The Focus

PADT

A Publication for ANSYS Users

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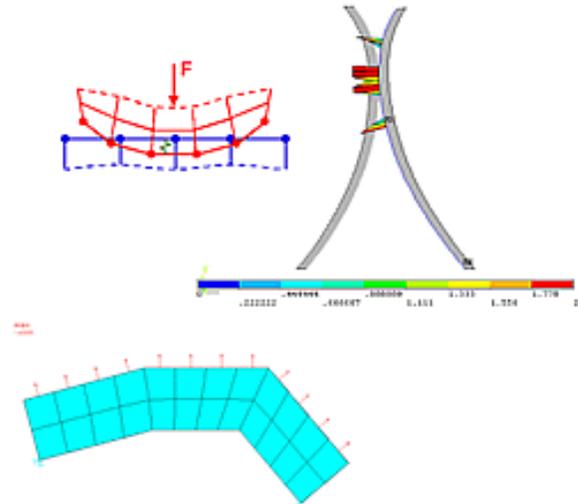
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Contact with Updating Stiffness

by Rod Scholl

In any contact problem, the penalty stiffness has a huge impact on convergence. The spring will deflect an amount Δ, such that equilibrium is satisfied:

$F = k$ Δ

where k is the contact stiffness, sometimes called the penalty stiffness . The penalty stiffness is calculated as a factor (FKN) times the stiffness of the underlying elements.
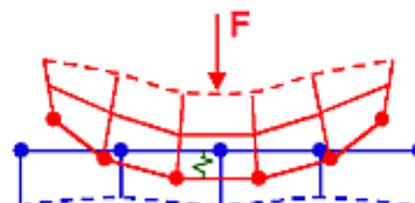
In ANSYS 6.1 and 7.0 the penalty stiffness can be updated during the analysis to reflect changes due to plasticity, stress-stiffening, etc. All of this behavior is controlled through key option 10. But a table is worth a thousand words&

Hooray for Keyopt 10 =1 !!!!!
(updates for mean stress of underlying elements)

Stiff / Flexible	Keyopt (10)	Iterations in 6.1	Iterations in 7.0
Stiff	0	320	320
Stiff	1	27	27
Stiff	2	320	1740+
Stiff	3	NA	320
Stiff	4	NA	320
Stiff	5	NA	1740+

...yikes!!

I m told that Keyopt = 1 in 6.1 has different meaning than Keyopt = 1 in 7.0. However, I get identical results for many test cases in both 6.1 and 7.0. Perhaps I m not choosing the correct test case to take advantage of the 7.0 superior contact element behavior?&

There are a few other features added to contact that you may want to read about in the new feature section in every releases help manual&

Also, don t miss the new plot-able output from the contact elements that allows one check how many times an element changed status (a.k.a. chattering). Checking these in an unconverged solution (Load Step 99999) might greatly help in debugging.

Below is shown the test case I used   we looked at the same one in an earlier ANSYS Focus article comparing F and U convergence criteria. Download the macro if you re curious&

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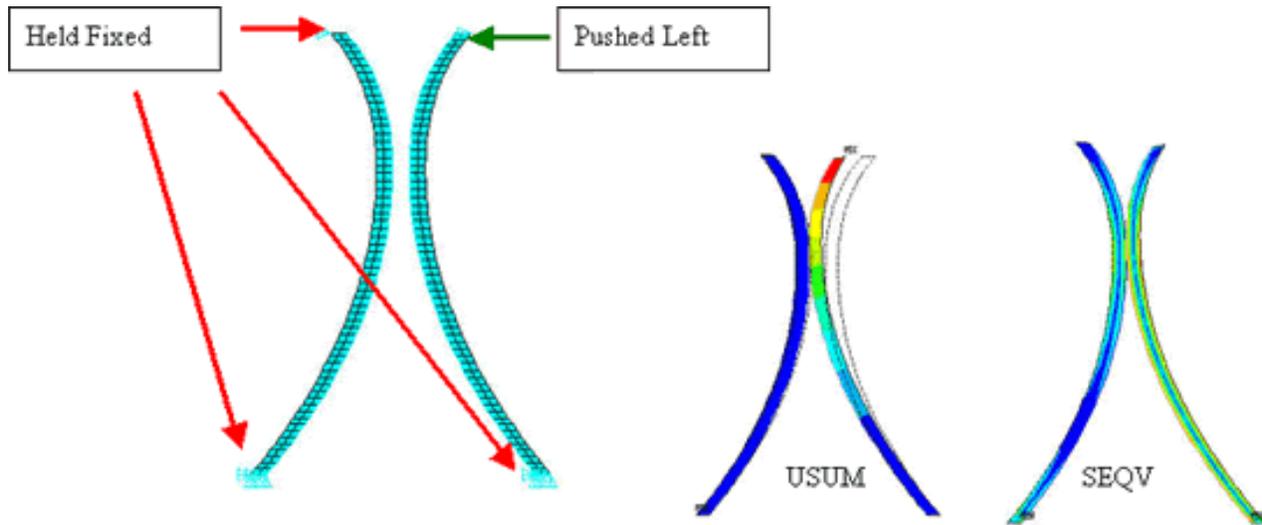
Learn more about contact analysis in the upcoming courses:

- [Basic Non-Linearities](#) (Jan. 27 - 29)
- [Advanced Non-Linearities](#) (Feb. 6 - 7)

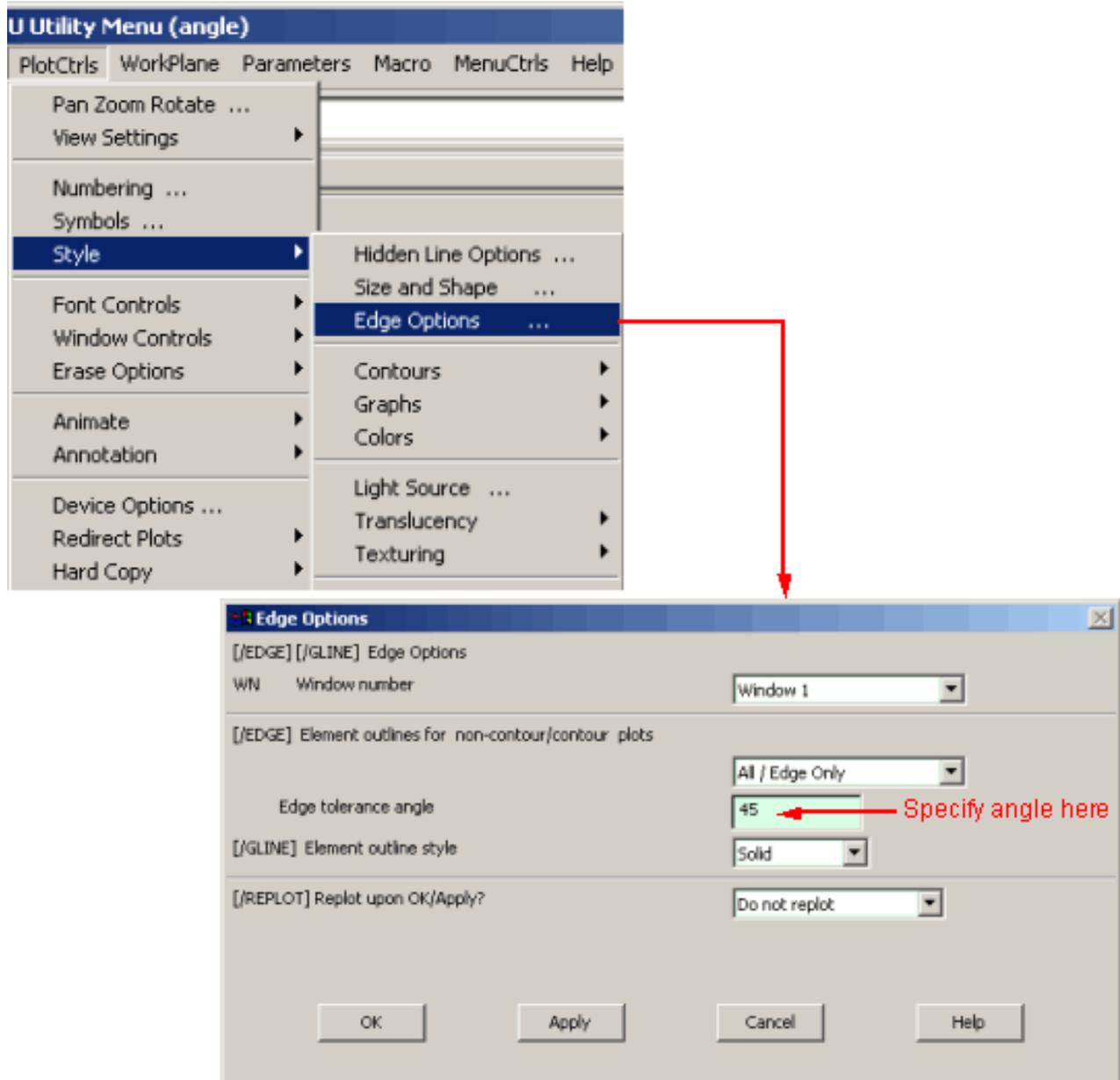A Publication for ANSYS Users

The Angle on Element Face Edges

by Jeff Elastic Strain, ANSYS Supporter and User

As evidenced by the calls logged in our ANSYS technical support database, some of you have
noticed that oftentimes, stress contour plots are discontinuous between certain element edges.
This only occurs in PowerGraphics and is determined by the *ANGLE* setting in the /EDGE
command. In PowerGraphics mode, ANSYS will calculate the subgrid solution by extrapolating
(for elastic strain anyway; the result is copied for plastic deformation) the result from the
corresponding element integration point to the node location. If the face angle between two
elements exceeds the value specified for *ANGLE* (default is 45 degrees), then the subgrid results
are not averaged at the node. If the face angle is less than or equal to this value, then the results
are averaged, as in full graphics mode. The command for specifying the face angle at which
subgrid stresses are averaged is /EDGE,,,ANGLE or Utility Menu > PlotCtrls > Style > Edge
Options. Note: This also controls edge display, but I'm mainly concerned with results
processing here.
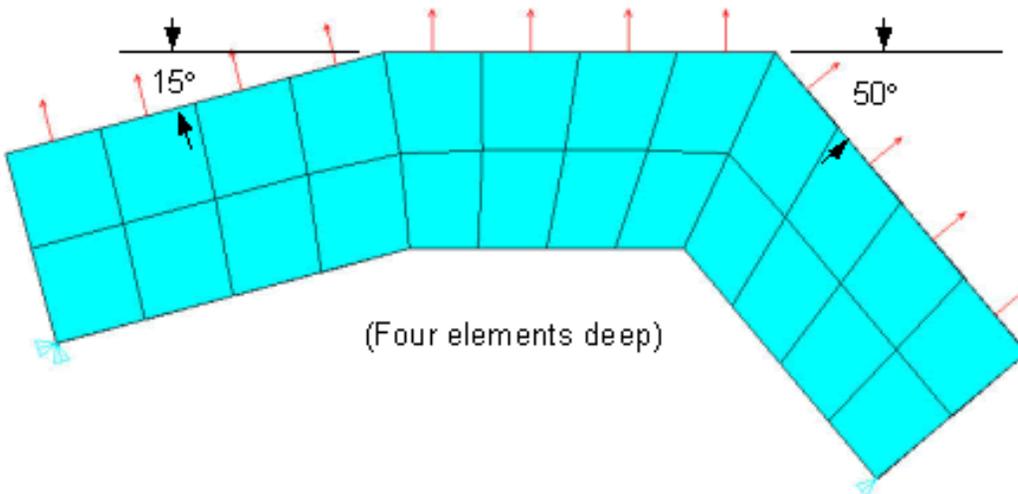
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As an example, consider the following model meshed with SOLID45s having a Young's modulus of 10×106 psi. The model is simply supported and subject to an outward pressure of 1000 psi.
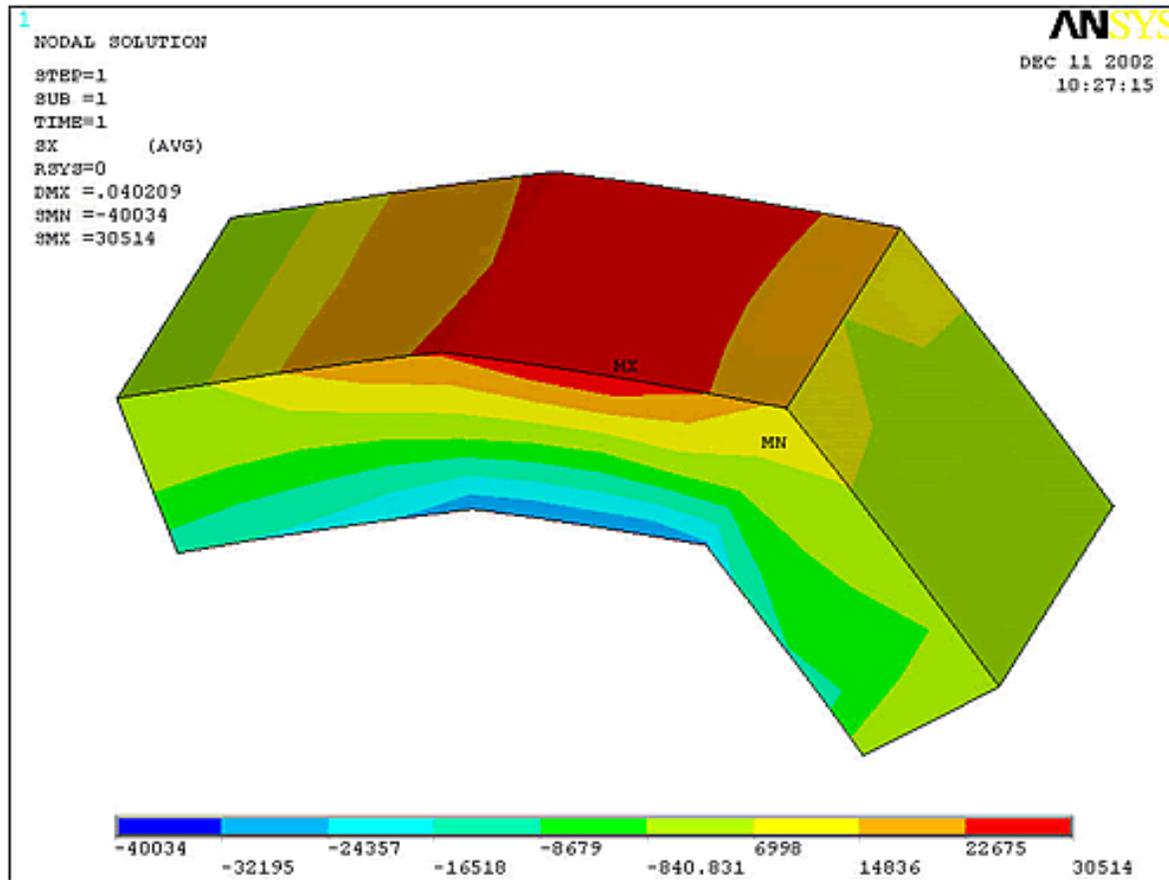
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As shown below, for an *ANGLE* setting of 45°, the x-direction stresses are averaged between the element faces having an edge angle of 15°, but remain unaveraged between the 50° faces, resulting in discontinous contour plot. Likewise, if you were to query subgrid results along this edge, ANSYS would prompt you to select the appropriate subgrid of the two (or three, at the corners) available quantities at each of these points.
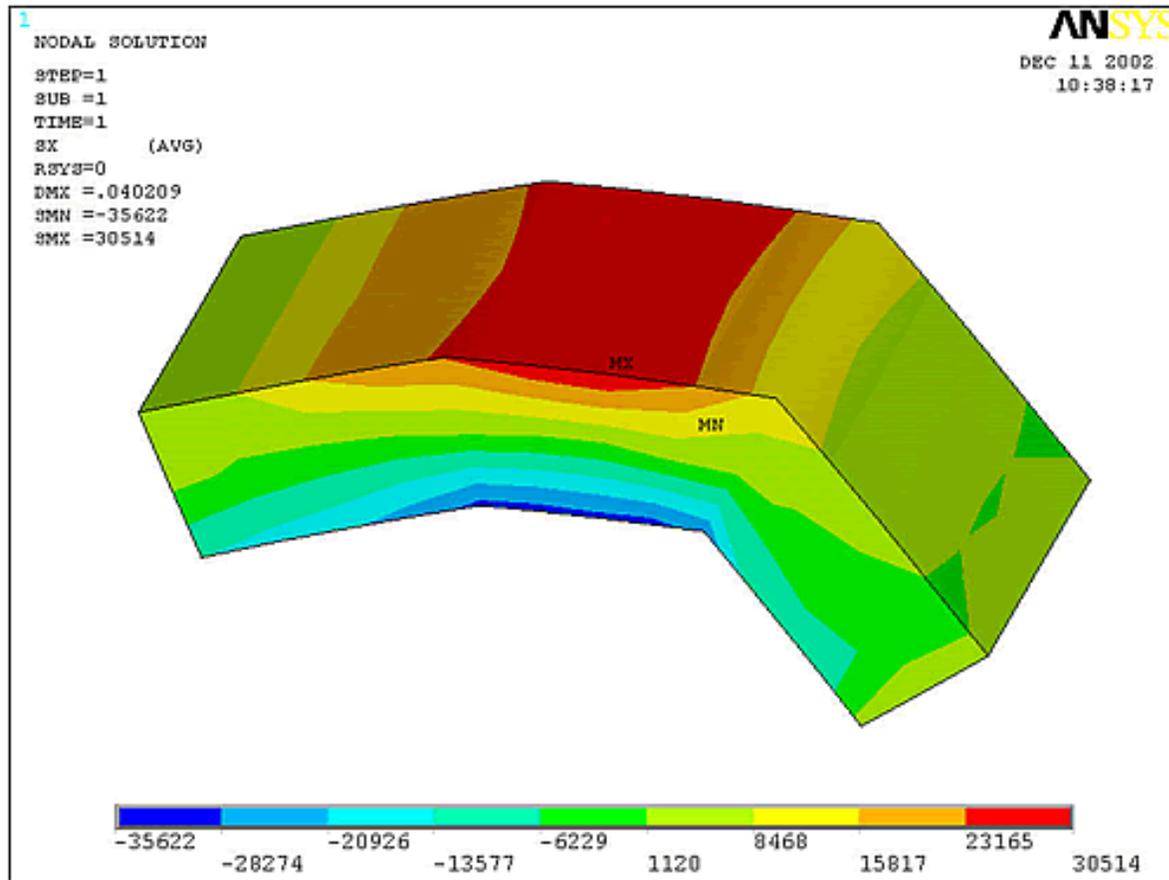
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However, if we change the *ANGLE* setting to 55° using the aforementioned /EDGE command, we end up with continuous stress contours for both the 15° and 55° edges.

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Another option to ensure all nodal stresses are averaged is to use full graphics (/GRAPHICS,FULL) which averages results regardless of the *ANGLE* setting.

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# Who Is PADT, Anyway?

by Eric Miller and Rod Scholl

One of the most difficult tasks that any of us face at PADT is trying to describe who PADT is. Our official corporate answer:

A dynamic customer-focused flexible enterprise focused on delivering scalable solutions to a diverse customer base through the use of synergistic computer centric processes.

&often leaves our listeners glassy-eyed, if not a little angry. In reality, we are a group of engineers and supporting people who help customers design, develop and manufacture products. We focus on keeping a diverse customer base so it is sometimes hard to be specific about what services we offer and how people use them. Also, some customers only interface with us for one particular services (such as ANSYS support) so they never learn about all the things we do. The purpose of this article is to briefly describe ourselves to *Focus* subscribers.

Intense debate about the storage of rotational momentum. Eric lost a finger in the melee.
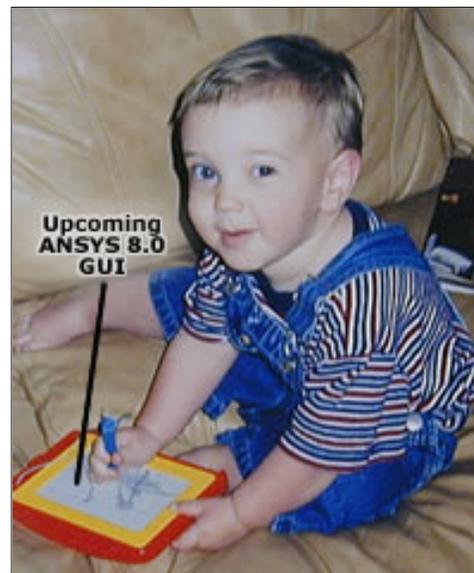
This is the only known photo of the savage genius who is forced to do all the work at PADT in exchange for food. He is never released from the holding tank.

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the work at PADT in exchange for food. He is never released from the holding tank.

Since we are engineers, we love to put things into categories, and for PADT we categorize our services into one of four areas: solutions, productivity services, systems R&D and engineering services. Since this is still pretty much marketing speak, we will give a few details for each area to make things clearer.

Solutions

Solutions is another way to say sales. PADT resells several CAE tools that we also use in house. Our focus is on the sale of products from ANSYS, Inc, and especially the ANSYS family of products. But is also includes other ANSYS, Inc. tools such as ICEM CFD, AI*Environment, AI*NASTRAN and AI*Workbench. In addition, we represent the SINDA heat transfer tool and the Dimension 3D printer from Stratasys.

High sales figures...

Slightly less than high sales figures.

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Okay...it s not actually him, but he charges way too much for his photo!

Alright, alright, I ll quit with the Sales Guy jokes.

Besides, he s got an engineering degree from a better college than I went to!

Productivity Services

This part of PADT focuses on making our customers more efficient and effective with their CAE tools. The largest chunk of that is ANSYS technical support for customers in Arizona and New Mexico. In addition, we hold regular ANSYS training classes and teach custom courses at larger customer sites. Several customers also call upon us to provide one-on-one advanced ANSYS support, referred to as mentoring, where we go on site and help to work out particular problems.

Training (staged photo)
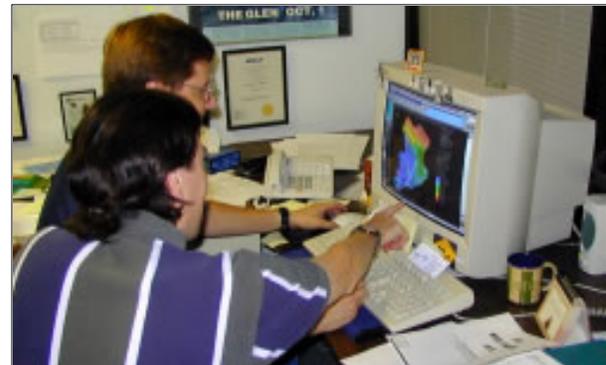
1-on-1 Help
(yeah, this was staged, too)

One area within productivity services that continues to see growth is software development. We are especially proud of the user interface work we have done for ICEM CFD, vertical applications for Honeywell and several small add on tools for ANSYS, Inc including automatic contact detection and the CIF translator.
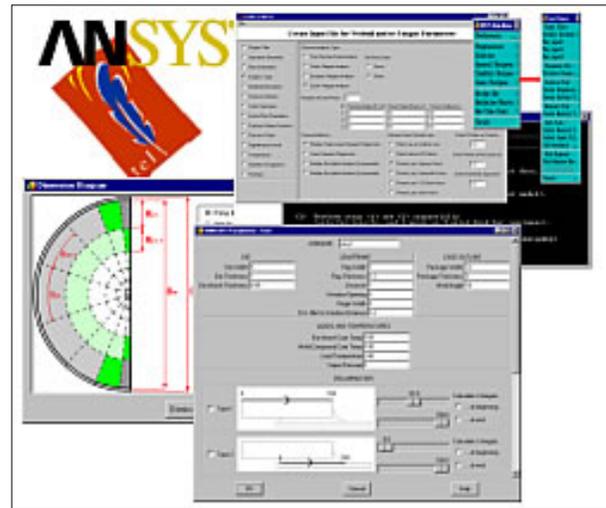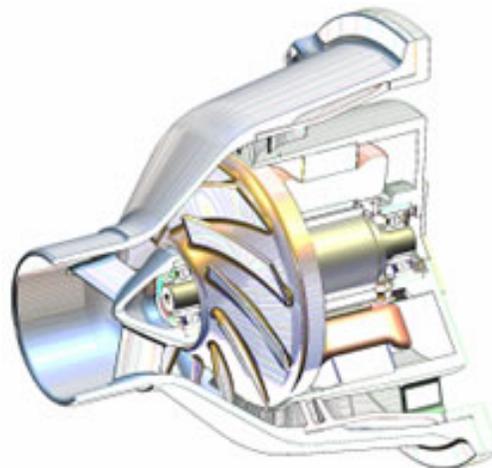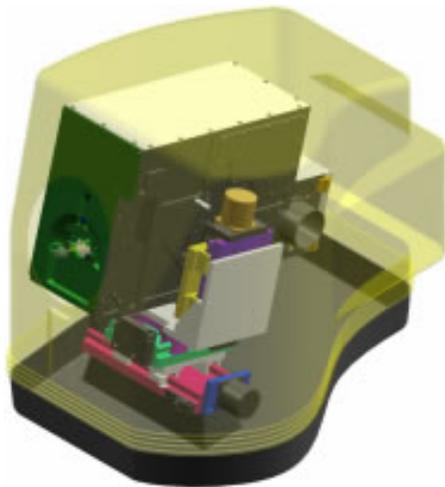
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Custom Tools

Systems R&D

Our product development capabilities have been grouped together under Systems R&D. This multidiscipline group of engineers focuses on working with customers to develop custom hardware to support a variety of industries. Much of the work centers on pumps and blowers for the fuel cell industry, but we have also done projects that involve medical devices, semiconductor manufacturing systems, and particle separators.

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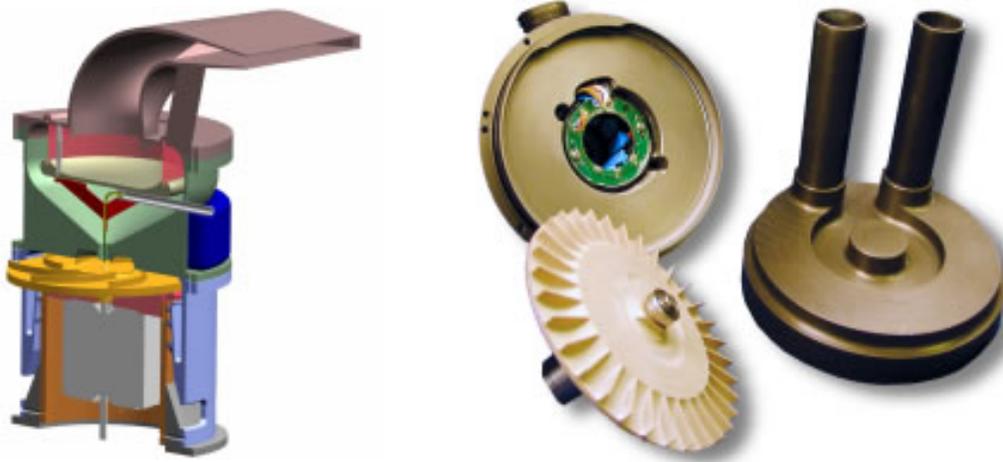
What we like best about Systems R&D is that it is the one place where we get to apply all of PADT s strengths on a complete project from concept through testing. Analysis driven design and design for manufacturing and assembly are applied heavily and result in industry leading turn around on some very complex projects.

Extra brains kept on site. We work 24 hours a day.

Our secret portal to Bill Gates lair.

Engineering Services

The foundation upon which PADT is built is Engineering Services. This is the core Design, Analysis and Rapid Manufacturing services that we have delivered to over 300 customers for the past 8 years. These jobs tend to be short and focused on one task, but they help people who lack certain capabilities to have an engineering team on call that they can bring in when they need it.
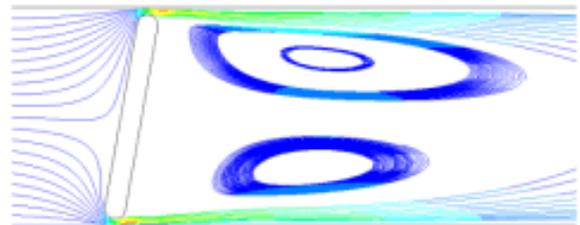
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For design, we use a variety of CAD packages including SolidEdge, SolidWorks, Inventor and Pro/Engineer. All of these have strong parametric and feature based modeling capabilities that we lean on heavily. The result is associative assemblies, solid models and drawings that customers can count on to be accurate and useful for down stream applications.

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APDL in ANSYS 9.1

(but, as with FireFox ,
you have to think it
in Russian)

If you can have a foundation for a foundation, Analysis would fit into that category. We love challenging simulation problems from stress and vib to high-strain rate deformation and fluid mechanics. Our analysts crave challenging geometry and unusual loads. But in the end, everyone focuses on how to use these simulation software to answer real world design questions. ANSYS and Fluent are our tools of choice for this.

An on-site analyst, often called The Mangler . You might reach him if you call for Technical Support.

He is also know as The Evil Dr. Strain .

Rapid Manufacturing

Rapid Manufacturing is probably the part of PADT that elicits the most ooh s and ah s . With on-site Stereolithography, Selective Laser Sintering, Fused Deposition Modeling, Vacuum Forming, Soft Tooling and Prototype Injection Molding, there are very few types of parts that have not worked their way through our shop. It is also a chance for PADT to be involved in the widest variety of projects with over 200 separate customers.

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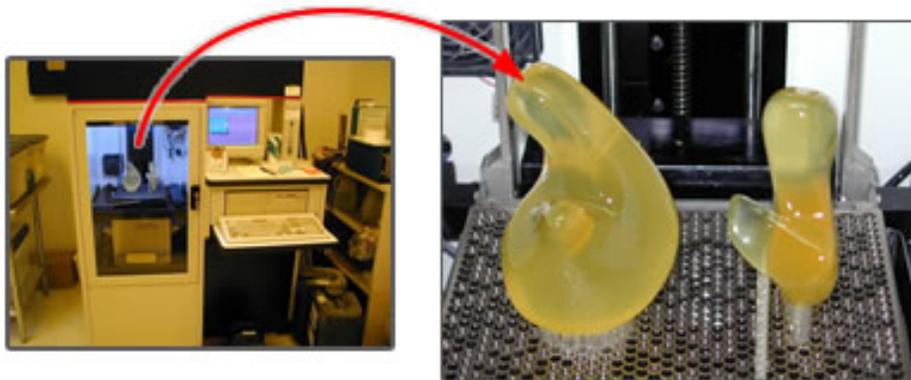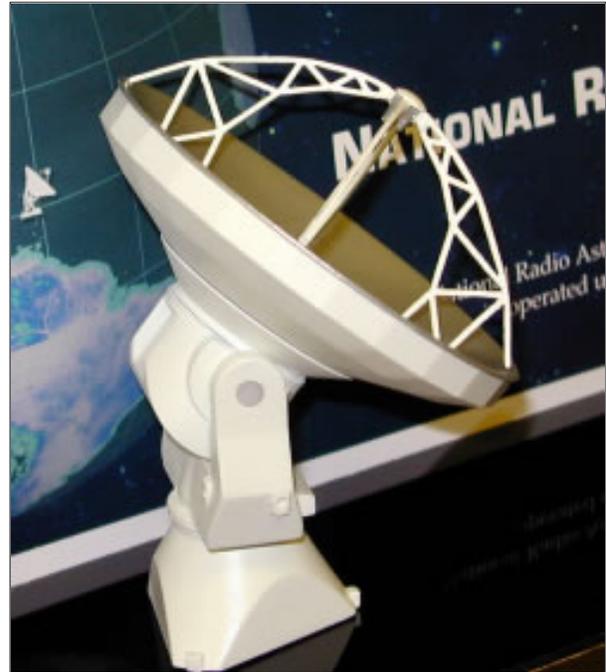
Growing new employees.

Synergy

Sum it all up, and it does add up to more than each individual part. When we started PADT in 1994, we wanted to create a different place to work where talented engineers could be involved in a variety of projects and use their skills and experience to their extremes. We have certainly achieved the variety part and since our customers keep coming back for more, we must be applying the skills and experience correctly as well.

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We take on a lot of different kinds
of projects.

If you are still confused about what we do, do not hesitate to poke around at
www.padtinc.com, shoot us an email at info@padtinc.com or, if you actually like to talk to
other human beings, give us a call at 1-800-293-PADT.

I Am the Monkey!
Worship Me!

P.S. I found this image on my boss s
computer. Presumably, there is some
explanation....

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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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