The Focus

A Publication for ANSYS Users

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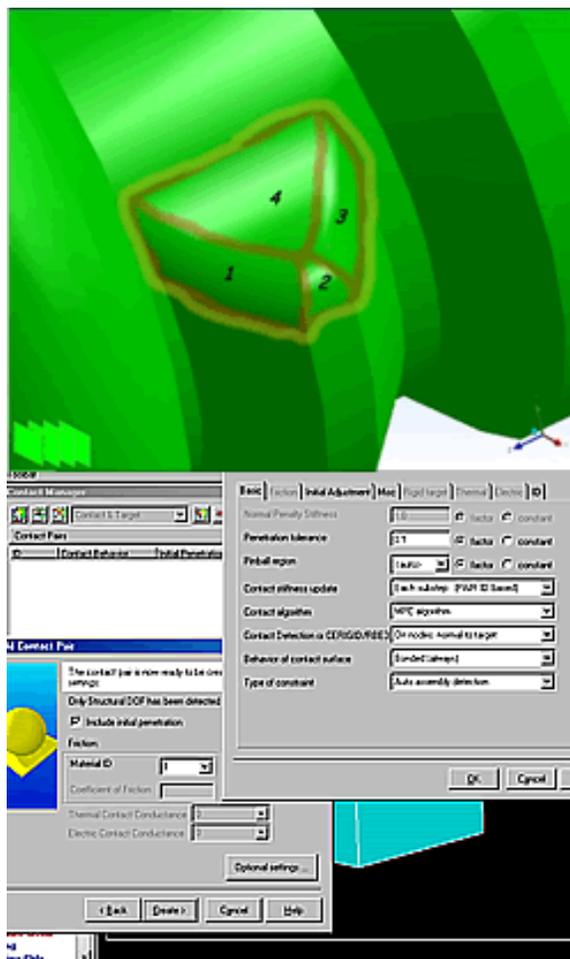## On the Web

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ANSYS Support Distributor

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Leveraging the Advantages of Workbench: Meshing

by Eric Miller, PADT

Overview

Over the past several releases, ANSYS Inc. has been rolling out more and more of their Workbench technology. There is already a lot of marketing and technical information available on the various aspects of Workbench, but PADT is still often asked: Why should I use Workbench? or How can Workbench help me? We will attempt to answer these questions with a series of articles about using these new tools to your advantage.

In this second article we will focus on the area of the software that PADT has found most useful: Robust Meshing. In coming issues we will discuss CAD associativety, embedding APDL, post-processing with report writing, and using Workbench hand-in-hand with ANSYS Classic. If you need some basic info on the Workbench or info on how to access it, please review the first article in this series.
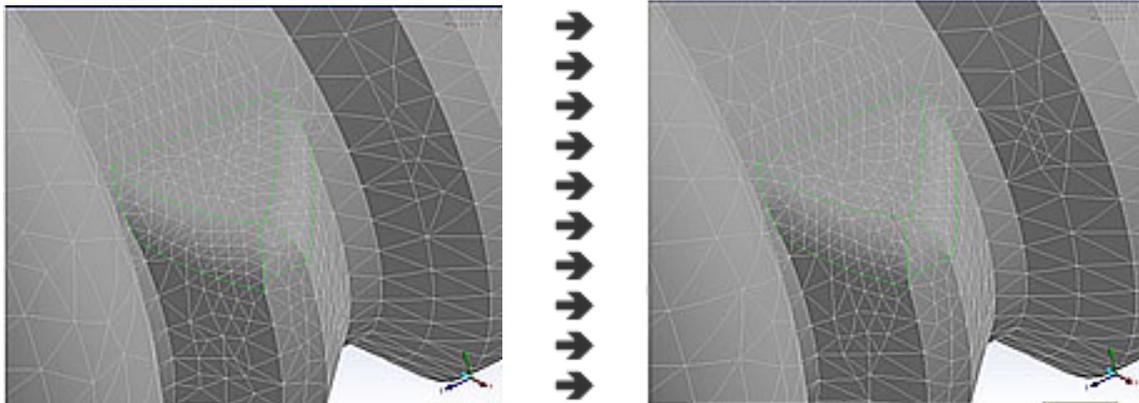
A Different Approach to Meshing

One of the most significant differences between the Workbench and the Meshers found in Traditional ANSYS is that the new meshing was built from the ground up for robustness. As solvers get faster and computers get bigger, the solve portion of analysis is getting shorter and a larger percentage of an analysts time is spent defining the mesh for the model. ANSYS Inc. has seen this trend and is addressing the need for faster and more reliable meshing with new technologies under the hood of Workbench.

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The meshing module found within the ANSYS Workbench Environment (AWE) is built around the premise that the CAD software is the best place to deal with geometry. When a geometry model is attached in AWE, the intelligence of the CAD system is used to extract all of the critical information needed to mesh the geometry reliably. This not only includes the mathematical definition for the points, curves, and surfaces that make up the object, but also how the entities are connected (topology), parameters, and any non-graphical attributes associated with the geometry. [More on the parameter part in the next article.]

With a smart copy of the geometry in the meshing module, the meshing algorithms can work more intelligently and deal with potential problems easier.

# No More Nasty Slivers Under Your Fingernails

Meshing geometry with small sliver areas is the first place that this new approach pays off. The software can recognize very small features and work around them, rather than trying to force a mesh on every single area in an object. However, the flexibility and control that ANSYS users expect is still there and they can specify a tight mesh on small areas if they feel they need it. PADT has found that castings with lots of fillets tend to have a large number these little slivers. In a more traditional mesher we used to have to go in to all the small areas and seed mesh them to ensure that we could mesh the entire object. In the Workbench mesher, we have almost eliminated this step and greatly sped up the meshing process.

If the automatic process doesn t work, the flexibility of the new meshing tools allows you to create something called Virtual Topology. This powerful function allows you to join two or more surfaces that share edges into a new virtual surface. Once joined, the mesher will not force nodes at the edges once shared by the original surfaces. The advantage of this approach is that there is no need to refit the NURB surfaces to the new surface, it is merely a database manipulation that tells the mesher to treat the collection of surfaces as a single surface. This is not only useful for slivers but also for merging fillets together as well as large complex surfaces.

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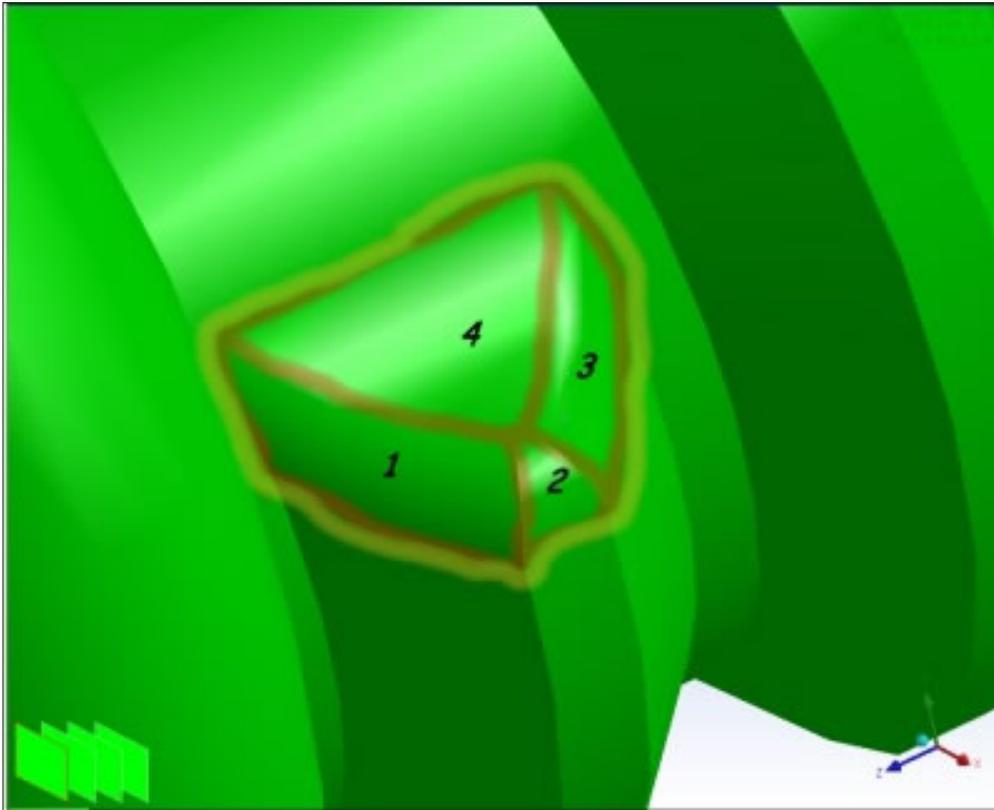
Keep Trying Till You Get it Right

Another major advancement found in the Workbench meshing technology is the way that the algorithm can keep going if it runs into a problem. When a potential mesh is not meeting the criteria for a valid mesh, the program does not quit. Instead it looks at where it is and tries different approaches. When you first see the little Overall Progress bar go from 75% back to 30% you may panic, but what is actually happening is that the program is saving you from having to go in and set size controls on troublesome features. Instead, it is trying different values automatically until it can get a good mesh. In the rare cases when the mesher could not find a valid solution, the program produces some highlights on the geometry plot that show where it thinks the problem is. So far this has only occurred when we have imported very bad geometry.

Control Without the Hassle

The first reaction that most experienced ANSYS users have to the Workbench mesher is a fear that they won t have the control over the mesh that they need. Over the past couple of releases, several powerful mesh control objects have been added to the mesher that give users the tools they have been asking for. These controls include absolute and

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relative size control on curves, surfaces, or entire bodies. A nice part of these controls is that they can be named in the tree, and tags point to the geometry they apply to.

PADT s favorite mesh control object is the ability to identify faces that you want to seed mesh with a uniform mapped mesh. This is especially useful on fillets to get a consistent mesh in a high gradient area. The most common control is the global size specification that allows the user to specify a preferred element size and a Curve proximity value.
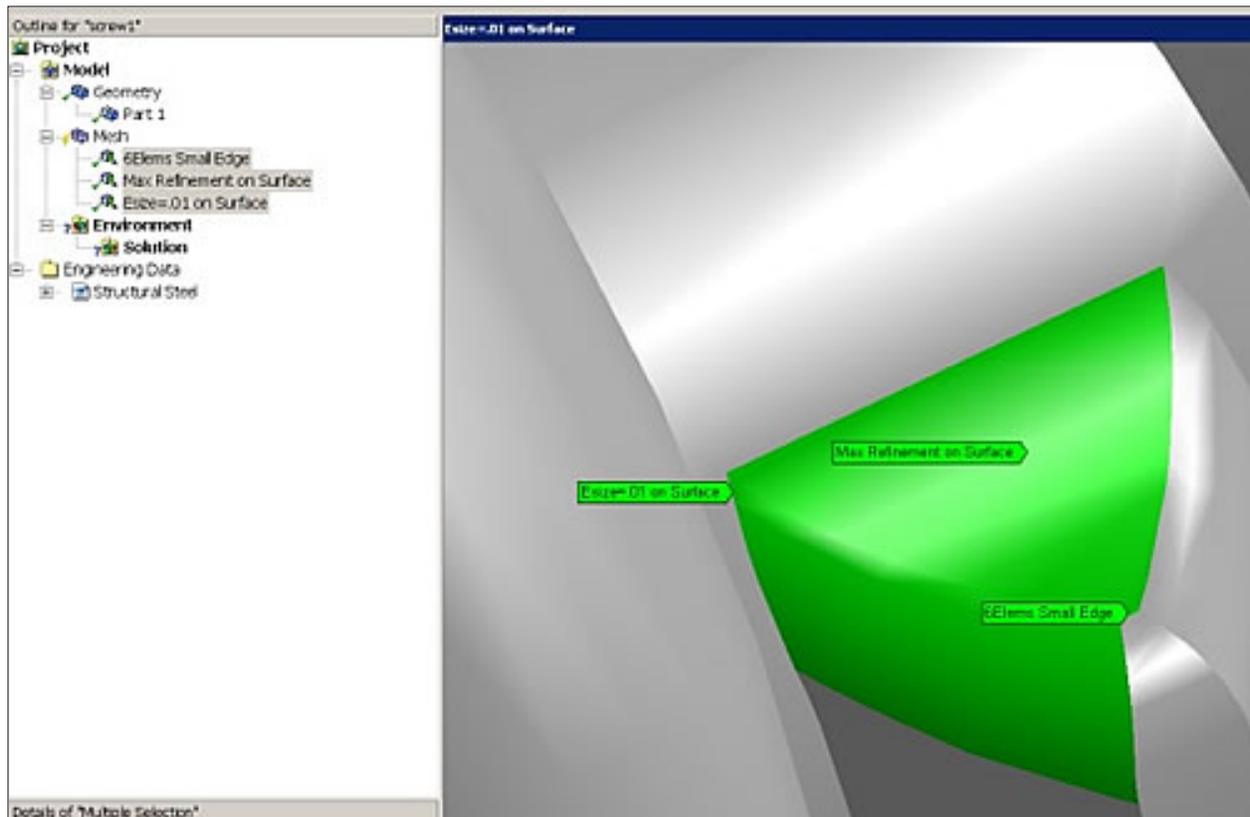
The Proof Is in the Pudding

The only way to see if this new meshing technology works for you is to try it out on some real geometry. The AWE comes with a built in IGES reader if you don t have a Geometry Interface for your CAD system. We recommend you contact your sales representative to get a temporary key for your CAD system so you can see the full power of these tools. If you run into problems, don t give up. This is a different way of doing things and you need to learn the new methodology. Most people who have taken the time to try it out have been very pleased.

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ANSYS 7.1 Released

by [Rod Scholl](), PADT

Getting lost in the release cycle? There have been a number of changes recently, largely due to feedback from you, the customer.

For traditional ANSYS products, there will be a major (x.0) release each year with an additional 6-month (x.1) release to correct bugs and make minor changes. Occasionally a must-have feature may be introduced at the x.1 release. Thus, you may want to consider whether you upgrade during the x.0 or x.1 release. If the features are something you need, then we recommend you upgrade at x.0 release. Workbench-related products are still on a 6-month release cycle.
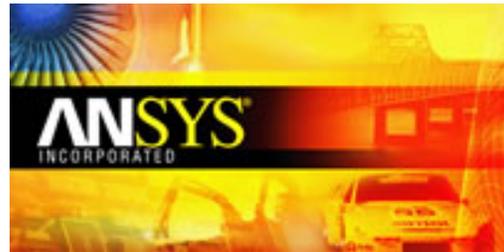
The stability of 7.1 compared to 7.0 is noticeably increased. We don t have any formal proof of this, but many of us at PADT have found it to be more reliable, and better able to handle memory requirements of large models. Of course, there are also bug-fixes discovered at 7.0 release.

So, in short, we recommend you make the upgrade to 7.1; 8.0 is already in alpha-testing, so you don t want to get left behind!

As always, you can learn about the new features of a release in the help files. We discussed some of the new features in 7.0 in a [previous article]() in *The Focus*. Thus we will only cover a few of the 7.1 features in this article.
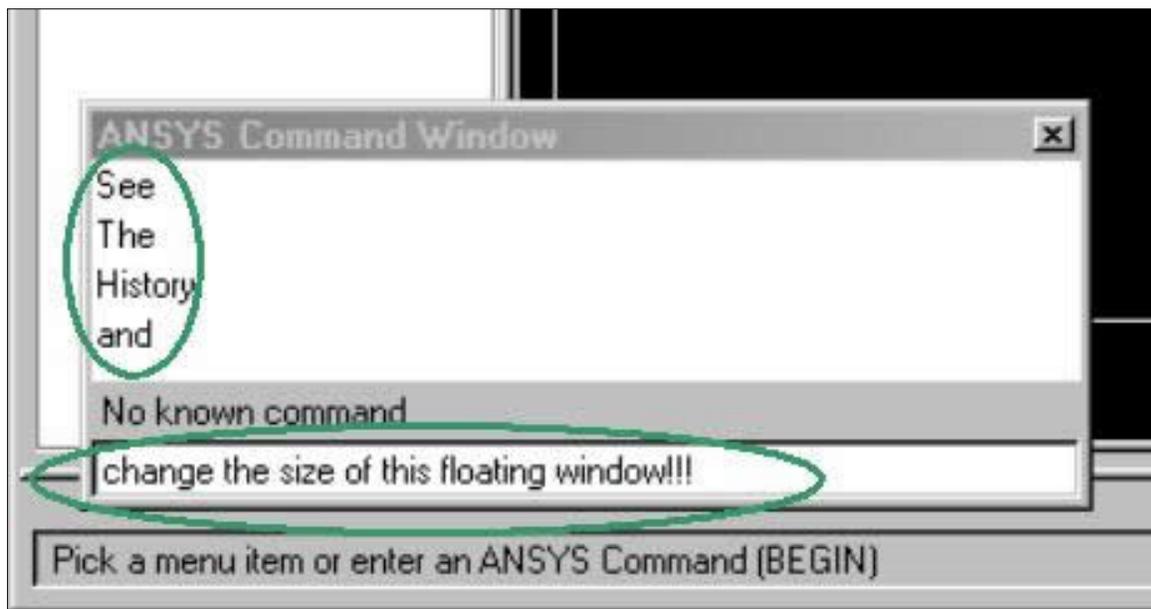
Usability

- Optional Floating Command Window   RESIZEABLE!!! Woo Hoo!!!
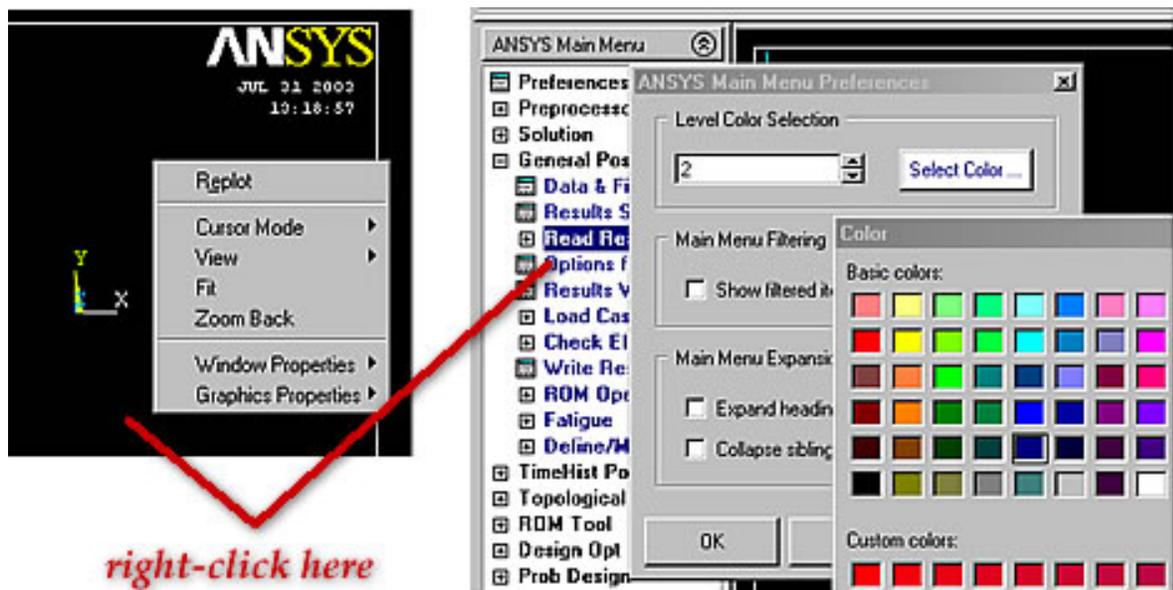
GUI

- Customize colors and fonts (poke around under MenuCtrls). This is a benefit of the new TCL GUI!
- Menus are context-sensitive. This means right-mouse-click brings up options like grey out, change colors, expansion behavior, etc.
- Graphics window is context-sensitive (right-click). Less hunting in the MenuCtrls pull-down.
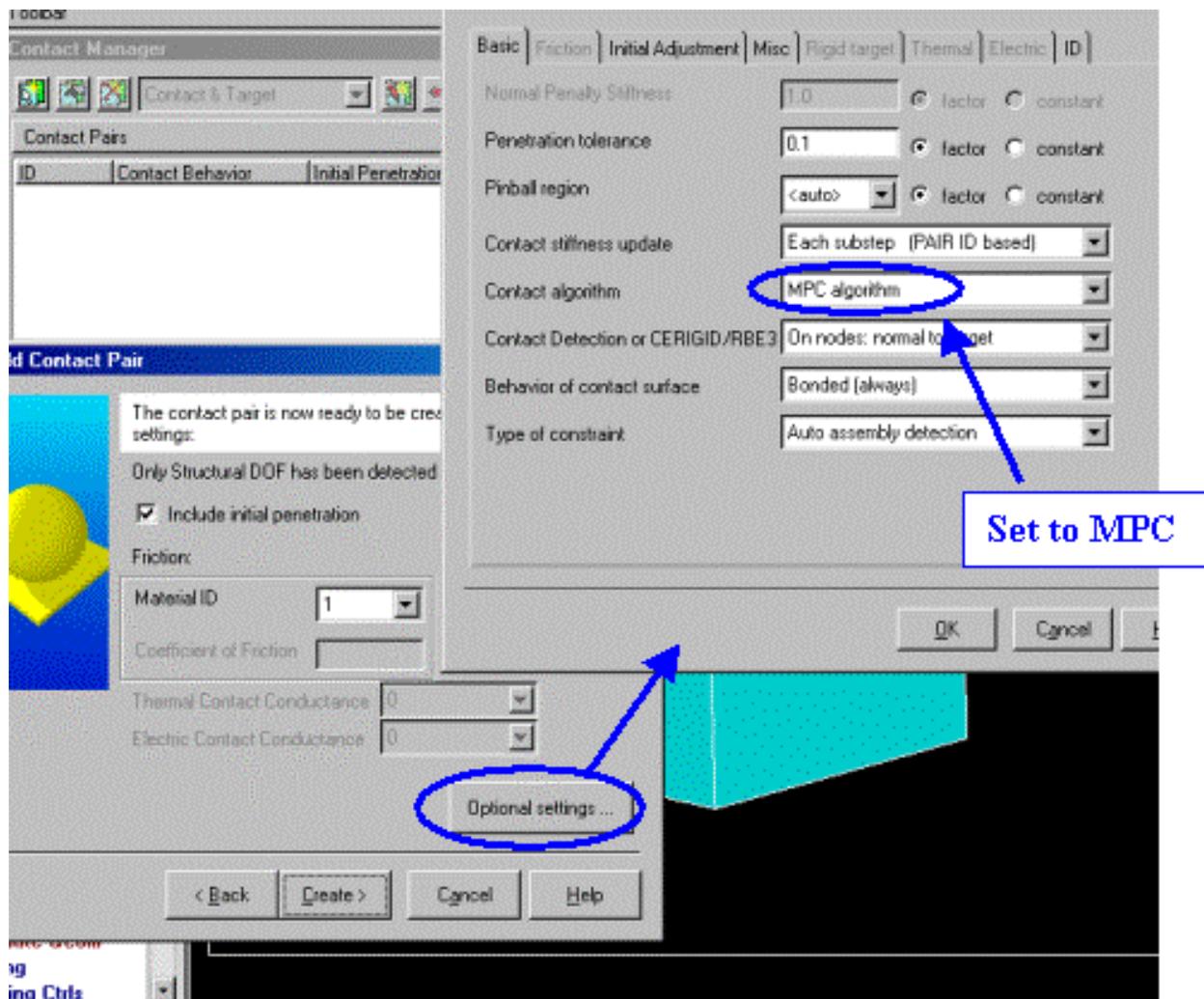
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- Results Viewer (an under-utilized time-saving feature) now has some more slick Post26 abilities

Structural

- Improved degenerated shape for the 18X series
- Generate MPC elements in tandem with contact 17X to better simulate contact scenarios. MPCs have several advantages over CERIG and RBE3. See Chapter 10.7 in the Structural Analysis Guide of the help manual.

- SHSD is a meshing tool/command aiding shell to solid interfaces
- Mid-Surface data available for shell elements (63, 93, 181)
- Shell153 and 154 now support complex pressure imputs for harmonic analysis.

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Thermal

- Surface-to-surface contact now available with THOPT,QUASI solver.

Coupled Field

- Model Fluid Solid interaction using external CFD code MpCCI

Installation and Licensing

- The help files are back to HTML format (.chm)
- A Wizard for the ANSLIC_ADMIN is yet another feature to make license management easier.
- ANSYS is now supported on the Windows IA-64 Itanium2 platform
- Connection Products/Readers are now called Geometry Interface licenses and work with ANSYS and Workbench environment

Connection Products / Geometry Interfaces

- CATIA V5 version 2   10 files supported. Plus import assemblies (.CATProduct)

Binary Files

- Enhancements to better support new features   see help files

FEMXplorer   ANSYS DesignXplorer VT and Frequency Sweep Module   Variational Technology

- Section properties can be used as input variables
- Support of Mass21 and COMBIN14 added
- Can vary non-constant properties like temperature dependent properties
- See help manual for more features

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Better, Stronger, Faster: Implied Do Loops in APDL

by [Ted Harris](), PADT

Well, at least do loops can be better and faster, now that the use of implied do loops is documented in ANSYS Parametric Design Language in version 7.1. What do we mean by implied do loops? It s a way of executing a do loop without using the *do or *enddo commands, and without explicitly defining an index variable with a starting and ending value and increment. For more information on do loops in general, please see our previous articles in *The Focus*:

- [Do Loop Techniques]()
- [Do Loops   Program Flow]()

The use of implied do loops can decrease execution times considerably. A simple benchmark was done using a macro that creates 50,000 keypoints using a do loop. The macro with the traditional do loop took 23 seconds wall clock time to complete. Replacing that do loop with the implied do loop reduced the execution time of the macro to three seconds. In other words, there was a factor of seven reduction in execution time using the implied do loop.

Instead of the traditional do loop, with implied do loops we use a colon as a separator between the beginning, ending, and increment values. Lets consider an example. A traditional APDL do loop such as:

```
*do,i,1,10
k,i,i,2*i
*enddo
```

Would define keypoints as

```
k,1,1,2
k,2,2,4
k,3,3,6
.
.
.
k,10,10,20
```

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This could be done with an implied do loop in one line:

k,(1:10),(1:10),(2:20:2)

The format for implied do loops is (x:y:z) where x is the beginning value of the index, y is the ending value of the index, and z is the increment. The increment value defaults to 1 if it is not specified. The (x:y:z) technique can be substituted anywhere in APDL where it makes sense to do so.

For more information on *do loops and APDL in general, please check out our upcoming classes:

- [Introduction to APDL](), December 15 - 16, at ANSYS West in Irvine, CA
- [Advanced APDL and Customization](), September 15 - 18, at ANSYS West in Irvine, CA

Additional course descriptions and registration information can be found on our [web site]().

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About *The Focus*

The Focus is a periodic electronic publication published by PADT, aimed at the general ANSYS user. The goal of the feature articles is to inform users of the capabilities ANSYS offers and to provide useful tips and hints on using these products more effectively. *The Focus* may be freely redistributed in its entirety. For administrative questions, please contact Rod Scholl at PADT.

The Focus Library

All past issues of *The Focus* are maintained in an online library, which can be searched in a variety of different ways.

Contributor Information

Please don t hesitate to send in a contribution! Articles and information helpful to ANSYS users are very much welcomed and appreciated. We encourage you to send your contributions via e-mail to Rod Scholl.

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