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MSC.Dytran 2002 r2 Release Guide

- Introduction
- About this Release
- New Solver Features and Enhancements
- Software Installation
- Memory Requirements
- Using MSC.Dytran
Introduction

MSC.Dytran is a general-purpose, three-dimensional computer program for simulating the dynamic response of solids, structures and fluids. It combines structural and fluid mechanics technology to facilitate modeling, and uses explicit time integration to provide an efficient solution. MSC.Dytran is developed, marketed and supported by MSC.Software Corporation.

We are pleased to introduce MSC.Dytran 2002 r2. The enhancements in this release are based largely on communication with our users, and we continue with providing you the best solutions in the industry.

Apart from general enhancements like a Job Submission queuing feature, new example problems, uniform documentation across platforms, general robustness and efficiency, we have also made updates specifically for the following application areas:

• Airbag analyses, especially for Out Of Position cases, where the Eulerian method is critical
• Material modeling
• Spotweld modeling
• Vulnerability analyses
• Oil filled dampers
• Hydro-mounts
• Fuel tank sloshing
About this Release

MSC.Dytran 2002 r2 is available on HPUX 10.20 (PA-RISC 1.1), HPUX 11.00 (PA-RISC 2.0), SGI R4K/R5K (IRIX 6.5), SGI R8K/R10K/R12K (IRIX64 6.5), IBM RS/6000 (AIX 4.3.3), Compaq Alpha (Digital UNIX 4.0), Sun SPARC Solaris (Solaris 2.7), Intel Linux (Red Hat 6.2) and Windows (Windows NT 4.0 and Windows 2000).

The current release supports the coupling to Madymo 5.4.1 for occupant dummy analysis, except on the following platforms: Linux Red Hat 6.2 and the Intel Windows NT 4.0 and Windows 2000.

The interface to the Underwater Shock Analysis program USA is not available on Intel Linux, Intel Windows NT 4.0 and Windows 2000.

New Solver Features and Enhancements

MSC.Dytran 2002 r2 offers many new features and enhancements. The list below summarizes the enhancements, and when applicable, the input file entry is given in bold. By using this entry, a more detailed description of the feature can be found in the MSC.Dytran Reference Manual and the MSC.Dytran Theory Manual.

- Parameter for Job Queuing, using new Flexlm feature
  \textbf{PARAM, AUTHQUEUE}

- Fast coupling is running in shared memory parallel mode
  \textbf{PARAM, FASTCOUP}

- Wintel and Linux platforms, running SMP now use the Intel compiler. Previously the PGI compiler was used.

- Limits on number of \texttt{PLOADS} is removed

- Upgraded to latest version of USA

- Upgraded to latest version of ATB

- \texttt{SPINCOR} option for shells elements to achieve symmetrical behavior during large in-plane shear
  \texttt{PSHELL1 ; PCOMPA}

- Spotwelds use more intuitive function for the failure force: \( P_{\text{weld}} = (F_1-F_2)/2.0 \)
  \texttt{PWELD}

- \texttt{PWELD} can now be referenced from a \texttt{CBAR} element. This allows output of shear forces in a the element coordinate system of the spotweld.
  \texttt{CBAR ; PWELD}

- Fixed the direction of the force output of cross sections
  \texttt{CSEC}

- Output request of Center of Gravity for a set of elements
  \texttt{COG}

- Adaptive Euler mesh, for hydrodynamic, single material euler with void
  \texttt{MESH, type=ADAPT}
• Multiple euler domains now also available for hydrodynamic, single material euler with void

  COUPLE ; COUPOR ; PORFCPL ; PORFLCPL ; IGNORE

• Contact based porosity – Used to simulate blocking of holes during airbag deployment

  PARAM, CONTACT, COPOR
• New porosity models for flow between airbag compartments
  \[ \text{PORHOLE; PORLHOLE; PERMEAB; PORFGBG; PORFLGBG; PERMGBG; PORFCPL; PORFLCPL} \]
• Porosity in a coupling surface by means of a user subroutine
  \[ \text{POREX} \]
• Fabric material model
  \[ \text{FABRIC} \]

Schematic Diagram of Test Setup for Determination of Coefficient of Friction
Additional inflator models:

- Support inflow of multiple gases
  \[ \text{INFLHYB} ; \text{INFLHYB1} \]
- Takes experimental tanktest data as input
  \[ \text{INFLHYB} ; \text{INFLHYB1} ; \text{INFLTANK} ; \text{INFLATR1} \]
- Takes static temperature as input
  \[ \text{INFLHYB1} ; \text{INFLATR1} \]
- Head Injury Criteria (HIC) available on output for Ellipsoids, Grids, and Ridges
  \[ \text{HIC} \]
New material models:
- **SHRPOL** – Polynomial Shear model
- **SHREX** – Shear model by means of a user subroutine
- **YLDTM** – Tinimura-Mimura yield model
- **YLDZA** – Zerilli-Armstrong yield model
- **YLDRPL** – Rate power law yield model
- **YLDPOL** – Polynomial yield model
- **YLDMSS** – Snow material for single material euler with strength

- Separate Maximum Plastic Strain failure mode for material under compression – Lagrangian Hexa only.
  \[ DYMAT24 ; FAILMPS \]

- Initialization of a radial velocity field in Euler
  \[ TICEUL \]

- Option to put the velocity to zero of nodes when all the connected elements have failed
  \[ PARAM, NZEROVEL \]

- Separate timestep safety factor for Lagrangian elements
  \[ PARAM, STEPFCTL \]

- Extended coupling to MADYMO, for interfacing with MADYMO facets
  \[ MADGRP \]

### Regular Coupling

- **Madyno**
  - Location Ellipsoids
  - Forces on Ellipsoids

- **Dytran**
  - Contact With FE
  - Forces on FE

### Extended Coupling

- **Madyno**
  - Location FE
  - Forces on Ellipsoids
  - Contact with Madyno Objects

- **Dytran**
  - Forces on FE

- The documentation is now available in pdf format on all platforms, including Windows.
- Three new example models are added to the *MSC.Dytran Example Problems Manual*
- Upgraded to Flexlm 7.2, which solved licensing problems on HP-UX11 and Linux.
- Improved interface to CEI/Ensight, for advanced post-processing
- Viscosity in fluids and gasses without voids – Roe solver only
  \[ EOSGAM \]
On the Windows platforms, MSC.Dytran 2002 r2 easily installs from CD-ROM as it uses the standard Windows 2000 Installation Wizard. On Unix and Linux platforms you use the MSC.Software standard installation script to install the software on your system. MSC.Dytran 2002 r2 is the successor of MSC.Dytran 2002.

MSC.Dytran uses the FLEXlm license manager as the licensing system for nodelock and network licensing. To run MSC.Dytran, you need an authorization code from MSC.Software Corporation. If you already have a license for MSC.Dytran, you can continue to use this. With this release, it is not possible to install the FLEXlm server on a Linux platform. On the Intel Linux platform, you can either use the definition of an existing FLEXlm server in your network, or install a nodelock license specific for the Intel Linux platform.

On Windows and Linux computers, MSC.Dytran requires your computer to have an Ethernet card even if your computer is not connected to a network. The FLEXlm licensing mechanism uses the Ethernet card to create the unique system identification encrypted in the license information file.

MSC.Dytran 2002 was built and tested on the following hardware with the listed software installed:
Table 1  Supported Hardware Configuration

<table>
<thead>
<tr>
<th>Hardware Platforms</th>
<th>Operating System</th>
<th>OpenMP Parallel Support</th>
<th>Other</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intel Pentium III</td>
<td>Microsoft Windows NT 4.0 SP5</td>
<td>Yes</td>
<td>Ethernet card.</td>
</tr>
<tr>
<td>Intel Pentium III</td>
<td>Microsoft Windows 2000</td>
<td>Yes</td>
<td>Ethernet card.</td>
</tr>
<tr>
<td>SGI R5000</td>
<td>IRIX 6.5</td>
<td>No</td>
<td>N.A.</td>
</tr>
<tr>
<td>SGI R10000</td>
<td>IRIX64 6.5</td>
<td>Yes</td>
<td>N.A.</td>
</tr>
<tr>
<td>HPUX PA-Risc 1.1</td>
<td>HPUX 10.20</td>
<td>No</td>
<td>N.A.</td>
</tr>
<tr>
<td>HPUX PA-Risc 2.0</td>
<td>HPUX 11.00</td>
<td>Yes</td>
<td>N.A.</td>
</tr>
<tr>
<td>Compaq Alpha</td>
<td>Tru64 Unix 4.0B</td>
<td>No</td>
<td>N.A.</td>
</tr>
<tr>
<td>Sun Sparc Solaris</td>
<td>Solaris 7</td>
<td>Yes</td>
<td>N.A.</td>
</tr>
<tr>
<td>IBM RS/6000</td>
<td>AIX 4.3.3</td>
<td>Yes</td>
<td>N.A.</td>
</tr>
<tr>
<td>Intel Linux</td>
<td>Red Hat 6.2</td>
<td>Yes</td>
<td>Ethernet card.</td>
</tr>
<tr>
<td></td>
<td>MSC.Linux</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 2  Hardware Configuration: Compilers

<table>
<thead>
<tr>
<th>Hardware platforms</th>
<th>Operating System</th>
<th>Compiler</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intel Pentium III</td>
<td>Microsoft Windows NT 4.0 SP5</td>
<td>Compaq Visual Fortran 6.6A SMP version: Intel Fortran 6.0*</td>
</tr>
<tr>
<td>Intel Pentium III</td>
<td>Microsoft Windows 2000</td>
<td>Compaq Visual Fortran 6.6A SMP version: Intel Fortran 6.0*</td>
</tr>
<tr>
<td>SGI R5000</td>
<td>IRIX 6.5</td>
<td>MIPSPro Compiler Version 7.2.1</td>
</tr>
<tr>
<td>SGI R10000</td>
<td>IRIX64 6.5</td>
<td>MIPSpro F90 V7.30</td>
</tr>
<tr>
<td>HPUX PA-Risc 1.1</td>
<td>HPUX 10.20</td>
<td>HP F90 V2.4</td>
</tr>
<tr>
<td>HPUX PA-Risc 2.0</td>
<td>HPUX 11.00</td>
<td>HP F90 V2.4</td>
</tr>
<tr>
<td>Compaq Alpha</td>
<td>Tru64 Unix 4.0B</td>
<td>Digital Fortran 90 V4.1-270</td>
</tr>
<tr>
<td>Sun Sparc Solaris</td>
<td>Solaris 7</td>
<td>Sun WorkShop 6U2 (FORTRAN 95 6.2)</td>
</tr>
<tr>
<td>IBM RS/6000</td>
<td>AIX 4.3.3</td>
<td>XL Fortran 7.1</td>
</tr>
<tr>
<td>Intel Linux</td>
<td>Red Hat 6.2</td>
<td>SMP version: PGI F90 3.1-3</td>
</tr>
<tr>
<td></td>
<td>MSC.Linux</td>
<td></td>
</tr>
</tbody>
</table>

*For correct operation of the Intel Fortran Compiler, MS DevStudio 6.0 or Compaq Visual Fortran 6.6A must be installed prior to installing the Intel compiler.

For the installation of the MSC.Patran-MSC.Dytran Preference, see the MSC.Patran-MSC.Dytran Preference Guide.
Memory Requirements

In general, the size of the memory required by MSC.Dytran depends on the size of the engineering problem you wish to solve. The default memory size is set to approximately 30 MB. This default size is appropriate for smaller sized problems.

You can change the preset default in the MSC.Dytran Explorer so that it fits your personal needs. In addition, you can define the minimum and maximum memory size and use the slider in the front panel to select the desired memory size. On Unix and Linux platforms you can use the command-line option (size="small/medium/large") or you can enter the MEMORY-SIZE definition in the input file.

MSC.Dytran traces the usage of memory and prints a summary at the end of the output file of each analysis. The memory size listed in the summary is exact. It reflects the memory required for storing the model in core memory after one integration step. Additional memory required during the analysis is automatically allocated and de-allocated.

When you change the memory setting for an analysis through the MSC.Dytran Explorer, the settings are stored to be used the next time that you run the analysis.

Under certain conditions, MSC.Dytran may stop and issue a message that it cannot allocate the required memory. Since the memory allocation in MSC.Dytran is dynamic, the system may require additional memory during an analysis. If the memory is available, it will be allocated and de-allocated when it is no longer needed. When your computer runs out of memory, the MSC.Dytran analysis may stop when it needs more memory to continue. You may solve this problem by closing applications on your computer that you do not need, or you can decrease the size of the core memory that MSC.Dytran allocates for the analysis if you are using substantially more than the analysis requires. You can find the information on the memory size requirements of the analysis in the memory summary at the end of the analysis. We recommend to use MSC.Dytran on a computer that has at least 256 MB of RAM.

Using MSC.Dytran

Running MSC.Dytran

Submit an MSC.Dytran analysis by double-clicking the MSC.Dytran icon. The icon should be available on your desktop. Alternatively, you can use the “Start Menu” to locate MSC.Dytran under the “Programs Folder”. Once you picked either the icon, or the menu entry, the MSC.Dytran user environment appears on your screen.

The MSC.Dytran Explorer provides an on-line help system that contains information about the functionality of the MSC.Dytran Explorer. The MSC.Dytran Explorer provides some basic postprocessing and animation tools.

On Unix and Linux platform you would use the command line interface or submit from MSC.Patran.
Postprocessing MSC.Dytran Results

MSC.Dytran results can be postprocessed with MSC.Patran or by any other third-party postprocessing product that supports MSC.Dytran results visualization. In addition, you can use the VisualVrml postprocessing and animation functionality and the Visual Time History functionality built into the MSC.Dytran Explorer.

Postprocessing MSC.Dytran Results on Windows with MSC.Patran

As of MSC.Patran Version 8.5 pre- and postprocessing on Windows is supported. See the MSC.Patran – MSC.Dytran Preference Guide for more details.

Postprocessing MSC.Dytran Results on UNIX

If you wish, you can post-process the Windows analysis results on a UNIX computer. In this case, you need to convert the binary result files (.ARC and/or .THS) files to a UNIX format. You can perform this conversion by using the right-mouse button menu in the MSC.Dytran Explorer. Point your mouse at the file that you wish to convert, click the right mouse button and select the “Convert to binary…” menu item. The converted files have the sb_ prefix. For Digital Alpha workstations, the native Windows result files can be used directly without conversion.

Alternatively, you can select the option to output result files in UNIX format by default. To set this option, select the “Preferences” from the “Options” menu. Choose “Formats” and select “Convert output files automatically to UNIX-format”. If you select this option, the regular Windows result files and the converted UNIX-format files are written at the end of the analysis. You can recognize the UNIX-format files by the “UX” prefix.