/Insight now supports direct optimization with MSC.EASY5 and MSC.Patran models, in addition to optimization using the response-surface-based surrogate model. You can access the direct optimization capability using **Simulation → Run → Direct**. This option can also be used to invoke a single run of the associated solver through the ADAMS/Insight interface. Direct optimization is also available with the ASCII conduit.

Usability Enhancements

This release also includes several usability enhancements, such as:

- Updated customization examples
- Extended command-line arguments

ADAMS/Linear

ADAMS/Linear has been enhanced in the following ways:

- ADAMS/Solver (C++) now supports the Linear command.
- Exact linearization is supported for time-dependent systems (ADAMS/Solver (C++) only).
- Linear models can be generated with user-specified states (ADAMS/Solver (C++) only).
- Automated specification of user-defined states (ADAMS/Solver (C++) only).
- Calculation and export of [M], [K], and [B] matrices (ADAMS/Solver (C++) only).

ADAMS/Solver (C++) now Supports ADAMS/Linear

ADAMS/Linear is now fully supported by the ADAMS/Solver (C++). You can use the existing features of ADAMS/Linear, such as:

- Eigenvalue solution
- Modal energy calculation
- State matrix generation

Any MSC.ADAMS model that was linearized using ADAMS/Solver (FORTRAN) can now be linearized using ADAMS/Solver (C++).

ADAMS/Solver (C++) doesn't have an .out file; you may need to look closely to recognize that the energy tables are written to a separate external file, as noted at the bottom of the eigenvalue output:

```
                E I G E N V A L U E S  at time = 0.00000E+00
    Number    Real(cycles/unit time)   Imag.(cycles/unit time)
       1              0.00000E+00    +/-        7.42040E-01
Energy tables calculations were written to file your_model.txt.
```

Exact Linearization is Supported for Time-dependent Systems (ADAMS/Solver (C++) only)

ADAMS/Linear has been enhanced so an exact linearization is now obtained for time-dependent and non-stationary systems. This enhancement directly leads to key benefits. ADAMS/Linear accurately captures the dependency of:

- Eigenvalues on angular velocity for rotating systems
- State matrices on system velocities

No simplifications of the equations of motion are made and all rotational effects (that is, gyroscopic effects, coriolis effects, and explicit time dependencies) are taken into consideration. The linearization can be done at any valid operating point:

- After assembly (IC solution)
- Static equilibrium
- Dynamic operating points

Linear Models Can Be Generated With User-specified States (ADAMS/Solver (C++) only)

ADAMS/Linear requires a minimum representation of the system to generate the state matrix from which eigenvalues can be computed. For non-stationary systems, the state matrix is a function of the states used to linearize the system.

In previous versions of ADAMS/Linear, the minimum representation of the system was automatically found; you were not given any control over the specification of coordinates used to represent the system.

A new modeling object, PSTATE, has been created that allows you to define a set of states that are to be used in the linearization scheme. You can specify as many states as there are degrees of freedom. If a smaller set of states are provided, then the system will fill in, by choosing a set of internally available states for the ones that were not explicitly specified. If too many states are specified, ADAMS/Solver identifies and discards the redundant states.

PSTATEs are a list of VARIABLES. The VARIABLES contain expressions that specify the states that are to be used in linearizing the system. PSTATE objects are defined in the model (ADM) file. The LINEAR command (in the ACF) can instruct ADAMS/Solver to

use a specific PSTATE object for generating the linear model. A model file (ADM) can contain any number of PSTATE objects. You can use any one of them with the LINEAR command.

Below are some sample commands using PSTATE:

ADM File:

```
VARIABLE/1001, FUNCTION=AZ(21,11)
VARIABLE/1002, FUNCTION=AZ(31,22)
VARIABLE/1003, FUNCTION=AZ(41,32)
VARIABLE/1004, FUNCTION=DZ(51,42,42)
VARIABLE/2001, FUNCTION=AZ(21,11) + AZ(31,22)
VARIABLE/2002, FUNCTION=AZ(31,22) + AZ(41,32)
VARIABLE/2003, FUNCTION=AZ(41,32) + AZ(21,11)
VARIABLE/2004, FUNCTION=SQRT(DX(51,42,42)**2+DY(51,42,42)**2+DZ(51,42,42)**2)
PSTATE/1, VAR = 1001, 1002, 1003
PSTATE/2, VAR = 2001, 2002, 2003
```

ACF File:

```
SIM/INI
LIN/EIG, PSTATE=2
LINEAR/STATEMAT, PSTATE=1, FORMAT=matrixx, FILE=m1.dat
LINEAR/STATEMAT, PSTATE=2, FORMAT=matrixx, FILE=m2.dat
```

The states used by ADAMS/Solver are reported in the message file. For example:

```
EigenSolution computation started.
Option RM was not used.
This model has
     26 kinematic states (displacement and velocities)
      0 differential states ( DIFFs, LSEs, etc.)
The selected kinematic states are:
      1 PSTATE VARIABLE   VAR/1   DX(20,23,23)
      2 PSTATE VARIABLE   VAR/2   DY(20,23,23)
      3 PSTATE VARIABLE   VAR/3   DZ(20,23,23)
      4 PSTATE VARIABLE   VAR/4   AX(20,23)
      5 PSTATE VARIABLE   VAR/5   AY(20,23)
      6 PSTATE VARIABLE   VAR/6   AZ(20,23)
      7 PSTATE VARIABLE   VAR/7   DX(21,23,23)
      8 PSTATE VARIABLE   VAR/8   DY(21,23,23)
      9 PSTATE VARIABLE   VAR/9   DZ(21,23,23)
     10 PSTATE VARIABLE   VAR/10   AX(21,23)
     11 PSTATE VARIABLE   VAR/11   AY(21,23)
     12 PSTATE VARIABLE   VAR/12   AZ(21,23)
     13 PSTATE VARIABLE   VAR/13   AZ(22,23)
```

For more information, see the ADAMS/Solver (C++) LINEAR command.

For theoretical details, see the white paper in Knowledge Base Article 12721:

http://support.adams.com/kb/faq.asp?ID=kb12721.dasp

For an example of using PSTATE, see Knowledge Base Article 12663:

http://support.adams.com/kb/faq.asp?ID=kb12663.dasp

Automated Specification of User-defined States (ADAMS/Solver (C++) only)

The identification of independent states can be quite tedious for large models. ADAMS/Solver (C++) offers an option to select relative coordinates for generating state matrices.

The LINEAR command now supports a new RM keyword. RM accepts a Marker ID as input. RM essentially serves as the reference frame for the observer of the system. The translational and rotational displacements of all bodies in the system are calculated relative to the RM marker and in the RM coordinate system (where applicable).

The following are examples of using RM:

ADM File:

```
MARKER/13, PART=3, QP=1,2,3, REU=0D,90D, 180D
```

ACF File:

```
SIM/DYN, END=1.5, STEPS=150
LIN/EIG, RM=13
LINEAR/STATEMAT, RM=13, FILE=local_RM_statM.txt
```

You can also use a combination or RM and PSTATE for even more flexibility. In such a situation, the states specified by PSTATE are given higher priority that the states specified by RM.

The following example uses both RM and PSTATE:

ADM File:

```
MARKER/13, PART=3, QP=1,2,3, REU=0D,90D, 180D
VARIABLE/2001, FUNCTION=AZ(21,11) + AZ(31,22)
VARIABLE/2002, FUNCTION=AZ(31,22) + AZ(41,32)
VARIABLE/2003, FUNCTION=AZ(41,32) + AZ(21,11)
VARIABLE/2004, FUNCTION=SQRT(DX(51,42,42)**2+DY(51,42,42)**2+DZ(51,42,42)**2)
PSTATE/2, VAR = 2001, 2002, 2003
```

ACF File:

```
SIM/INI
LINEAR/STATEMAT, RM=13, PSTATE=2, FILE=local_RM_statM.txt
LIN/EIG, ENERGY=1,2, DISS=1,2, KINETIC=1,2, STRAIN=1,2, PSTATE=2
```

Sample for energy tables:

```
SIM/INI
LIN/EIG, ENERGY=1,2, DISS=1,2, KINETIC=1,2, STRAIN=1,2, PSTATE=1
```

The states used by ADAMS/Solver are reported in the message file. For example:

```
EigenSolution computation started.
Option RM=23 was used.
This model has
     26 kinematic states (displacement and velocities)
      0 differential states ( DIFFs, LSEs, etc.)
The selected kinematic states are:
      1 Relative displacement DX(GROUND,23,23)   PART/2
      2 Relative displacement DY(GROUND,23,23)   PART/2
      3 Relative displacement DZ(GROUND,23,23)   PART/2
      4 Relative rotation AX(GROUND,23)   PART/2
      5 Relative rotation AY(GROUND,23)   PART/2
      6 Relative rotation AZ(GROUND,23)   PART/2
      7 Relative rotation AZ(BCS,23)   PART/3
      8 Relative displacement DX(BCS,23,23)   PART/4
      9 Relative displacement DY(BCS,23,23)   PART/4
     10 Relative displacement DZ(BCS,23,23)   PART/4
     11 Relative rotation AX(BCS,23)   PART/4
     12 Relative rotation AY(BCS,23)   PART/4
     13 Relative rotation AZ(BCS,23)   PART/4
```

For more information, see the ADAMS/Solver (C++) LINEAR command.

For theoretical details, see the white paper in Knowledge Base Article 12721:

http://support.adams.com/kb/faq.asp?ID=kb12721.dasp

For an example of using RM, see Knowledge Base Article 12690:

http://support.adams.com/kb/faq.asp?ID=kb12690.dasp

Calculation and Export of [M], [K], and [B] Matrices (ADAMS/Solver (C++) only)

The mass [M], stiffness [K], and damping matrices [B] matrices can now be exported from ADAMS/Linear. This is useful when you want to take the system matrices from MSC.ADAMS to a finite element (FE) package, such as MSC.Nastran, for further analysis.

Below is an example of how to generate [M], [K], and [B] matrices from ADAMS/Linear:

ACF File:

```
PREFERENCES/SOLVER=CXX
SIM/STA
LINEAR/MKB, FORMAT=matlab, FILE=mkb_mat, PSTATE=5, PINPUT=1, POUTPUT=1
```

The above command produces the following list of state matrix files:

```
mkb_matb
mkb_matc
mkb_matd
mkb_matk
mkb_matm
mkb_matpi
mkb_matpo
mkb_matst
```

ADAMS/View Interface

You can create the PSTATE and RM objects in ADAMS/View in several ways:

- Use **Build → Controls Toolkit → Plant State** to create a plant state.
- Access existing PSTATE objects and/or select RM through the Simulation Control dialog box in ADAMS/View.
- Create/access PSTATE and select RM through the ACF builder interface.
- Access to PSTATE and RM is also available in ADAMS/Vibration through the **Test → Vibration** Analysis dialog box.

ADAMS/PostProcessor

See the release notes for ADAMS/View on page 51.

ADAMS/Rail

Curve Manager Enhancements

Curve Manager now supports a new format for the track property file (TRK_4). A toolkit for the conversion of old property files is also available. You can use the same conversion tool to convert the old irregularities format (*.dat files) to the new irregularities TOF format (*.idf file). Old property files are still compatible with ADAMS/Rail Solver.

Curve Manager now supports property files for rail profiles (RPR).

Profiles are now displayed using the same interpolation function used in the simulation, allowing you to see possible problems in the profile description at design time.

We enhanced analytic track visualization to support track with U-turns.

Curve Manager plots for wheel and rail profiles have the same scale for lateral and vertical coordinates so that the profile is shown with its actual shape.

We added visualization of track irregularities (analytic, measure, PSD).

Improved Track Measured Irregularities Description

We added a new format for measured irregularities, allowing you to specify lateral and vertical perturbation of the centerline, as well as a value for banking perturbation.

You can specify an additional column containing the abscissae for all available formats. If you specify this column, the abscissa is calculated using the user-input data rather than the fixed step.

Improved Analytic Track Description

You can now specify consequent curve segments. ADAMS/Rail uses clothoid curves for the transition between the two sections.

Property Files Unit Independence

All ADAMS/Rail-specific property files now support unit independence:

- Track property file (*.trk)
- Wheel property files (*.wpf)
- Contact configuration file (*.ccf)
- Wheel and rail profile property files (*.wpr and *.rpr)
- Rail and guiding rail flexibility configuration files (*.frp and *.grp)

Improved RSGEO

We removed the limitation to the number of rows of the contact table in RSGEO. The contact table is now dynamically allocated, and table size is only limited by your computer's capabilities.

Stability Map

It is now possible to create a Stability Map Plot starting from a previously created .stb file, without re-running the stability analysis.

ADAMS/Solver

Enhanced SMP Capabilities

ADAMS/Solver (C++) 2005 r2 can now apply Symmetric Multi-Processing (SMP) (also known as Shared-Memory Parallelism) during the evaluation of nearly all the elements in the MSC.ADAMS element library. Parallel processing is enabled in ADAMS/Solver (C++) by setting the statement PREFERENCES/NTHREADS (number of threads accordingly).

The most significant enhancement to parallel-processing capabilities for version 2005 r2 is that ADAMS/Solver (C++) is now capable of evaluating 3D solid-to-solid (Default_library only) and 2D contact elements in parallel.

Notable exceptions from the parallel evaluation are:

- 3D solid-to-solid based on the Parasolid geometry engine are **not** evaluated in parallel. ADAMS/Solver (C++) is only capable of evaluating 3D solid-to-solid contacts in parallel when the default Rapid geometry engine is used. To identify whether you are currently using the Parasolid geometry engine, look for the following statement in your .adm file:

  PREFERENCES/CONTACT_GEOMETRY_LIBRARY=Parasolid

- The General State Equation (GSE) element is not yet evaluated in parallel.
- Elements based on user-written subroutines (for example, GFOSUB or VARSUB) are not evaluated in parallel unless you declare the user subroutine thread-safe by calling the utility subroutine ADAMS_DECLARE_THREADSAFE. A user subroutine is thread-safe when two threads can be executing the subroutine concurrently when the value of IFLAG is zero or false.

ADAMS/Solver (C++) carefully excludes elements from these categories from parallel evaluation and evaluates them serially after evaluating other elements in parallel.

For an example, see Knowledge Base Article 12664:

http://support.adams.com/kb/faq.asp?ID=kb12664.dasp

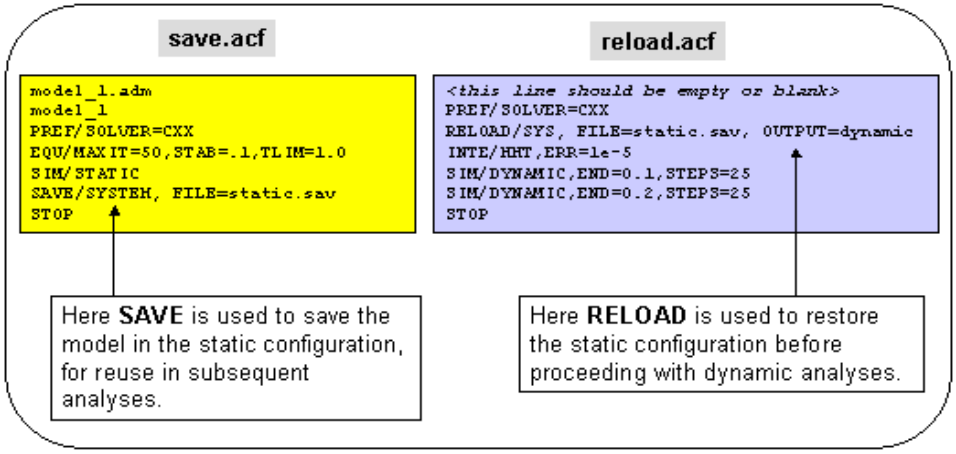
SAVE and RELOAD Command Support

The SAVE/SYSTEM command stores the current ADAMS/Solver (C++) model and simulation conditions. This restart file allows you to return to the model at a later time using the RELOAD/SYSTEM command to continue where you left off. This feature is particularly useful when debugging complex models. For example, you could save a static equilibrium solution that was difficult to get to run and reload it later as a starting point for dynamic analyses. Similarly, if you have a problematic model, the save operation can be used to capture the model before difficult events, and then you can reload the model as you experiment with different solution strategies.

Sample Usage:

In the example in Figure 2, reload.acf shows ADAMS/Solver (C++)'s ability to start with an empty line, followed by the reload. In other words, there is no need to have access to the .adm for the reload operation.

Figure 2. Example of save.acf and reload.acfI



Note that save.acf could have had multiple save-points, which could then be reloaded with other ACF files.

Note: ADAMS/Solver (C++) has been modified so that when it sees a SAVE/STATES command, it issues the following warning and continues:

STATES option in SAVE command is not supported. SYSTEM will be saved.

For an example, see Knowledge Base Article 12665:

http://support.adams.com/kb/faq.asp?ID=kb12665.dasp

Compliance Matrix Support (GTCMAT)

The GTCMAT utility subroutine is now supported in ADAMS/Solver (C++). This allows you to compute the compliance matrix for a set of markers in an ADAMS/Solver model. The GTCMAT has been enhanced so you are no longer restricted to performing a static or quasi-static simulation first; you can now compute compliance after a dynamic simulation. This feature is unique to ADAMS/Solver (C++) and it may be helpful to vehicle dynamics engineers who have traditionally looked only at compliance for the static configuration and have wondered how compliance can change during dynamic events.

For an example, see Knowledge Base Article 12689:

http://support.adams.com/kb/faq.asp?ID=kb12689.dasp

Support for ADAMS/Linear

ADAMS/Linear is now fully integrated with ADAMS/Solver (C++). You can use existing features of ADAMS/Linear, such as eigenvalue solution, modal energy calculation, and state matrix generation.

Also, capabilities have been enhanced so you can now find the correct eigenvalues for rotating systems. You can achieve this through new RM and/or PSTATE features. For more details, see the release notes for ADAMS/Linear on page 33.

For an example, see Knowledge Base Article 12663:

http://support.adams.com/kb/faq.asp?ID=kb12663.dasp

Support for ADAMS/Vibration

Vibration simulations can now be solved with ADAMS/Solver (C++). New features introduced in ADAMS/Linear are also available, including PSTATE and RM for rotating systems and [M][K][B] export for obtaining the mass, stiffness, and damping matrices.

For more information, see the release notes for ADAMS/Vibration on page 47.

For an example, see Knowledge Base Article 12670:

http://support.adams.com/kb/faq.asp?ID=kb12670.dasp

ADAMS/Solver (C++) Support in MSC.EASY5 2005

ADAMS/Solver (C++) is now available as an experimental feature within MSC.EASY5 Solver. This is another step in the integration of the two products and allows MSC.EASY5 users to seamlessly run their models with ADAMS/Solver (C++) while staying within the familiar MSC.EASY5 modeling environment. ADAMS/Solver (C++) has been enhanced with switch-state technology for the handling of discontinuous events prevalent in many MSC.EASY5 models.

For an example, see Knowledge Base Article 12699:

http://support.adams.com/kb/faq.asp?ID=kb12699.dasp

NFORCE Support

The NFORCE multi-point force element is now supported by ADAMS/Solver (C++).

If you have legacy models containing NFORCEs for general flexibility, you can now run them with ADAMS/Solver (C++), which enables you to take advantage of a growing number of features unique to C++. Unlike ADAMS/Solver (FORTRAN), the NFORCE measure can appear in any function expression in the ADAMS/Solver (C++) dataset.

For an example, see Knowledge Base Article 12662:

http://support.adams.com/kb/faq.asp?ID=kb12662.dasp

MARKER Command Enhancement (C++ Solver only)

The RM argument on the MARKER command can now be a marker on any part in the model, instead of being restricted to the parent body only. This modeling feature becomes particularly useful when, for example, you want to make a joint's J-marker coincident with its I-marker before activating the joint.

```
MARKER/8, QP=0,0,0, REULER=0d,0d,0d, RM=7    !---move J-marker of JOINT/2
ACTIVATE/JOINT, ID=2                         !---enable joint
```

Note that marker reorientation occurs on-the-fly in ADAMS/Solver (C++) during run-time, and as such, the orientation change does not persist into the modeling position of ADAMS/View. In other words, use ADAMS/View if you want to change the modeling positions and orientations of markers during design-time.

For an example, see Knowledge Base Article 12681:

http://support.adams.com/kb/faq.asp?ID=kb12681.dasp

ADAMS/Tire

3D: Interface to Generate 3D Road

A Road Builder interface has been introduced in ADAMS/Car and ADAMS/Chassis to create and edit XML 3D Road definition files. The features of the Road Builder include:

- TeimOrbit 3D road definition files automatically translated to XML format
- Create, edit, and visualize the 3D Road data points table
- Create and edit 3D Road obstacles

Using XML 3D Road Definition files, the 3D Road obstacles, which are independent of the traveled distance of the vehicle, can now be visualized in ADAMS/Car and ADAMS/View.

Note: You can still use TeimOrbit 3D Road Definition files.

Pacejka '94 and '89: Mirroring in Pacejka '94 and '89 Tire Models

Similar to the mirroring functionality in PAC2002, you can now mirror the tire lateral force and aligning moment response to use the tire on the other side of the vehicle, then for which the parameters have been measured. You introduce mirroring in the [MODEL] section of the tire property file:

TYRESIDE = 'LEFT' / 'RIGHT' / 'SYMMETRIC'

All Handling Tires: Implement the Option to Use Nonlinear Vertical Stiffness

Spline functionality was introduced for PAC2002, PAC_MC, and all other handling tire models in ADAMS/Tire 2005 r2. Instead of the current linear vertical stiffness, you can define tire deflection-load spline data in the [DEFLECTION_LOAD_CURVE] section, which then is used for the vertical tire load response. See the example tire property files in ADAMS/Tire online help.

PAC2002: More Advanced Tire Transient Behavior and Standstill in PAC2002

An advanced transient tire model, the contact-mass model, has been added to PAC2002:

- Longitudinal and lateral tire carcass stiffness
- Slip dependent relaxation effect
- Transient response to friction changes
- Improved low-speed tire damping

PAC2002: Enhancements for PAC2002

In addition to the advanced tire transient behavior, following items have been introduced in the PAC2002 tire model:

- Advanced modeling for loaded radius and rolling radius modeling, important for roll over and racing applications.
- Tire bottoming, for example, to simulate the rim hitting the road.
- Online scaling factors—the PAC2002 scaling factors can be changed during the simulation. This can also be applied in a MATLAB co-simulation analysis.
- Switch for linear quasi-statics calculations at the start of the simulation for avoiding statics problems with very (longitudinal) stiff tires.

PAC_MC: Updated Contact Model for ADAMS/Tire Motorcycle Tire

The PAC_MC tire model, a Pacejka handling tire model for motorcycle tires, was extended with a more advanced method for calculating the contact point between the tire and the road.

Because the inclination between the wheel and road plane can run up to considerable values (60 degrees), the cross-section shape of the tire plays an important role. The contact calculations were updated to include the tire cross section.

PAC-TIME: New PAC-TIME Tire Model in ADAMS/Tire Handling

A new Pacejka type tire model for handling has been introduced. The model is close to PAC2002, however, it uses different modeling for Fy and Mz according to the European Research project TIME, focusing on measuring tire properties during realistic tire operation conditions.

ADAMS/Vibration

New Vibration Build-Test-Review-Improve Menu Structure

A Vibration menu has been added to the ADAMS/Vibration plugin with all new and preexisting features of ADAMS/Vibration now organized into Build, Test, Review, and Improve menus. This change is meant to reinforce the paradigm for building successful models, to improve ease-of-use, and to shorten the learning curve for new and occasional users. For an example, see Knowledge Base Article 12667:

http://support.adams.com/kb/faq.asp?ID=kb12667.dasp

Eigenvalue and Energy Table Highlighting

To assist you in identifying potential NVH trouble spots in your model and/or designs, we have enhanced the tabular output tables to better identify key values. Bold fonts and highlighting are now used to draw your attention to values of interest in the following tables:

- **Eigenvalue -** Unstable modes are now highlighted and the Real component is displayed in bold font, since that is the key identifier of an unstable mode. A threshold value can be set so you have some control over the highlighting of small (insignificant) values. Another useful feature added to the Eigen Table is +/- buttons which allow you to quickly step through a series of eigenvalue tables when you have several analyses to review. To access this table, use **Vibration → Review → Display Eigenvalue Table**.
- **Modal energy** - The name(s) of maximum energy objects are now highlighted, for a given mode, and for the row that contains the maximum energy object, we use bold font for the cell containing the highest component of energy on that row.
- **Modal participation -** Maximum values, for a given frequency, are now highlighted and displayed in bold font.

Spec-line Navigation in Forced Vibration Animations

Navigating between peaks of an FRF plot and the associated frequency in a forced vibration animation is simplified with the ability to add spec lines using new keyboard shortcuts. ADAMS/PostProcessor already has functionality in plot statistics (tracking) mode to navigate from one local maximum/minimum to the next. Using Shift+left/right arrow moves you from one local maximum to the next. Using Ctrl+left/right arrow moves you from one local minimum to the next. Now, making a spec line is done easily, as follows:

- **s** and **S** create vertical spec lines.
- **h** and **H** create horizontal spec lines.

Navigating to the associated frequency in a forced vibration animation is also made easier by allowing you to browse for a spec line in the Frequency text box in the Vibration animation dashboard in ADAMS/PostProcessor. For an example, see Knowledge Base Article 12669:

http://support.adams.com/kb/faq.asp?ID=kb12669.dasp

Support for ADAMS/Solver (C++)

ADAMS/Vibration is now fully supported by ADAMS/Solver (C++). You may exercise existing features of ADAMS/Vibration, such as normal modes analysis, forced-vibration analysis, and modal-energy calculation. Any MSC.ADAMS model that was linearized with ADAMS/Solver (FORTRAN) can now also be linearized by ADAMS/Solver (C++). For an example, see Knowledge Base Article 12670:

http://support.adams.com/kb/faq.asp?ID=kb12670.dasp

Support for User-Defined States

The new PSTATE and RM capabilities introduced in ADAMS/Linear (ADAMS/Solver C++ version) are also fully supported in ADAMS/Vibration. Now your vibration studies will accurately capture the dependency of eigenvalues on angular velocity for rotating systems (for example, gyroscopic effects, coriolis effects, and explicit time dependencies). For further details, see the release notes for ADAMS/Linear on page 33.

Vibration Design Constraints

New vibration design constraints have been added to complement existing vibration design objectives. You now have the option of creating design constraints (for optimization studies) from the following categories:

- Freq. Resp. Magnitude Limit: 1 Input , 1 Output
- Freq. Resp. Magnitude Limit: All Inputs , 1 Output
- Modal Energy: Kinetic Energy
- Modal Energy: Strain Energy

To access this feature, use **Vibration → Improve → Vibration Design Constraint → New.**

Extended 3D Plotting Support

Support for 3D Frequency Response and Transfer Function plots has been extended to support the following scenarios:

Table 1. Scenarios for 3D Frequency Response and Transfer Function Plots

Analysis	Input Channel(s)	Output Channel(s)
single	single	multiple
single	sum selected	multiple
single	sum all	multiple
single	multiple	single

Linearized MSC.ADAMS Model Export in MSC.Nastran Format (Experimental Feature)

You can create bulk data files (.bdf) for MSC.Nastran from linearized MSC.ADAMS models that can be used for performing eigenvalue and frequency response analysis. This allows you to uses many of the solution sequences available in MSC.Nastran, such as SOL 107 for eigenvalue analysis and SOL 108 for frequency-response analysis.

You can also export linearized MSC.ADAMS models containing flexible bodies to be exported as bulk data decks with the flexible body excluded. In MSC.Nastran, these bulk data decks can then be combined with the original FE bulk data deck from which the flexible body in the form of an .mnf was derived. You can manually assemble the complete model (the linearized partial MSC.ADAMS model and the flexible body FE representation) using constraints (RJOINT) and/or compliant elements, such as CELAS or CBUSH.

For an example, see Knowledge Base Article 12668:

http://support.adams.com/kb/faq.asp?ID=kb12668.dasp

ADAMS/View

New Units

ADAMS/View now supports the following units:

- **Angle** - Revolutions
- **Force** - Micronewton, nanonewton, meganewton
- **Linear** - Micrometer, nanometer, angstrom, microinch, mils, yard
- **Mass** - Milligram, microgram, nanogram, us_ton
- **Time** - Microsecond, nanosecond, day

On-demand Purge of Animation Flexible-Body Cache Files

Flexible-body cache files (.fcf) used to improve the performance of flexible body animations could accumulate on disk after repeated simulation-animation iterations. You now can purge the cache files from the disk (Purge Cache Files) using the **Tools → Purge Cache Files** menu in both ADAMS/PostProcessor and ADAMS/View.

Generalized Damping of Flexible Bodies

As part of the Nastran-ADAMS Integration effort, this functionality allows you to apply the generalized damping matrix from MSC.Nastran to an MSC.ADAMS flexible body. There is an additional option for applying generalized damping in the create and modify flexible body dialog boxes and the corresponding commands.

State-dependent Modal Force

You can now create modal forces using a force function to define a load vector.

Plant State (PSTATE) Support

The Plant State object, available in ADAMS/Solver (C++) 2005 r2, is supported in ADAMS/View with command language and graphical user interface (**Build → Controls Toolkit → Plant State**).

Expanded General State Equation (GSE) Interface

To enable ADAMS/Solver (C++) to support implicitly defined general-state equations, such as those found in MSC.EASY5 models, we've added an IMPLICIT keyword to the command language for general state equations. For more information about implicit general state equations, refer to the ADAMS/Solver (C++) online help.

Expanded Sensor Interface

To enable ADAMS/Solver (C++) to support systems of equations provided by MSC.EASY5 that contain state variables that are not necessarily continuous or continuously differentiable in time, we've added a SWITCH_STATE keyword to the command language for sensors.

Visual Identification of Durability Hot Spots

When you load the ADAMS/Durability plugin, there is now a Hot Spots tab on the ADAMS/PostProcessor dashboard in Animation mode. The tab allows you to define the hot spots and control their display. Using hot spots, you can easily identify locations of high stress or strain on a flexible body or rigid stress object.

Deleting Unused Markers

Many times models become cluttered with irrelevant or extra markers. A macro has been implemented to delete any markers that are not being used in a joint, force, request, parametric expression, or so on.

To access the macro, enter the command:

mdi marker delete_unused body=<*rigid* or *flexible body*>

Deselect All

The ability to deselect all current selections has been added to the Edit menu.

Highlights of Online Help Improvements

We've significantly added to the content of the help for each product. We've listed the highlights below.

Overall Online Help Improvements

- **New search engine** – We've provided a new search engine, which lets you enter searches just like popular search engines, such as entering Boolean characters (AND, NEAR, and so on). It is integrated into the help interface, not a separate window, and the Search field is always available.
- **Combined tables of contents (TOCs)** - We've integrated the TOCs for a product into one so you do not have to go to different tabs to look for information.
- **Improved TOC and search pane** – You can now expand and close (in certain browsers) the pane on the left side of the help window that contains the TOC and search results. The TOC also contains automatic sync to show you where your current topic is in the TOC.
- **Integrated master site** – You can now access all product help from one site and search globally across all products. To access the integrated master site, from any MSC.ADAMS product, from the **Help** menu, select **MSC.ADAMS Help**. You can also select the **All Products** button in any product's online help.
- **Improved popup definitions** – Popup definitions of terms are now positioned directly over the term they define.
- **Focused F1 dialog box help** – When you press F1 in a dialog box, the help that appears only shows the help for the dialog box; it does not display the TOC or extraneous information. To see TOC or search, select Show in the upper left corner.
- **More printable versions of reference material** – You will find more printable versions of the reference material for ADAMS/Tire, ADAMS/View, ADAMS/View Function Builder, and ADAMS/Solver.

ADAMS/Aircraft

We added three tutorials: Modeling Shimmy in ADAMS/Aircraft, Wheel Analysis, and Flight with AeroDynamics. We also added new information throughout the ADAMS/Aircraft help on topics, such as aerodynamics and flexible bodies.

ADAMS/Car

Updated the help to reflect the new functionality, including the theory behind the new Driving Machine and ADAMS/SmartDriver.

ADAMS/Controls

Updated MSC.ADAMS Extension for MSC.EASY5 installation procedure. Note that the documentation on TCP/IP Communication has been moved from the *Getting Started Using ADAMS/Control* guide to the online help. It is now searchable and easily accessible from the product.

ADAMS/Durability

- **Shortened Stress/Strain Modes** – In previous releases there was some confusion about how to take advantage of the new shortened stress modes capability. Now we provide guidance for using shortened stress/strain modes in recent versions of MSC.Nastran.
- **New MSC.Fatigue Tutorial** – A new tutorial on using MSC.Fatigue has been added to the guide, *Getting Started Using ADAMS/Durability*. It includes instructions on performing modal stress recovery and fatigue analysis using MSC.Patran, MSC.ADAMS, MSC.Nastran, and MSC.Fatigue.
- **Theory of Modal Stress Recovery** – A new theory section has been added to provide theoretical details of modal stress recovery.
- **XDB Help for Stress Recovery** – The online help now includes information on XDB file support of MSC.Nastran-MSC.ADAMS integration. It describes how to get stresses from orthonormalized mode shapes into the .xdb file.

ADAMS/Solver

Updated the online help to reflect all changes made to the product, including:

- INTEGRATOR statement help includes material on second-order integrators: HHT and Newmark.
- Information on DXYZ and VXYZ 3D expressions.

ADAMS/Tire

The ADAMS/Tire help has been updated for the new features, including the new tires, PAC TIME and PAC2002, and additional information. SWIFT Tire documentation is now in HTML format. The 521 Tire is still in PDF format.

ADAMS/Vibration

- Updated the help to reflect the new Build-Test-Review-Improve menu structure.
- Added new and updated Python scripts.

ADAMS/View

Added help for six more ADAMS/View commands (analysis, geometry, marker, model, part, and undo).

7 Running MSC.ADAMS Products

Starting MSC.ADAMS Products

This section describes how you can start your MSC.ADAMS products on UNIX and on Windows.

Starting MSC.ADAMS Products on UNIX

The MSC.ADAMS Toolbar is a starting point to using MSC.ADAMS products on UNIX. The toolbar is shown below.

MSC.ADAMS Toolbar tool - Right-click to set up Toolbar, manage memory models, access online help and Technical Support resources, and more.

Product tools - Click to run product or right-click to configure products and create user libraries.

Hold the cursor over a tool to see the name of the associated product.

You can also use the MSC.ADAMS Toolbar to:

- Customize, keep track of, and organize multiple libraries of standard MSC.ADAMS products
- Create binaries
- Manage custom memory models and product preferences

For more information on these or other MSC.ADAMS Toolbar operations, see the Running and Configuring online help (from the **Help** menu in any product, select **MSC.ADAMS Help**, near the bottom of the pane on the left, select **Running and Configuring MSC.ADAMS**).

To start a product on UNIX:

1. To display the MSC.ADAMS Toolbar, at the command prompt, enter the command **adamsx** where **x** is the version number, for example **adams05r2.**
2. Click on the tool representing the product you want to start.

   Note: We recommend that you use the MSC.ADAMS Toolbar to start your MSC.ADAMS products, but if you want to automate certain operations, use the text-based Program Menu. For more information, see the Running and Configuring online help.

Starting MSC.ADAMS Products on Windows

You start any MSC.ADAMS product from the Start menu. You can also use the Start menu to:

- Change your license type
- Generate problem reports
- Uninstall products, demonstrations, and documentation
- Set MSC.ADAMS preferences

For more information on these or other operations, see the Running and Configuring online help.

To start a product on Windows:

- From the **Start** menu, point to **Programs**, point to **MSC.Software**, point to **MSC.ADAMS 2005 r2**, point to the name of the product you want to start, and then select the product type. For example, point to **AEngine**, and then select **ADAMS - Engine.**

  Tip: Select the corresponding desktop icon for the product, if you installed it on your desktop.

Setting Preferences

This section describes how you can set preferences, such as your working directory, graphics setting, and memory model size.

Setting Preferences on UNIX

You use the Registry Editor from the MSC.ADAMS Toolbar to set a variety of preferences. For information on the preferences you can set, see the Running and Configuring online help.

To display the Registry Editor:

- From the **MSC.ADAMS Toolbar**, right-click any product tool, and then select **Change <Product Name> Settings**.

Setting Preferences on Windows

You use the Settings menu to modify:

- Graphics settings
- HOOPS settings
- Memory model size

To display the Settings dialog box:

- From the **Start** menu, point to **Programs**, point to **MSC.Software**, point to **MSC.ADAMS 2005 r2**, and then select **ADAMS - Settings**.

Setting Your Working Directory

During a session in a default or custom product, you can select the directory where you want to place your model and output files.

For ADAMS/View, you can set the working directory from the Welcome dialog box.

To set your working directory:

1. From the **File** menu, select **Select Directory**.
2. In the dialog box that appears, select the working directory.

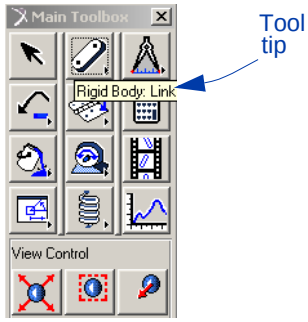
4 Getting Help

Overview

Learn about the many ways to get help in the MSC.ADAMS products:

Tool Tips

Tool tips display information about the item the cursor is currently over in an MSC.ADAMS product. The following shows the tool tip that appears when you place the cursor over the link geometry tool.



To display tool tips:

- Move the cursor over the item in the interface on which you'd like information.

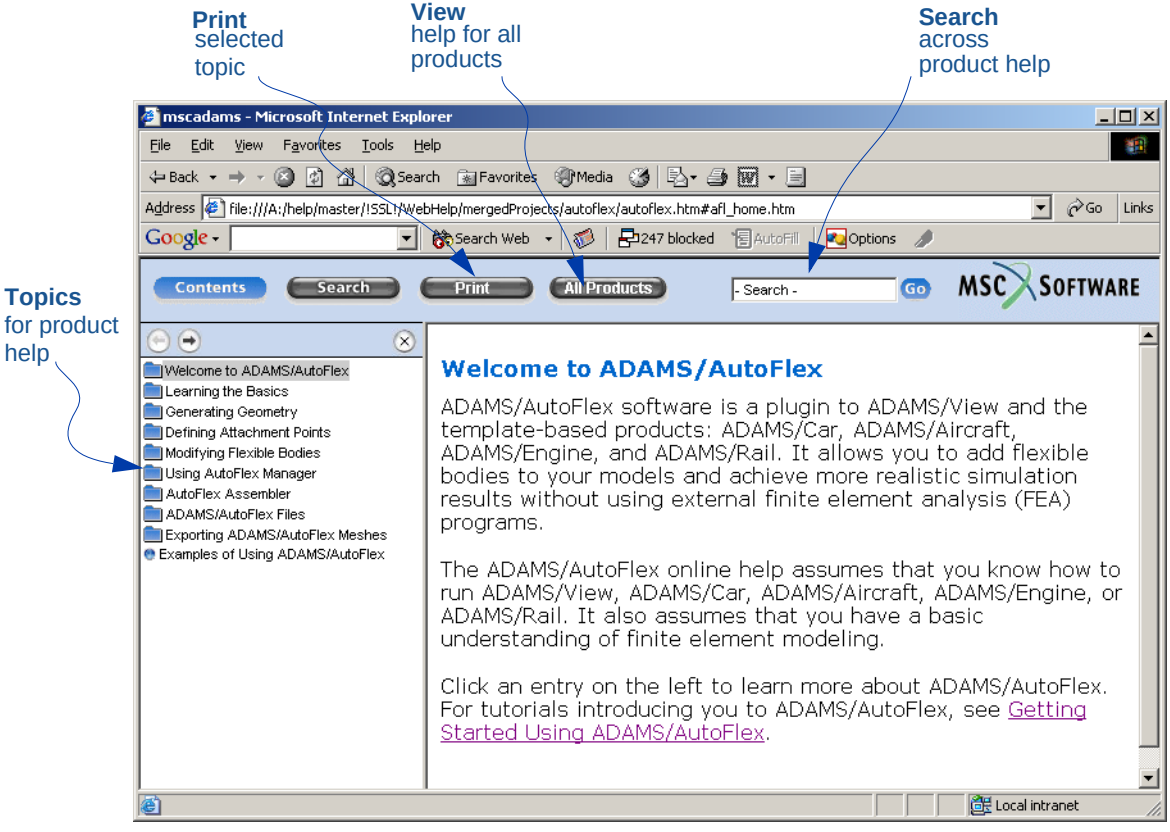
  A brief description of the item appears.

Online Help

To help you use the MSC.ADAMS products, MSC.Software provides online help (HTML format) and a set of tutorial guides (PDF format). To view the online help and tutorials, you can use your default Web browser. To read the PDFs along with the help, Acrobat Reader must be set up as a plugin to the browser, as explained in Configuring Reader on page 64.

Note: The help for 521 Tire is in PDF format.

The online help shown below is for ADAMS/AutoFlex.



Versions of Web Browsers and Adobe Acrobat Reader

We recommend that you view the online help in one of the following browsers:

- Internet Explorer 6 (or higher)
- Netscape Navigator 7 (or higher)
- Mozilla/Firefox 1.0

The help works on Netscape 4.78; however, you may experience slower response times and the style sheets for defining the look of the help do not work.

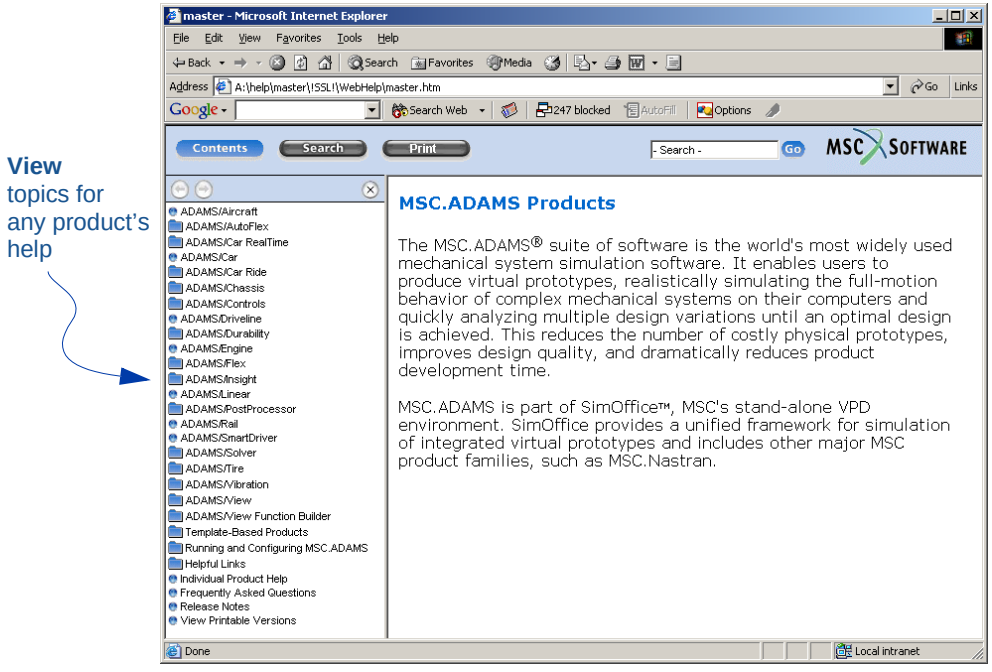
Configuring Reader

To view the online guides in PDF format from a Web browser, configure Adobe Acrobat Reader as a plugin to your browser. To configure Reader as a plugin, go to http://www.adobe.com/support, and search their knowledge base for instructions. In particular, see documents:

- 324610 - How to Set Up Netscape Navigator 4.x in UNIX to Display PDF Files
- 313692 - Configuring Netscape Navigator for Windows to Display PDF Files
- 315029 - Configuring Internet Explorer or AOL to Display PDF Files

Accessing the Online Help

You can view help for a dialog box, a product, or for all MSC.ADAMS products. The figure below shows the help for all MSC.ADAMS products, called the integrated master site. You can use this site to view any product's help and search across all product help. You can also access frequently asked questions, release notes for all products, and view the available printable versions.



To get help on a dialog box:

1. Click in the dialog box for which you need help.
2. Press **F1**.

   MSC.ADAMS launches a browser window that contains information about the dialog box.

   Tip: To view the help's table of contents and search buttons, select **Show**.

To get general help on your product:

- From your product's **Help** menu, select ***Product Name* Help (**where ***Product Name*** is the name of your MSC.ADAMS product**)**.

  MSC.ADAMS launches a browser window that contains the starting point for your product's online help.

To get help on another MSC.ADAMS product:

- Perform one of the following:
  - If you're in an MSC.ADAMS product, from its **Help** menu, select **MSC.ADAMS Help**.
  - If you're in the help for an MSC.ADAMS product, select the **All Products** button from the top of the window.

  Your default browser starts and displays the master site for MSC.ADAMS online help.

To open the MSC.ADAMS online help from the MSC.ADAMS Toolbar:

- Right-click the MSC.ADAMS Toolbar tool, and then select **Online Help**.

  Your default browser starts and displays the master site for MSC.ADAMS online help.

To open the MSC.ADAMS online help from the Start Menu:

- From the **Start** menu, point to **Programs**, point to **MSC.Software**, point to **MSC.ADAMS *x*** (where ***x*** is the release number), and then select **ADAMS - Online Help**.

  Your default browser starts and displays the master site for MSC.ADAMS online help.

Navigating through the Help

You navigate through the MSC.ADAMS help system as you do through any help system, selecting topics in the pane on the left. In addition, we've provided:

- Navigation arrows  at the top of the pane to let you scroll through topics one at a time.
- A close button at the top of the pane so you can close the pane and only view the help topic.

  Note: Works only in Internet Explorer.
- Automatic sync to show you where your current topic is in the table of contents (TOC). This is very helpful if you, for example, search for a topic and want to know if there are more topics on the subject. It shows you where the topic is in the TOC, allowing you to see whether or not there are more topics with it.

Searching

You can search all the help files in HTML format for a particular product or all MSC.ADAMS products. If a product's help is in PDF format, you can use the Acrobat Find tool to search through the PDF.

To search a single product:

1. Open the online help for your product.
2. In the **Search** text box at the top of the help window, enter the search text, and then press the **Go** button Go. (You can also select the **Search** button Search along the top of the window to display the Search pane and enter text in the pane.)

   The results appear in the pane on the left, replacing the table of contents.
3. Click the topic you want to view.

To search all MSC.ADAMS products:

1. At the top of the help window, select the **All Products** button All Products.

   The table of contents displays a list of all MSC.ADAMS products.
2. In the **Search** text box at the top of the help window, enter the search text, and then press the **Go** button Go.

   The results appear in the pane on the left, replacing the table of contents.
3. Click on the topic you want to view.

Tip: Use the AND, OR, NOT, and NEAR operators to precisely define your search by creating a relationship between search terms. If no operator is specified, AND is used. For example, the query "steering suspension subsystem" is equivalent to "steering AND suspension AND subsystem." For more information, see the Frequently Asked Help questions in the online help. For information on accessing them, see Accessing the Online Help Frequently Asked Questions on page 70.

Printing

To print a file:

- Display the file, and from the top of the window, select the **Print** button 

. (If you use your browser's print feature, you may end up with separate printouts of the various frames of the window.) Note that whatever print method you use, the fonts will print in the same size as displayed on the screen.

For information that you may want to print all of (such as ADAMS/Solver commands or the ADAMS/Tire tire models), we've provided printable versions of this material in PDF. You can find printable versions for:

- ADAMS/Solver (C++) and (FORTAN):
  - Statements
  - Functions
  - Commands
- ADAMS/Solver User-Written and Utility Subroutines
- ADAMS/View Commands
- ADAMS/View Functions
  - Design-Time Functions
  - Run-Time Functions
- ADAMS/Tire:
  - Tire Models
  - Road Models
  - User-Written Tire/Road Models

To print the printable versions:

1. Do one of the following:
   - Display the help for a product, and from the pane on the left, select **View Printable Version.**
   - From the master site, near the bottom of the pane on the left, select **View Printable Version.**
2. Select the topic whose printable version you want to print.
3. From the Web browser **File** menu, select **Print.**

Switching to a Different Product's Help

You can view any product's help from the master site. To work with the help from only one product, you can switch to just that product's help.

To switch to a different product's help:

1. At the top of any help window, select the **All Products** button 

.
2. From the pane on the left, select **Individual Product Help.**
3. Select the help you want to view from the list.

Accessing the Online Help Frequently Asked Questions

We've provided answers to questions that are frequently asked about the online help, such as which browsers should I use, how do I set the help so it reuses an existing window, and how do I print the help.

To view frequently asked questions about the online help:

1. At the top of any help window, select the **All Products** button 

.
2. Near the bottom of the pane on the left, select **Frequently Asked Questions.**

Setting the Location of the Online Help (UNIX Only)

You can change where you store the online help. By default, it is in /*install_dir*/mscsoftware/mscadams/help, where *install_dir* is the directory in which MSC.ADAMS is located.

To change the location of the online help:

1. Right-click the MSC.ADAMS Toolbar tool, and then select **Start Registry Editor**.
2. In the treeview, click the plus sign (+) in front of Toolbar, and then select **Preferences**.
3. Change the value for **docsDirectory**. For example, to run the online help from a CD-ROM, change the value to contain CDROM and the subdirectory help (/CDROM/help).

Viewing the Online Help from CD (UNIX Only)

You can view the online help from the CD on UNIX.

To view the online help from the CD:

1. Insert the MSC.ADAMS Documentation CD into your CD drive.

   The CD asks you if you want to install the help.
2. Exit the installation program.
3. Right-click the CD labeled **Adamshelp2005r2**, and then select **Open**.

   A list of files on the CD appear.
4. Double-click **help**, and then **master.htm**.

   Your default browser starts and displays the master site for MSC.ADAMS online help.

Tutorials and Examples

Each MSC.ADAMS product has a set of tutorials or getting started guides that step you through examples of using the product's features, as well as introduces the basic concepts of the product. The getting started guides are online. In addition, many of the products have examples of its features that are stored in Knowledge Base Articles.

You will find links to all the tutorials and examples for a product under its Examples tab.

To access the tutorials and examples:

- From the online help for a product, from the pane on the left, select **Examples**.

A Supported Versions of Integrated Products

Overview

The tables on the next pages list the versions of products that work with MSC.ADAMS 2005 r2. In addition, there are notes on using MSC.EASY5 and MATLAB.

Support for MSC.EASY5 and MATLAB

MSC.EASY5

This release of ADAMS/Controls is certified to run with MSC.EASY5 2005 r1. Note MSC.EASY5 2005 r1 does not support SGI-IRIX and HP-Itanium (IA64).

Platform support is subject to change. For the latest information, see the MSC.EASY5 2005 r1 Hardware and Software Requirements at:

http://www.mscsoftware.com/support/prod_support/easy5/?Q=135&Z=144&Y=208

Note: If you want to co-simulate with MSC.EASY5 and you are running ADAMS/Controls on one of the platforms that MSC.EASY5 does not support, you should consider using TCP/IP communication. This allows ADAMS/Controls to communicate with MSC.EASY5 even though the codes are running on different platforms.

MATLAB

The supported version of MATLAB is R14 SP2 (MATLAB 7.0.4, Simulink 6.2.1). ADAMS/Controls 2005 r2 does not officially support older MATLAB versions, such as R14 and R13.1 (MATLAB 6.5.1, Simulink 5.1.1), although they have been tested and are working. Note that MATLAB R14 SP2 does not support IBM and HP-Itanium (IA64) platforms. For more information on R14 platforms and compatibility, see:

http://www.mathworks.com/support/sysreq/current_release/unix.html

Note: If you want to co-simulate with MATLAB and you are running ADAMS/Controls on one of the platforms that is not supported by MATLAB, you should consider using TCP/IP communication. This allows ADAMS/Controls to communicate with MATLAB even though the codes are running on different platforms.

For further information regarding UNIX platform support for ADAMS/Controls, see Knowledge Base Article 12445:

http://support.adams.com/kb/faq.asp?ID=kb12445.dasp

Table 2. MSC.Software Integrated Products

Product name and version:	MSC.ADAMS product:	Platform:
MSC.EASY5 2004.1	ADAMS/Controls	UNIX and Windows
MSC.Nastran 2001 and 2004 (Bulk Data Export)	ADAMS/AutoFlex	UNIX and Windows
MSC.Nastran 69.X and above	• ADAMS/Durability • ADAMS/Flex*	UNIX and Windows
MSC.Fatigue 2001 and above	ADAMS/Durability	UNIX and Windows
MSC.Marc • 2005 • 2003 and above	• ADAMS/Durability • ADAMS/Flex	UNIX and Windows

The following table lists those products that MSC.ADAMS works with that are from other vendors.

Table 3. Other Integrated Products

Company:	Product name and version:	MSC.ADAMS product:	Platform:
ANSYS, Inc.	ANSYS • 6.0 and above • 5.4 and above	• ADAMS/Durability • ADAMS/Flex	UNIX and Windows
Hibbitt, Karlsson & Sorensen, Inc. (HKS)	ABAQUS/ADAMS • 6.3 and above • 6.1-1 and above	• ADAMS/Durability ADAMS/Flex	UNIX and Windows
nCode	FE-Fatigue 5.2 and above	ADAMS/Durability	UNIX and Windows
The MathWorks, Inc.	Release 13 SP1 • MATLAB 6.5.1 • Simulink 5.1.1	ADAMS/Car RealTime Standalone and Embedded	• Windows 2000 • Windows XP Professional
The MathWorks, Inc.	Release 14 • MATLAB 7 • Simulink 6	ADAMS/Car RealTime Standalone and Embedded	• Red Hat Linux 9.0 Red • Hat Enterprise Linux 3
The MathWorks, Inc.	Release 13 SP1 • MATLAB 6.5.1 • Simulink 5.1.1 • Real-Time Workshop 5.1.1	ADAMS/Controls	• HP HP-UX 11, 11i • HP Intel Itanium 2 • SGI IRIX 6.5.14

Table 3. Other Integrated Products *(continued)*

Company:	Product name and version:	MSC.ADAMS product:	Platform:
The MathWorks, Inc.	Release 14 • MATLAB 7 • Simulink 6 • Real-Time Workshop 6	ADAMS/Controls	• Red Hat Linux 9.0 • Red Hat Enterprise Linux 3 • Sun Solaris 8, 9 • Windows 2000 • Windows XP Professional
TNO Automotive	MF-Tool 2.2 and above	ADAMS/Tire	UNIX and Windows
UGS PLM Solutions	I-DEAS Mechanism Design • I-DEAS NX 10 and above • I-DEAS 8, 9, NX 10, and above	• ADAMS/Durability • ADAMS/Flex	UNIX and Windows

* ADAMS/Flex is not compatible with MSC.Nastran for Windows.

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