Boeing Computer Services
P.O. Box 24346
Seattle, WA 98124-0346

March 22, 1994
G-1151-RSO-94-080

Document Control Desk
United States Nuclear Regulatory Commission
Washington, D.C. 20555

BOEING

Reference: a) Boeing Letter G-1551-RSO-365 dated August 31, 1992; R. S. Orr to the NRC Operations Center

b) NRC Letter Docket No. 99901227 dated August 12, 1992; L. J. Norrholm to R. S. Orr; Subject: Response to 10 CFR 21 Inquiry

Dear Sir or Madam:

In accordance with the reference correspondence and 10 CFR 21, Boeing is sending the NRC the attached error notice(s) received from our former software suppliers. Because of unknown current addresses, the following former customers were not notified:

Reactor Controls, Inc.

Echo Energy Consultants, Inc.

Nuclear Applications and Systems Analysis Company (Japan)

Nuclear Power Services

Error notices have been sent to our other former customers.

Very truly yours,

S. Charles, for

R. S. Orr
Nuclear Administrator
G-1151 M/S 7A-33
(206) 865-6248

Attachment(s): ANSYS Class3 Error Reports 94-03, 94-04, 94-05, 94-06, and 94-07. Revised Class3 Error Report 93-110 R1 and ANSYS QA Notice QA94-01

IE19
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Swanson Analysis Systems, Inc.

Johnson Road, P.O. Box 65, Houston, PA 15342-0065

PHONE (412) 746-3304
FAX (412) 746-9494

March 1, 1994

Dear Class3 Error Recipient:

Enclosed you will find ANSYS Class3 Error Reports 94-03, 94-04, 94-05, 94-06 and 94-07. Also enclosed is revised Class3 Error Report 93-110 R1 and ANSYS QA Notice QA94-01.

Class3 Error Report 93-110 was revised to indicate a change in the corrected version of the ANSYS Component Products.

QA Notice QA94-01 has been issued to explain a behavior of the new method of solving thermal transient analyses. In particular, the inappropriate use of stepped boundary condition changes can have unexpected inaccurate solutions.

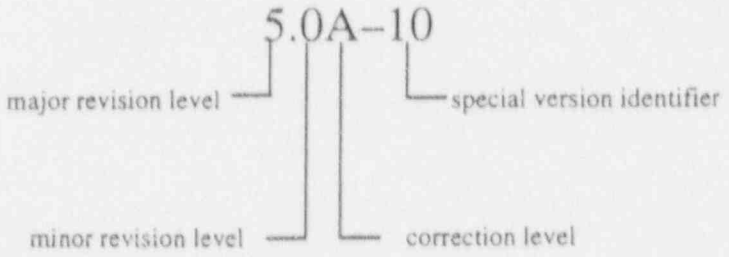
Sincerely,

SWANSON ANALYSIS SYSTEMS, INC.

Mark C. Imgrund, Manager
Quality Assurance Department

ANSYS Revision Identifier Description

ANSYS revision identifiers consist of a major revision level, a minor revision level, a correction level, and occasionally a special version level. An example of how this is constructed is shown below:



Major revision level changes indicate that new features have been added to the program and that some level of program architecture change and/or file structure has occurred. Minor revision level changes also indicate that new features have been added to the program, but files are upwardly compatible. All known error fixes are included in both minor and major revisions. Changes to the correction level indicate that it is primarily an error correction release. Special version identifiers indicate that one or more additional minor changes have been made to the program, normally to circumvent an error. Special versions are not general releases to all ANSYS licensees, since they typically represent errors occurring only on one system, a subset of our customers who have specific graphics devices, etc.

The ANSYS revision identifier(s) shown under "corrected in" on the front side of this Class3 Error Report indicates the first possible revision that could contain the correction. A major program change needed to fix an error can dictate that the next minor or major revision will contain the fix rather than the next correction level. For example, when errors were being reported while Rev. 4.3A was the latest production version, most Class3 error reports indicated that 4.3B was the "corrected in" revision. Others requiring significant code restructuring were reported as fixed in 4.4. Rev. 4.3B was never released, but Rev. 4.4 contained all error corrections noted as fixed in 4.3B.

An identifier indicated under "corrected in" does not guarantee that a general release of that revision of ANSYS will occur. It does indicate that the correction is known and implemented in the coding that would be part of that general release.

Equivalent Product Identifiers

The ANSYS family of component products occasionally undergoes name changes between revisions and/or changes in the functionality of derived products (such as ANSYS-PC/LINEAR). To minimize the potential for confusion in these areas, the important product name equivalences (similar program functionality and error content) are listed below.

ANSYS/ED	contains all errors shown for	the full ANSYS product, starting at Rev. 5.0, and beyond, unless otherwise noted.
PC/LINEAR	is equivalent to	WS/LINEAR at Rev. 4.4A, and ANSYS/LINEAR starting at Rev. 5.0 and ANSYS/LinearPlus starting at Rev. 5.0A.
PC/THERMAL	is equivalent to	WS/THERMAL at Rev. 4.4A, and ANSYS/THERMAL starting at Rev. 5.0.
PREPPOST	contains relevant errors shown for	the full ANSYS product, for included pre- and postprocessing functionality
PC/MAGNETIC	is equivalent to	ANSYS/Emag starting at Rev. 5.0A

ANSYS® CLASS3 ERROR REPORT

ERROR NO: 94-03

KEYWORDS: *ELEM51* *ELEM61* *SHELL51* *SHELL61*

DESCRIPTION OF ERROR:

When a thin axisymmetric shell element (SHELL51 or SHELL61) is aligned so that the element is exactly parallel to the X-axis (radial axis) and node I has a greater X coordinate value than node J, all results are incorrect.

FIRST INCORRECT VERSION(S):*	CORRECTED IN:*
Rev. 2.0	Rev. 5.1
PC/LINEAR Rev. 4.3	ANSYS/LinearPlus Rev. 5.1

SUGGESTED USER ACTION FOR RUNNING ON UNCORRECTED VERSION:

Either switch the order of nodes or give the element a slight angle with the X-axis.

COMMENTS:

SHELL51 and SHELL61 were referred to as STIF51 and STIF61 prior to Rev. 5.0.

AUTHOR/CORRECTOR: Peter C. Kohnke DATE: February 28, 1994

REVIEWED BY QA: Mark C. Imgrund DATE: February 28, 1994

APPROVAL: John A. Swanson DATE: February 28, 1994

*If a product name is not included in the "first incorrect version", the full ANSYS program is implied. For products not listed, this error does not apply, but see the reverse side for equivalent product designations.

Unless noted otherwise, this error report also applies to all revisions after the first incorrect one and prior to the corrected revision. All revisions after "corrected in" are corrected. Manual corrections are included in on-line documentation as appropriate. Please see the reverse side of this sheet for additional information on ANSYS revision identifiers.

FORM SASI-QA25
DEC 19, 1988

ANSYS® CLASS3 ERROR REPORT

ERROR NO: 94-04

KEYWORDS: *PICK* *ASEL* *KSEL* *LSEL* *VSEL* *NSEL* *ESEL*

DESCRIPTION OF ERROR:

If:

1. ANSYS entities (nodes, elements, keypoints, lines, areas, or volumes) are selected using picking;

and 2. the "QUIT" button is executed before any picking is done;

and 3. there are gaps in the entity numbering;

then entities with entity numbers greater than the total number of defined entities will not be selected. Any subsequent operation that works only on selected items will give results different than expected.

FIRST INCORRECT VERSION(S):*

Rev. 5.0
PC Products Rev. 5.0

CORRECTED IN:*

Rev. 5.1
ANSYS Component Products Rev. 5.1

SUGGESTED USER ACTION FOR RUNNING ON UNCORRECTED VERSION:

After using the "QUIT" button during picking, select all entities.

COMMENTS:

A log file that contains this error, if used as input, could produce different results than the interactive run.

AUTHOR/CORRECTOR: Anton V. Mobley DATE: February 28, 1994

REVIEWED BY QA: Mark C. Ingruna DATE: February 28, 1994

APPROVAL: John A. Swanson DATE: February 28, 1994

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FORM SASI-QA25
DEC 19, 1988

ANSYS® CLASS3 ERROR REPORT

ERROR NO: 94-05

KEYWORDS: *DAMPED EIGENVALUE* *MODAL ANALYSIS*

DESCRIPTION OF ERROR:

The following errors apply to modal analysis (ANTYPE,MODAL) using the damped eigensolver (MODOPT,DAMP):

1. The modal damping command DMPRAT does not apply to the damped eigensolver, as erroneously listed in Table 3.5-2 of the Rev. 5.0 Procedures Manual (Upd0, printings 1 and 2), and in the 5.0 Theory Manual (Upd0, printing 2 only), Section 15.3.

2. The structural damping command ALPHAD fails to produce a damping matrix when the damped eigensolver is used.

FIRST INCORRECT VERSION(S):*

Rev. 5.0

CORRECTED IN:*

for (1) Rev. 5.0 Procedures and Theory Manuals Upd0, Printing 3
for (2) Rev. 5.1

SUGGESTED USER ACTION FOR RUNNING ON UNCORRECTED VERSION:

For (2) use discrete damping elements (COMBIN14).

COMMENTS:

Upd0, printing 1 of the Theory Manual is correct.

AUTHOR/CORRECTOR: C. Rajakumar DATE: March 1, 1994
Charles Rajakumar

REVIEWED BY QA: M. Ingrund DATE: March 1, 1994
Mark C. Ingrund

APPROVAL: J. A. Swanson DATE: March 1, 1994
John A. Swanson

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FORM SASI-QA25
DEC 19, 1988

ANSYS® CLASS3 ERROR REPORT

ERROR NO: 94-06

KEYWORDS: *POST1* *DESOL* *SHELL,43,91,93*

DESCRIPTION OF ERROR:

In POST1, the DESOL,,,NL command can incorrectly assign nonlinear data for shell elements SHELL43, SHELL91 and SHELL93. Data being assigned to the element may be lost, or could be incorrectly assigned to other nodes or the wrong component of the element.

FIRST INCORRECT VERSION(S):*	CORRECTED IN:*
Rev. 5.0	Rev. 5.1

SUGGESTED USER ACTION FOR RUNNING ON UNCORRECTED VERSION:

COMMENTS:

The DESOL command will work correctly if the shell specification is top (SHELL,TOP) and no previous nonlinear data has been stored.

AUTHOR/CORRECTOR: H. J. Mrgz DATE: February 28, 1994

REVIEWED BY QA: Mark C. Imgrund DATE: February 28, 1994

APPROVAL: John A. Swanson DATE: February 28, 1994

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FORM SASI-QA25
DEC 19, 1988

ANSYS® CLASS3 ERROR REPORT

ERROR NO: 94-07

KEYWORDS: *MANUAL* *MASS71* *ELEMENTS*

DESCRIPTION OF ERROR:

The equation for the MASS71 heat generation rate in Section 4.71.1 of the Elements manual (ANSYS 5.0 User's Manual, Volume III, Elements; Upd0, printings 1 and 2) is incorrect. The correct equation is

$$\dot{q}(T) = A_1 + A_2T + A_3T^{A_4} + A_5T^{A_6}.$$

FIRST INCORRECT VERSION(S):*

Rev. 5.0

CORRECTED IN:*

Rev. 5.0 ANSYS User's Manual, Volume III, Elements; Upd0, 3rd printing

SUGGESTED USER ACTION FOR RUNNING ON UNCORRECTED VERSION:

COMMENTS:

AUTHOR/CORRECTOR: Daniel D. Ketelaar DATE: February 28, 1994

REVIEWED BY QA: Mark C. Imgrund DATE: February 28, 1994

APPROVAL: John A. Swanson DATE: February 28, 1994

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FORM SASI-QA25
DEC 19, 1988

ANSYS® CLASS3 ERROR REPORT

ERROR NO: 93-110 R1

KEYWORDS: *SHELL63* *ELEM63* *WARPED ELEMENT* *THERMAL LOAD*

DESCRIPTION OF ERROR:

Stresses are inaccurate for a SHELL63 model (the elastic quadrilateral shell) if:

1. thermal loads are present (ALPX on the MP command greater than 0 and any element temperature not equal to TREF);

and 2. any of the elements in the model have their four nodes not lying in a plane (the element is warped). The warping factors for which this inaccuracy occurs are as follows:

- Rev. 3.0 - Rev. 4.1C: If any nodal normal is less than .00001 times the average element normal (see the Theory Manual for more details on this computation).
- Rev. 4.2 - Rev. 4.4: For all warped elements.
- Rev. 5.0 - Rev. 5.0A: If the amount one node is out-of-plane (with respect to the others) is less than .01 times the average thickness (see the Theory Manual for more details on this computation).

For Rev. 3.0 - Rev. 4.1C and Rev. 5.0 - Rev. 5.0A, if any of the element warping factors are greater than the above reference values, the results are correct.

FIRST INCORRECT VERSION(S):*	CORRECTED IN:*
Rev. 3.0	Rev. 5.1
PC Products Rev. 4.2	ANSYS Component Products Rev. 5.1

SUGGESTED USER ACTION FOR RUNNING ON UNCORRECTED VERSION:

Use triangular elements.

COMMENTS:

For a stress-free thermal expansion in Rev. 3.0 - Rev. 4.1C and Rev. 5.0 - Rev. 5.0A, the erroneous stresses obtained (which should be zero) are equal to about 5% of the "thermal stress", EX*ALPX*(T - TREF). In Rev. 4.2 - Rev. 4.4A, the erroneous stresses obtained are about 25% of the "thermal stress". For a constrained model (not stress-free), the erroneous contribution to the stress from the thermal terms will be of similar magnitude.

AUTHOR/CORRECTOR: David L. Conover DATE: February 28, 1994

REVIEWED BY QA: Mark C. Imgrund DATE: February 28, 1994

APPROVAL: John A. Swanson DATE: February 28, 1994

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ANSYS QA NOTICE

NOTICE NO: QA94-01

SUBJECT: *THERMAL* *TRANSIENT*

DESCRIPTION:

In a transient thermal analysis with the time integration parameter (THETA) less than unity (TINTP Command, default = 0.5), a time step (substep) always treats a change in load as a ramp change. This is true for any load changes, including changed temperature boundary conditions, heat generation rate change, and convection load changes due to changes in the heat transfer coefficient, ambient temperature, or surface temperature. The effect is independent of the setting of KBC and can result in solution inaccuracies for large time steps under certain circumstances.

The numerical treatment of a thermal transient uses the time derivative of temperature from the previous time step in calculating the temperature increment for the current time step. The influence of the time derivative from the previous step will vary according to the value of THETA. For THETA=1, there is no influence from the previous step; for THETA=0.5 [default], the previous rate is weighted equally to the current rate.

The previous time derivative causes an inaccuracy that is proportional to the change in the derivative during the current step and to the size of the time step. The inaccuracy can be minimized by reducing the time step or, alternatively, by raising the time integration parameter to unity. This is particularly critical in the first time step following any large step change in loading conditions.

As an example, suppose a rectangular body of unit depth with unit values for density, conductivity, and heat capacity is heated from 0 to 1 degree over 1 second, then perfectly insulated for 1 second. The expected temperature at time = 2 seconds is 1 degree. The following input streams illustrate the possible outcomes:

```
/PREP7
ET,1,PLANE55
MP,KXX,1,1
MP,DENS,1,1
MP,C,1,1
N,1
N,2,1
N,3,1,1
N,4,,1
E,1,2,3,4
FINISH
/SOLU
ANTYPE,TRANS
KBC,1
TIME,1
D,ALL,TEMP,1
SOLVE
```

ANSYS QA NOTICE

NOTICE NO: QA94-01

Alternative solution methods for second load step:

```
DDELE,ALL,TEMP
TIME,2
SOLVE
FINISH
```

```
DDELE,ALL,TEMP
TIME,1.000001
SOLVE
TIME,2
SOLVE
FINISH
```

```
DDELE,ALL,TEMP
TINTP,,,,1
TIME,2
SOLVE
FINISH
```

ANSYS results corresponding to the above inputs:

TEMP = 2.000000 (incorrect)

TEMP = 1.000001

TEMP = 1.000000

AFFECTED VERSIONS: Rev. 5.0, Rev. 5.0A. The documentation will be clarified in the next printing of the User's Manual.

AUTHOR: Geoff Eggert DATE: February 28, 1994

REVIEWED BY QA: Mark C. Imgrund DATE: February 28, 1994

APPROVAL: John A. Swanson DATE: February 28, 1994

SASI-QA3
AUG. 29, 1993