

AN

DOCKETED
USNRC

2003 JAN 21 PM 3:48

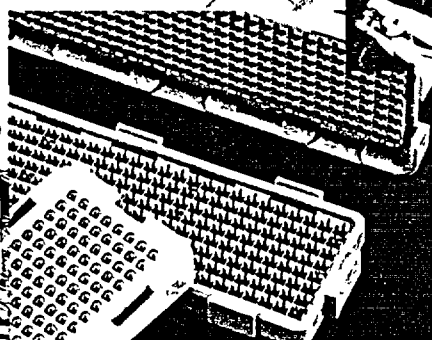
OFFICE OF THE SECRETARY
RULEMAKINGS AND
ADJUDICATIONS STAFF

Advanced Contact and Bolt Pretension

Training Manual

for Release 5.6

001361 (Volume 1)
May 30, 2000



ANSYS, Inc.
is a UL registered
ISO 9001 : 1994
Company

quality
power
flexibility
speed
productivity



Advanced Contact and Bolt Pretension

For ANSYS 5.6

Contact and Bolt Pretension - Training Manual

Inventory Number: 001361

Version: 1

ANSYS Release: 5.6

Published Date: May 30, 2000

Registered Trademarks:

ANSYS® is a registered trademark of SAS IP Inc.

All other product names mentioned in this manual are trademarks or registered trademarks of their respective manufacturers.

Disclaimer Notice:

This document has been reviewed and approved in accordance with the ANSYS, Inc. Documentation Review and Approval Procedures.

"This ANSYS Inc. software product (the Program) and program documentation (Documentation) are furnished by ANSYS, Inc. under an ANSYS Software License Agreement that contains provisions concerning non-disclosure, copying, length and nature of use, warranties, disclaimers and remedies, and other provisions. The Program and Documentation may be used or copied only in accordance with the terms of that License Agreement."

Copyright © 2000 SAS IP, Inc.

Proprietary data. Unauthorized use, distribution, or duplication is prohibited.

All Rights Reserved.



Advanced Contact and Bolt Pretension - Training Manual

Table of Contents

1. Introduction	1-1	7. Node-to-Node Elements	7-1
2. Contact Overview	2-1	8. Node-to-Surface Elements	8-1
A. Typical Applications	2-2	9. Bolt Pretension Elements	9-1
B. Contact Classifications	2-7	A. PRETS179 Element	9-4
3. Contact Stiffness	3-1	B. Typical Procedure	9-7
A. Basic Concepts	3-2	C. Workshop	9-15
B. Determining a Value	3-5		
4. Friction	4-1		
5. Contact and Auto Timestepping	5-1		
6. Surface-to-Surface Elements	6-1		
A. Overview	6-4		
B. Advanced Options for Special Problems	6-7		
C. Rigid Surface Considerations	6-54		
D. Creating without the Contact Wizard	6-63		
E. Troubleshooting	6-83		

Advanced Contact & Pretension B.6

1. Introduction

Introduction

Welcome!

- Welcome to the *Advanced Contact and Bolt Pretension* Training Course!
- This course covers those contact models that cannot be readily solved using the Contact Wizard, default contact settings, and automatic solution control settings. It also covers a related topic, bolt pretension analysis.
- This course is intended for ANSYS users who are already familiar with the concepts and procedures for iterative nonlinear analysis, and who have learned how to do “simple” contact analysis (topics covered in *Basic Structural Nonlinearities*).

-
- This is the second in a series of three training course on ANSYS nonlinearities:
 - *Basic Structural Nonlinearities* (2 days)
 - *Advanced Contact and Bolt Pretension* (1 day)
 - *Advanced Structural Nonlinearities* (2 days; scheduled for completion in September 2000)

To teach advanced nonlinear contact analysis procedures,
including the following topics:

- Contact classifications
- Contact stiffness
- Friction
- Surface-to-surface, node-to-node, and node-to-surface elements
- Bolt pretension



Introduction

Course Material

- The *Training Manual* you have is an exact copy of the slides.
- Workshop descriptions and instructions are included in the *Workshop Supplement*.
- Copies of the workshop files are available in ftp://ftp.ansys.com/pub/archive/training/adv_cont56

• CLEAR REGULATORY COMMISSION

Docket No. _____ Official Ex. No. 220
In the matter of _____
Staff _____ IDENTIFIED X
Applicant X _____ RECEIVED _____
Intervenor _____ REJECTED _____
Other _____ WITHDRAWN _____
DATE 6-3-02 Witness _____
Clerk _____