The Focus PADT
A Publication for ANSYS Users

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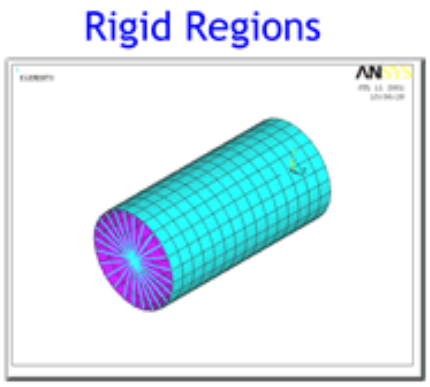

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Rigid Regions

Often in a model, a region is very stiff compared to another region, and may be an opportunity to use a Rigid region. Using rigid regions to simulate these areas can keep model size and solution times down. If you only want to distribute a load (but not form a rigid region), consider using RBE3 to form constraint equations, instead.

A rigid region can be modeled using several methods:

A. High Stiffness Plane/Solid Elements
B. High Stiffness Link Elements
C. Constraint Equations (CERIG)*
   *Note that RBE3 distributes a load but does not form a rigid region.

Method A. Uses 2-D elements to simply model a region and sets a very high stiffness for the material properties. This is acceptable, but can result in a high element count. Method A is the most expensive, and is not further discussed in this article.

Method B. The most common method applied, because it will work for all cases. It uses link elements with appropriately high stiffness. The wagon-wheel spokes are common as depicted below. Case Study 1 applies this methodology.

Method C. Uses constraint equations (CE s) to form a perfectly rigid region. To use CERIG, the automatic CE generator, the Mass21 key option must be set such that it expects *both* a mass and a rotational inertia even if the rotational inertia is zero. Case Study 2 applies this methodology.

Bonus:
When using RBE3, remember that a rigid region is not formed, but the applied load(s) are distributed. Because no rigidity is formed, no rotational moments of inertia are transferred to the slave nodes, and the key option for Mass21 must be set to ignore rotational inertia effects!

Case 1

Develop a rigid region using Link8 Elements.

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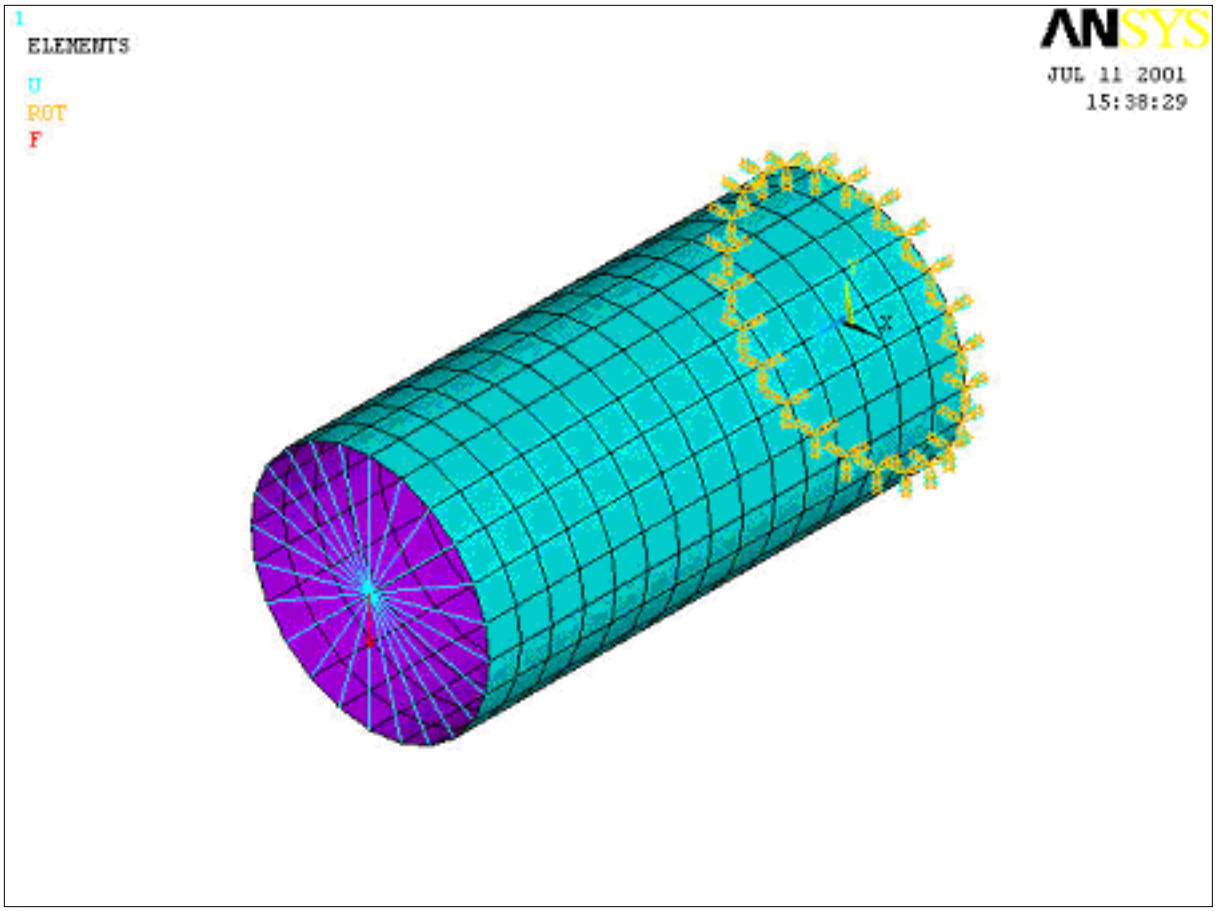
Geometry

Use either the input file or the equivalent menu picks to generate the geometry shown below. Save as tubecap.db.



Geometry

Boundary Conditions

Use either the input file or the equivalent menu picks to create the following boundary conditions.

- No constraint equations are used in this case.
- Fix the lines on the back end (Z=0) of the tube in all directions.
- Apply a downward (-Y) 2,000 lb. load on the node at the center of the spoke.

The total deflection plot (USUM), after solving, should look as follows:

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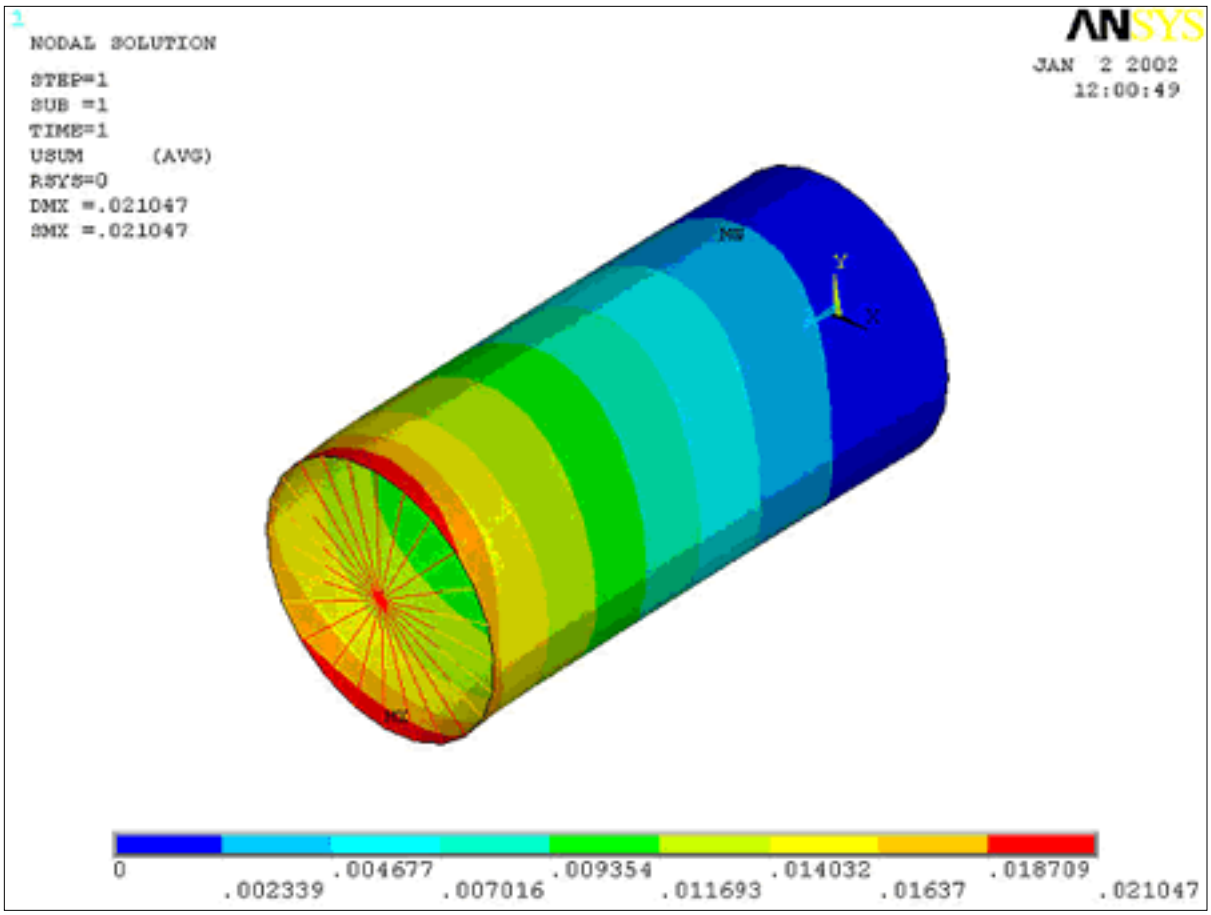

Case 2

Develop a rigid region using CERIG.

Geometry

Use either the input file or the equivalent menu picks to generate the geometry shown below. Save as linktube.db.

Note: The Key Option 3 of the Mass 21 element is set to 3-D w/ Rotational Inertia , even though we do not intend on specifying any mass or rotational inertia. Setting the Key Option 3 to 3-D w/out Rotational Inertia will generate erroneous constraint equations!

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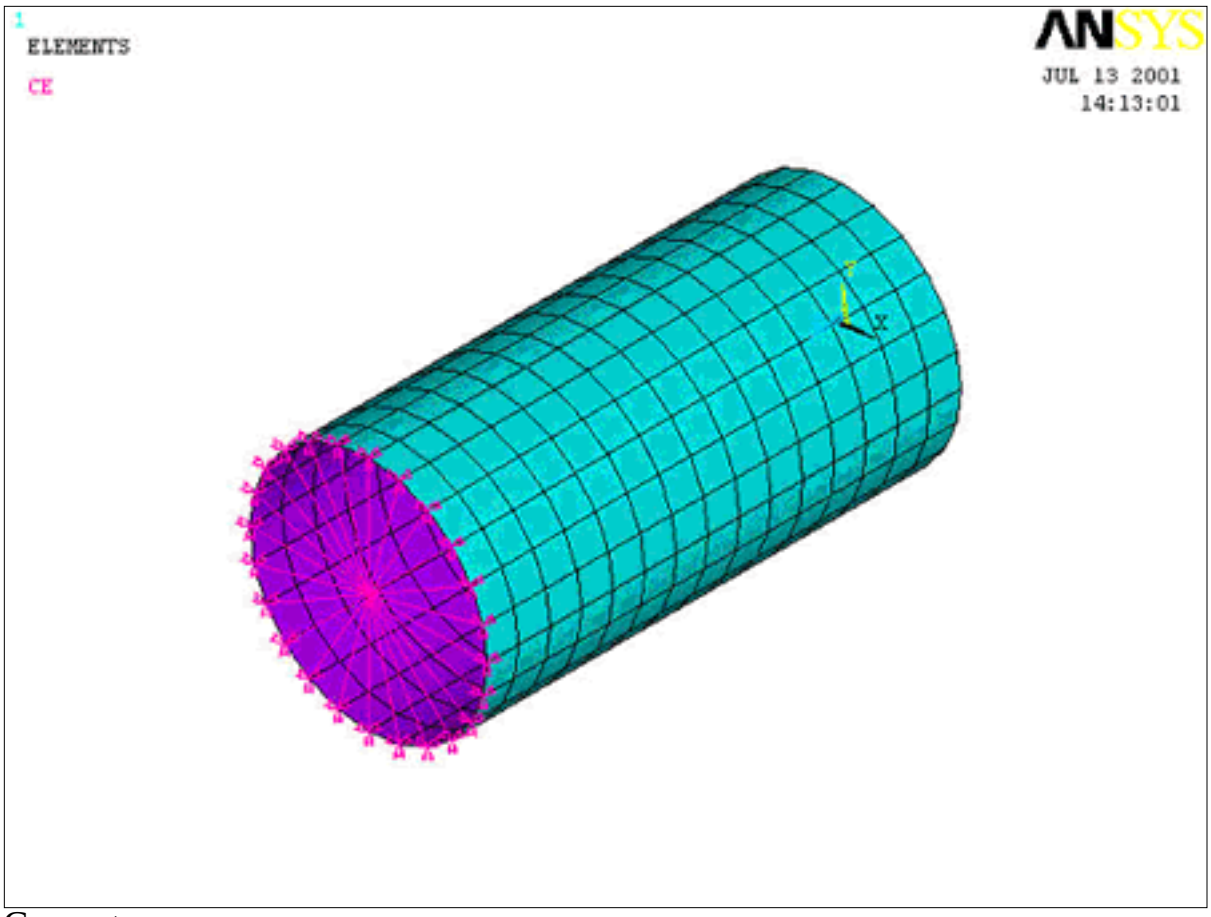

Geometry

Boundary Conditions

Use either the input file or the equivalent menu picks to create the following boundary conditions.

- Utilize the CERIG function to generate constraint equations representing the rigid region at Z=4.
- Fix the lines on the back end (Z=0) of the tube in all directions.
- Apply a downward (-Y) 2,000 lb. load on the node at the center of the spoke.

Save as cetube.db.

The total deflection plot (USUM), after solving, should look as follows:

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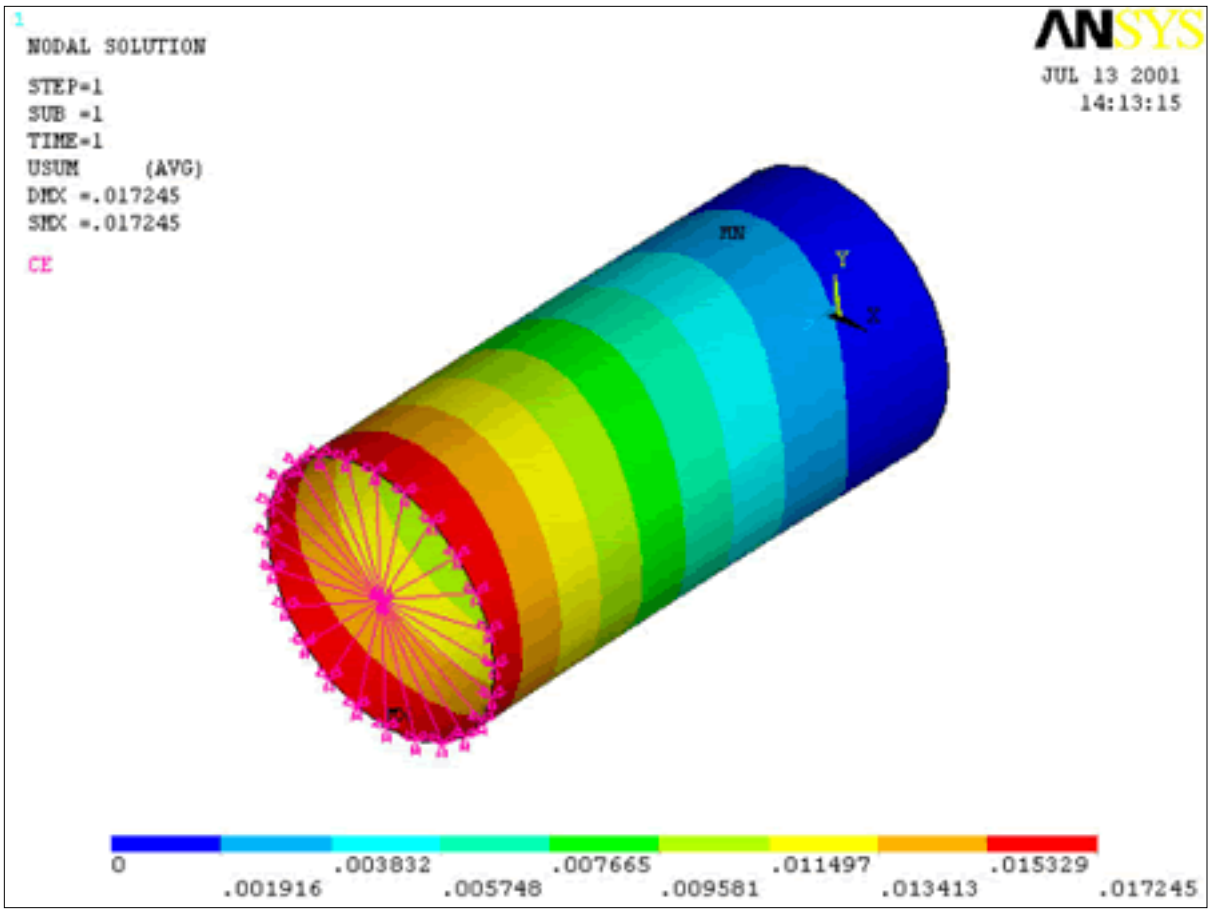

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ANSYS, Inc. and SAS LLC Enter into Strategic NASTRAN Partnership

Agreement Includes Joint Development of New NASTRAN Solution and Exclusive OEM Distribution

Canonsburg, PA - November 27, 2001 - ANSYS®, Inc. (NASDAQ: ANSS), the global innovator of simulation software and technologies designed to optimize product development processes, today announced a strategic OEM partnership with SAS LLC, a provider of NASTRAN simulation software and services. The global alliance is focused on the joint development of a new NASTRAN computer-aided engineering solution that will be distributed exclusively by ANSYS, Inc.

ANSYS, Inc. has been selected by SAS to be the sole distributor and support network for the new NASTRAN solution. The NASTRAN solution is also being developed in coordination with key aerospace and automotive companies, providing additional guidance about the core capabilities needed.

Development of the new NASTRAN product is being driven by Dr. Richard MacNeal, founder and former chairman of MacNeal-Schwendler Corporation, and Dr. Harry Schaeffer to advance current NASTRAN capabilities.

"This joint development effort will provide companies with the next generation of NASTRAN solutions. As we work together to broaden users options, we also will provide the most innovative NASTRAN product implementation ever produced," commented Dr. Harry Schaeffer, president of SAS LLC and Dr. Richard MacNeal. "ANSYS, Inc. was the perfect partner for our initiatives. They have a proven dedication to providing the highest-quality solutions through highly-skilled and reliable global sales and distribution networks."

"By being data compatible, this new offering directly addresses the inertia against change within the NASTRAN user community, " stated Don Brown, chairman of

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D H Brown & Associates. "Combining this with the unique open architecture of the AI*Workbench platform will dramatically broaden the opportunities for users and ANSYS, Inc. as a supplier."

The solution will integrate the technologies of ANSYS, Inc., CADOE S.A., ICEM CFD Engineering and SAS LLC to provide users with the most comprehensive NASTRAN product. Building off of ANSYS, Inc. architecture, NASTRAN will also be fully compatible with existing customer data and processes, and will provide a unique open architecture design and economic solutions for complex product and manufacturing processes.

The NASTRAN solution is expected to ship in early 2002. ANSYS, Inc. is providing an Early Adopter Program that is now available for organizations that want to ensure long-term affordability for their NASTRAN usage. For more information, please email earlyadopter@ansys.com.

"We are fortunate to have the technology and expertise of the pioneers of NASTRAN technology to make this offering the richest solution available," stated Michael J. Wheeler, vice president of marketing for ANSYS, Inc. "The inclusion of this technology further advances ANSYS, Inc.'s support of the overall product development process. This new solution will allow companies upgrade their simulation tools and processes with minimal impact on the existing infrastructure."

About SAS LLC

Implemented by the pioneers of NASTRAN technology, SAS LLC provides worldwide software and services that improve engineers' ability to perform automated simulation of product and process performance.

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About ANSYS, Inc.

ANSYS, Inc., founded in 1970 as Swanson Analysis Systems, Inc., develops and globally markets engineering simulation software and technologies widely used by engineers and designers across a broad spectrum of industries, including aerospace, automotive, manufacturing, electronics and biomedical. Headquartered at Southpointe in Canonsburg, PA, ANSYS, Inc. employs 400 people and focuses on the development of open and flexible solutions that enable users to analyze designs directly on the desktop, providing a common platform for fast, efficient and cost-conscious product development, from design concept to final-stage testing and validation. ANSYS, Inc. distributes its ANSYS®, DesignSpace®, AI* Solutions" and ICEM-CFD Engineering products through a network of channel partners in 37 countries, in addition to its own direct sales offices in 18 strategic locations throughout the world. For additional information on ANSYS, Inc., please visit http://www.ansys.com.

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Get a New Computer by Benchmarking

Justifying hardware expenditure is always difficult. Benchmark your current machine and compare it to others. Using this data, provide your manager or I.T. department with true-life performance comparison. Also, when hardware upgrades are available, steer the decision towards hardware you know will perform ANSYS tasks most efficiently. Perhaps you can use this to justify your new hardware purchase.

Check out the PADT benchmarks to review performance on different hardware and platforms. This site allows users to enter data from their hardware, and also compare to data that others have entered. Three types of tests currently exist:

1. Hard Drive
2. CPU
3. Graphics Card

Be sure to also check out benchmarking at ANSYS.

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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.

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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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