

# ADINA System Newsletter

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## Season's Greetings

Once again, we have come to the end of another year. First, we would like to wish you a Happy Holiday Season and a good New Year ahead.

Although the economy is currently going through some rough times, we are glad to let you know that ADINA R & D continues to grow. We believe the key to our success is that we have a team of highly qualified professionals in an environment that fosters collaboration, commitment, and excellence.

We are committed to provide all our users the best tool and support for their analyses. In this Newsletter, we mention some updates for ADINA 7.5 and present an overview of our development efforts for improvements in ADINA 7.6.

## ADINA System 7.5 Updates

ADINA 7.5.2 is now available. This version fixes bugs found from ADINA 7.5.0 onwards. The list of bugs fixed for each of the program modules is given on the Support > Download page of our web site. In this web page, you can download the PC Windows version of the program executables for ADINA 7.5.2. Please note that a password is required to access this web page and current users can contact us to obtain the password.

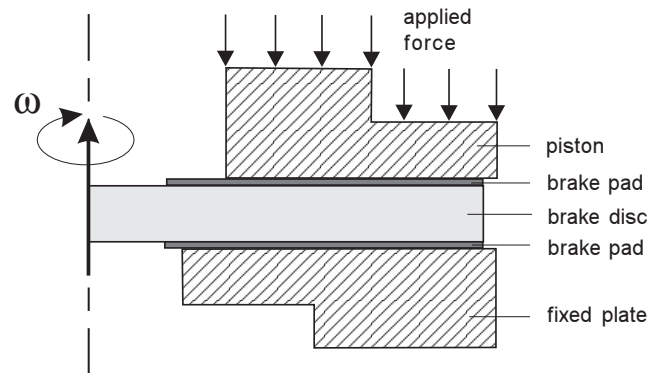
There are also some updates regarding our CAD interface programs.

### • TRANSOR for Patran

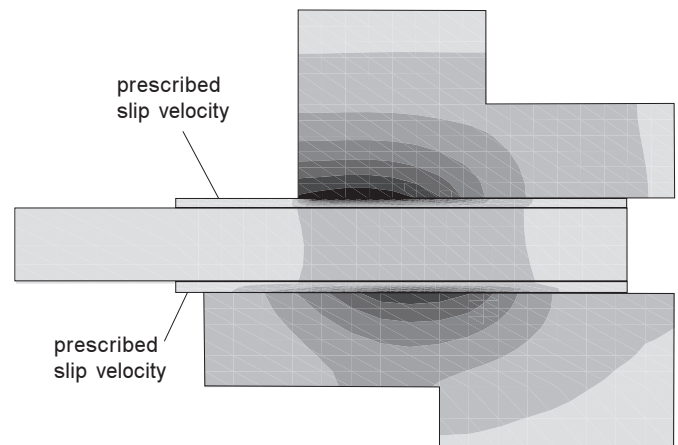
TRANSOR for Patran is now available for MSC.Patran 2001r2. Unix versions can be downloaded from the download page of our web site. The PC Windows version is provided in an updated CD.

### • TRANSOR for I-DEAS

We are working on the interface to I-DEAS 9 and we will inform you via our web site (news page) and the ADINA Newsgroup when it is ready.



(a) Schematic



(b) Temperature Distribution at time = 2 seconds

Figure 1: Thermo-Mechanical Coupled Analysis of Disc Braking System

## Training Classes

The next ADINA-AUI training course will be held at ADINA R & D on January 24-25, 2002.

## INSIDE THIS ISSUE

- ADINA System 7.5 Updates
- Analysis of Disc Braking System
- Analysis of Rubber Seal
- ADINA System 7.6 Developments

## Improved Contact Capabilities

A new feature in ADINA 7.6 is the ability to model contact slip, i.e. a tangential (slip) velocity can be prescribed between contacting surfaces. This new feature has several practical applications, including the thermo-mechanical coupled analysis of a disc braking system.

In Figure 1(a), we show the schematic of a disc braking system where the heat generation caused by friction between the rotating disc and the piston and plate is to be analyzed. In this simulation, the rotating disc is prescribed to slow from 300 to 0 rpm in 5 seconds. The analysis is performed using a simple 2-D axisymmetric model with the new contact slip feature. Figure 1(b) shows the solution of the temperature distribution on the brake components at the time of 2 seconds.

In ADINA 7.6, the contact algorithm is significantly improved, especially with respect to problems where the normal vector between the contacting surfaces frequently changes in direction during the analysis. This phenomena often occurs in contact between flexible surfaces as in the analysis of a rubber seal shown in Figure 2.

Initially, as shown in Figure 2(a), there is only contact between the rubber ring and the rigid surfaces. As the deformation progresses, self-contact occurs with considerable amount of sliding between the surfaces of the flexible rubber ring.

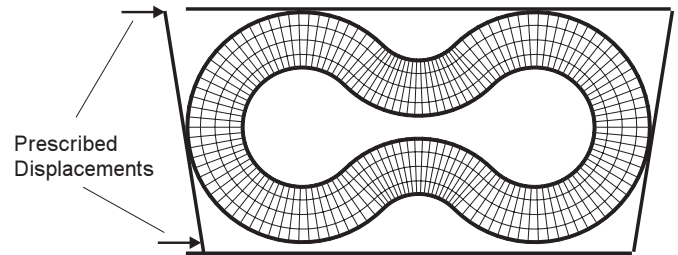
First, we compare the static analysis solution between ADINA 7.5 and ADINA 7.6. The maximum deformation that can be solved is significantly greater in ADINA 7.6 (Figure 2(b)) than in ADINA 7.5 (Figure 2(c)). The automatic time-stepping (ATS) method is used in both cases.

When response smoothing (see notes on page 4) is used to overcome convergence difficulties, the problem can be solved up to the deformed configuration shown in Figure 2(d) for both ADINA 7.5 and ADINA 7.6. However, the solution time in ADINA 7.6 is much less than in ADINA 7.5.

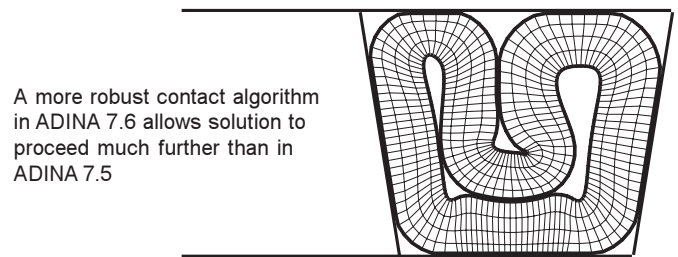
We observe from this rubber seal example that the

robustness and efficiency of the contact algorithm implementation in ADINA 7.6 are significantly improved.

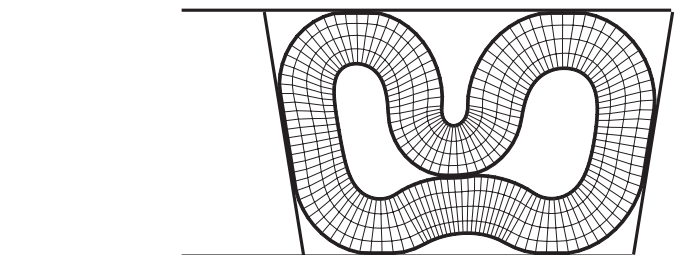
Another new contact analysis feature in ADINA 7.6 is the user-supplied friction law option, where a user's own friction law can be implemented.



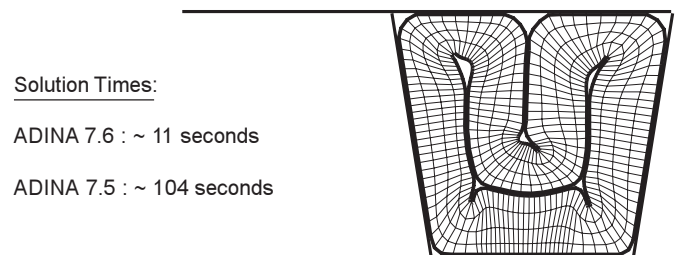
(a) Initial Configuration



(b) Static Analysis - ADINA 7.6



(c) Static Analysis - ADINA 7.5



(d) With Response Smoothing - ADINA 7.5 and ADINA 7.6

Figure 2: Analysis of Rubber Seal

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## ADINA System 7.6 Developments

It is our goal to provide our users state-of-the-art capabilities that are easy to use. We present here an overview of the major developments that we are working on for ADINA 7.6.

- **Online Help**

Continue to strengthen the interactive HTML-based help system. More topics will be added.

- **Material Definition**

Introduce a material management dialog box to provide easy access and view of all material definitions.

Allow users to add a description text to material definitions so that it is easier to identify the defined materials.

Add material database file that allows users to save material definitions created in the ADINA User Interface (AUI). Material definitions stored in the material database file can then be loaded for use in other AUI models.

- **Progress Bar**

Add progress bar in pop-up window to indicate the progress of certain tasks which may take a substantial amount of time to complete, e.g. mesh generation. A Cancel button in the pop-up window allows the user to terminate the task before it is completed.

- **Automatic Brick Meshing**

Improvements to our automatic brick meshing capability with respect to element distribution and speed.

- **Display Processing**

Various improvements such as OpenGL on Linux, improved geometry zone definitions, plotting only selected applied loads, and partial loading of the porthole file for selected timesteps.

- **ADINA-M for 64-bit Version**

Implement the ADINA Modeler (ADINA-M) for the 64-bit version of the ADINA User Interface (AUI) on certain Unix platforms.

- **Rubber Material Models**

Extend the existing Ogden and Mooney-Rivlin models to allow viscoelastic effects and add new rubber material models. While the other rubber material models are incompressible, a hyper-foam polymer model that is highly compressible is also added.

- **Metal Forming**

Implement modeling of drawbeads for metal forming analysis. Add adaptive mesh refinement capability.

- **Potential-based Fluid Element**

Simplify the modeling of problems involving potential-based fluid elements. Some current limitations are removed. For example, infinite elements can be used with the ADINA Modeler (ADINA-M) and large fluid velocities are allowed in the analysis.

- **New Shell Element Capabilities**

Implement the MITC-9 and MITC-16 shell elements for large strain analysis. In general, these elements give more accurate results, but are not as efficient as the MITC-4 elements.

- **Rebar Modeling**

Add capability to construct rebar elements automatically from geometry lines passing through 2-D and 3-D solid elements at arbitrary locations.

- **New Navier-Stokes Fluid Elements**

New 4-node quadrilateral 2-D elements and 8-node hexahedral 3-D elements are added for fluid flow analysis. These elements produce more accurate results, especially when very slender elements are used in the model, as encountered in the modeling of long channels.

- **Phase Change**

Improve capabilities of phase change analysis in fluid flow simulations. Arbitrary phase change boundaries which propagate depending on the temperature distribution in the fluid are solved. Phase changes between liquid and vapor regions can be analyzed.

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## ADINA System 7.6 Developments (cont'd)

- **Joule Heating**  
Add Joule heating (heating caused by resistance to current flow) capability in fluid flow analysis. Applications include the analysis of thermal ablation (damage) of tissues in the bio-medical field.
- **Linux Version**  
Implement the 64-bit version with parallel processing for the Linux platform.
- **Automatic Memory Allocation**  
Automatically calculate the amount of memory required by the solver programs for matrix storage and solution.

We will provide further details on some of the exciting developments in the upcoming issues of the Newsletter and also through the ADINA Newsgroup. However, you are most welcome to contact us at any time for more information on any particular development item that is of interest to you.

### Notes on Response Smoothing

Response smoothing is an option that can be selected with the automatic time-stepping (ATS) method for static analysis problems.

It is a special technique developed to overcome convergence difficulties in collapse, post-collapse, and contact problems. In essence, response smoothing includes dynamic effects to solve a

static problem. However, once the solution has been obtained, the dynamic effects are no longer present.

Note that you must specify density values for your material properties for the response smoothing option to be effective.

Did you know that you can find this information in the AUI online help? To locate this information, look under Index > Analysis Control > Analysis Type > Automatic Time Stepping.

### Windows XP

We are glad to let you know that our tests show that the ADINA System installs and works without problems with respect to the new Windows XP operating system.

### Second M.I.T. Conference on Computational Fluid and Solid Mechanics, June 17 - 20, 2003

Please mark your calendars for the above Conference which will be held in the same spirit as the First Conference on the M.I.T. campus.

#### The mission of the M.I.T. Conference:

“To bring together Industry and Academia, and To nurture the next generation in computational mechanics.”

You can find more information on the Conference at <http://www.secondmitconference.org>.



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