ADINA System Newsletter

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As we come to the end of another year, all of us at ADINA R & D would like to wish you a happy holiday season.

In the past few months, we have been working hard towards the new capabilities and features for the ADINA System 7.4. On the one hand, we continue to enhance the power of the ADINA System for solving tough engineering problems. On the other hand, much effort is spent to make the program more user-friendly and easy to use.

In this newsletter, we want to highlight some of the valuable new features that will be available in the ADINA System 7.4, to be released together and with the same capabilities for both the Unix and Windows platforms.

Adaptive Meshing Capability

We are excited and proud to be the leader in many aspects of fluid flow with structural interaction (FSI) analysis. We have now achieved further enhancements to the power of the ADINA System with a new adaptive meshing capability.

In the analysis of fluid flow with structural interaction problems, one difficulty that is encountered during the solution process is that the fluid mesh can become highly distorted as certain parts of the mesh move due to the displacements of the structure. Such difficulty may also be encountered in a pure fluid flow problem with moving boundaries (such as a moving wall or free surface).

When the adaptive meshing capability is selected for an analysis, remeshing is performed when the fluid mesh becomes too distorted for the solution to continue. In Figure 1, we show the remeshing used in a 2D FSI problem. This adaptive meshing capability is of course also available for 3D problems.

Thermo-Mechanical Coupling

As a new feature, the ADINA System 7.4 offers the capability for the analysis of fully coupled thermo-mechanical problems.

In a coupled thermo-mechanical problem, the structural deformation is affected by the tempera-

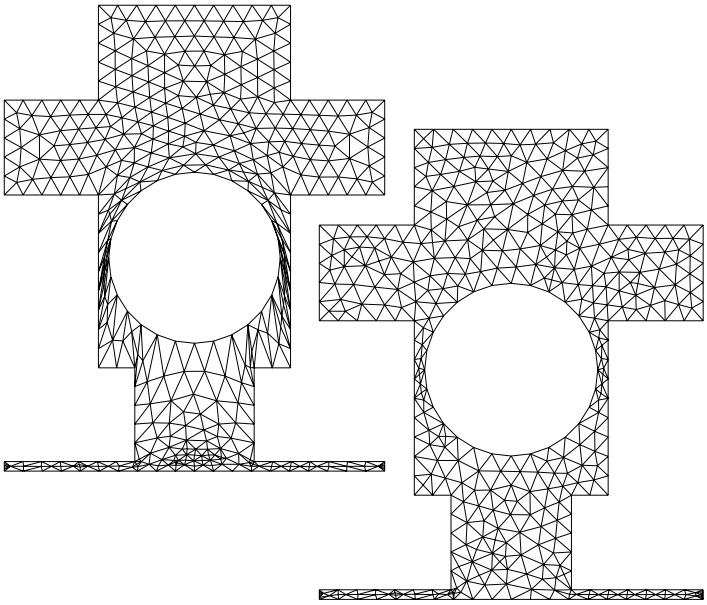

Figure 1: Mesh Before and After Remeshing

Training Classes

The next ADINA/AUI training course will be held at ADINA R&D on January 20-21, 2000.

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ture distribution and the temperature calculation in turn depends on the structural deformation. Contact with heat transfer is also included.

Trimmed Surfaces

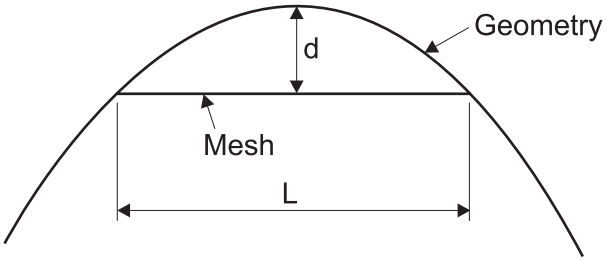
Version 7.4 includes the capability to create trimmed surfaces using the ADINA Modeler (ADINA-M). The trimmed surface is defined using an external loop with zero or more internal loops. The lines which form the loops can be created in the ADINA User Interface (AUI) or be imported via IGES.

The trimmed surface can then be swept along a line or revolved to form a 3D solid part. All ADINA-M operations can then be used on the solid part.

Meshing Improvements

Our meshing capabilities were greatly enhanced in the ADINA System 7.3. For Version 7.4, we have made further improvements to the meshing algorithm in various areas.

In Version 7.4, the user can specify a parameter to control the discretization error when using the 3D Delaunay automatic mesher. The geometric discretization error (d/L) is illustrated below.



d/L = geometric discretization error

The discretization error parameter can be used for geometries with high curvatures that have to be resolved accurately by the finite element mesh.

Figure 2 shows an ADINA-M part that has been meshed using just the discretization error control and without specifying any mesh density elsewhere.

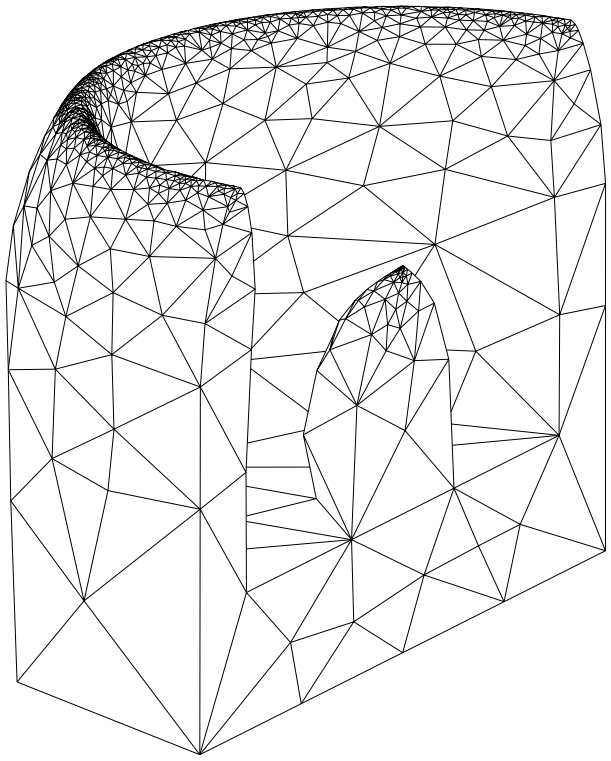


Figure 2: Use of Geometric Discretization Error

Additional enhancements in the meshing capability include:

- Improvement of the 2D free mesher which produces all quad elements
- Extrusion or revolution of 2D quad elements to create 3D brick elements

In Figure 3, we show a 3D brick mesh created using various new features in Version 7.4. First, a trimmed surface is created using an external loop formed by lines in the AUI. The new 2D quad mesher is then applied on the trimmed surface. The 2D quad elements are revolved to obtain the 3D brick mesh.

Strengthening for Civil Applications

In addition to the Cam-Clay material model already available in Version 7.3, we have added the following material models to the libarary of ADINA material models. This will strengthen the use of ADINA for civil engineering applications.

- Porous media properties can be applied to element groups for consolidation and undrained types of analyses
- Mohr-Coulomb material model
- Visco-elastic material models

The porous media and visco-elastic material models can of course be used also for general mechanical problems.

Solver Improvements

The state-of-the-art solver technology in the ADINA System has been proven in many industrial applications and benchmark problems. We continue to strengthen our solvers in Version 7.4.

For FSI analysis, we of course always solved in ADINA for the fully coupled response. We have now greatly strengthened the capability by using a new algorithm in Version 7.4. For many problems, a much more effective solution is achieved. In the Application Showcase section, we show an analysis that requires the use of this new solver technique.

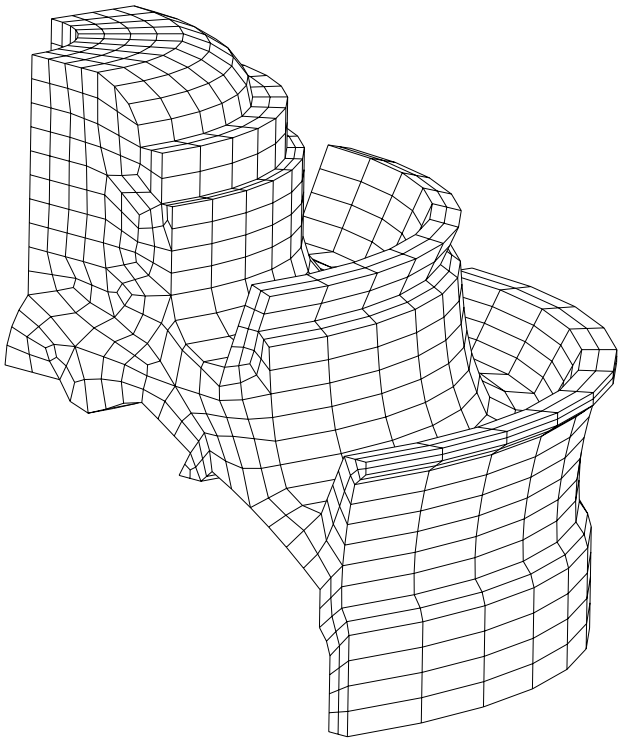


Figure 3: Brick Mesh Created from 2D Quad Mesh

A Lanczos method has been added for frequency calculations in the ADINA program. For some large system solutions, this method can be very effective.

The out-of-core parallel sparse solver is implemented for the ADINA-F program.

Special 900 Nodes Version

We are pleased with the excellent response we have received with our offer of the special 900 nodes version. We have already hundreds of users of this limited version in the short period since its offer.

Note also, that you can still request for a free animation CD which features several interesting applications using the ADINA System. The animations are also included in the PC Windows full version CD and the 900 nodes version CD.

Upcoming ADINA Trade Shows and Seminars

We wil be demonstrating the ADINA System, and/or giving invited lectures at the following trade shows and seminars. We wil be glad to see you there!

February 24 - March 1, 2000	***CeBiT***
S. Mohasseb, J. Dong	Hannover, Germany
May 10-11, 2000	***ADINA Seminar***
K. J. Bathe, L. Tan	München, Germany

Please contact us for additional information.

Application Showcase

Figure 4 shows the simulation of a blood cell with radius of order 10^{-6} meter flowing through a pulmonary capillary. The very soft blood cell is modeled using a visco-elastic material model.

The solution for this problem uses the new coupled solver technique in the ADINA System to achieve excellent stability and convergence.

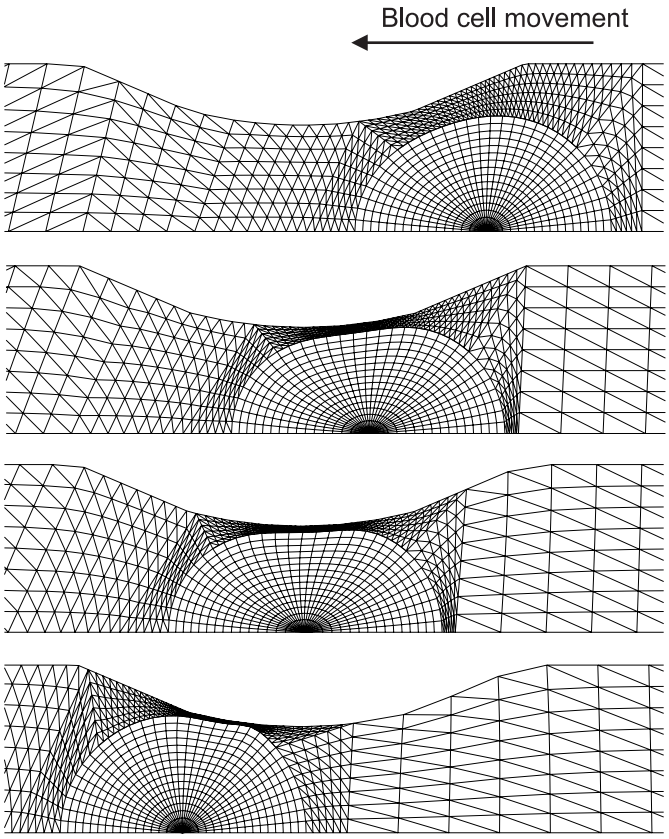


Figure 4: Blood Cell Flowing through Capillary

User Hints

How do I change the background color of the graphics window in the AUI?

You can use the AUI command (PC and Unix)

```
PLCONTROL XWINDOW BACKG=<color>
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to change the background color of the graphics window (<color> = WHITE, GREEN, etc).On Unix systems, if you are using OpenGL, replace XWINDOW with OPENGL in the above command.

On Unix systems, you can also use the dialog box to change the background color. From the menu File → Screen Plot Setup → X Windows.../Open GL..., you can access the dialog box which will allow you to specify the backgound color.

When do I need to mesh a contact surface?

A rigid contact surface (i.e. the contact surface is not attached to finite elements) has to be meshed. A 2D illustration (from primer problem 7) is given in Figure 5.

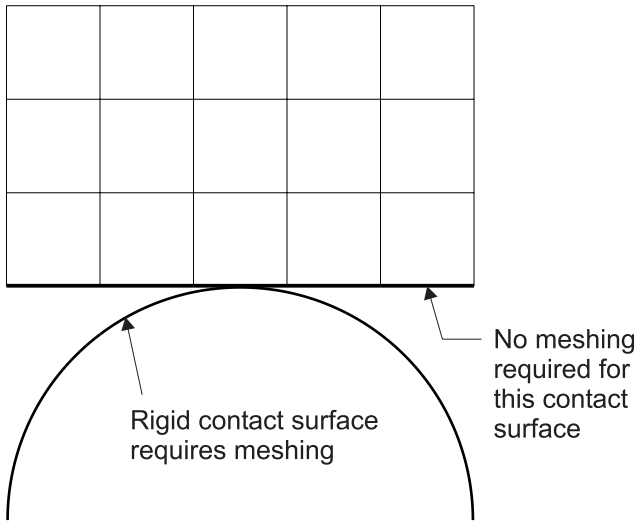

Figure 5: Meshing of Contact Surface

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