PRESSURE EQUIPMENT ENGINEERING SERVICES, INC.
402 WILD PEACH PLACE
MISSOURI CITY, TX - 77459
TEL. : (281)-261-4628
FAX : (281)-261-4629
E-Mail: Bharat@peesi.com

FINITE ELEMENTS ANALYSIS OF PRESSURIZED DONUT CHAMBER

PROBLEM DESCRIPTION:

A rectangular stainless steel pressurized donut chamber was to be designed for a special application. The bottom edges of the donut chamber had rubber seals. The sealing against the pressure at the bottom edges of the chamber was obtained by the clamping the chamber at four (4) places using the bolts. The design to obtain this pressure seal was performed separately by the client. The remaining three sides of the rectangular donut chamber were to be designed for pressure loading using the finite element analysis technique.

The 3-D FEA of the Pressurized donut chamber was to be performed with the following objectives:
(1) To ensure compliance with ASME B&PV Code Section VIII, Div.-1.
(2) To ensure that the top plate of the chamber does not deform excessively.

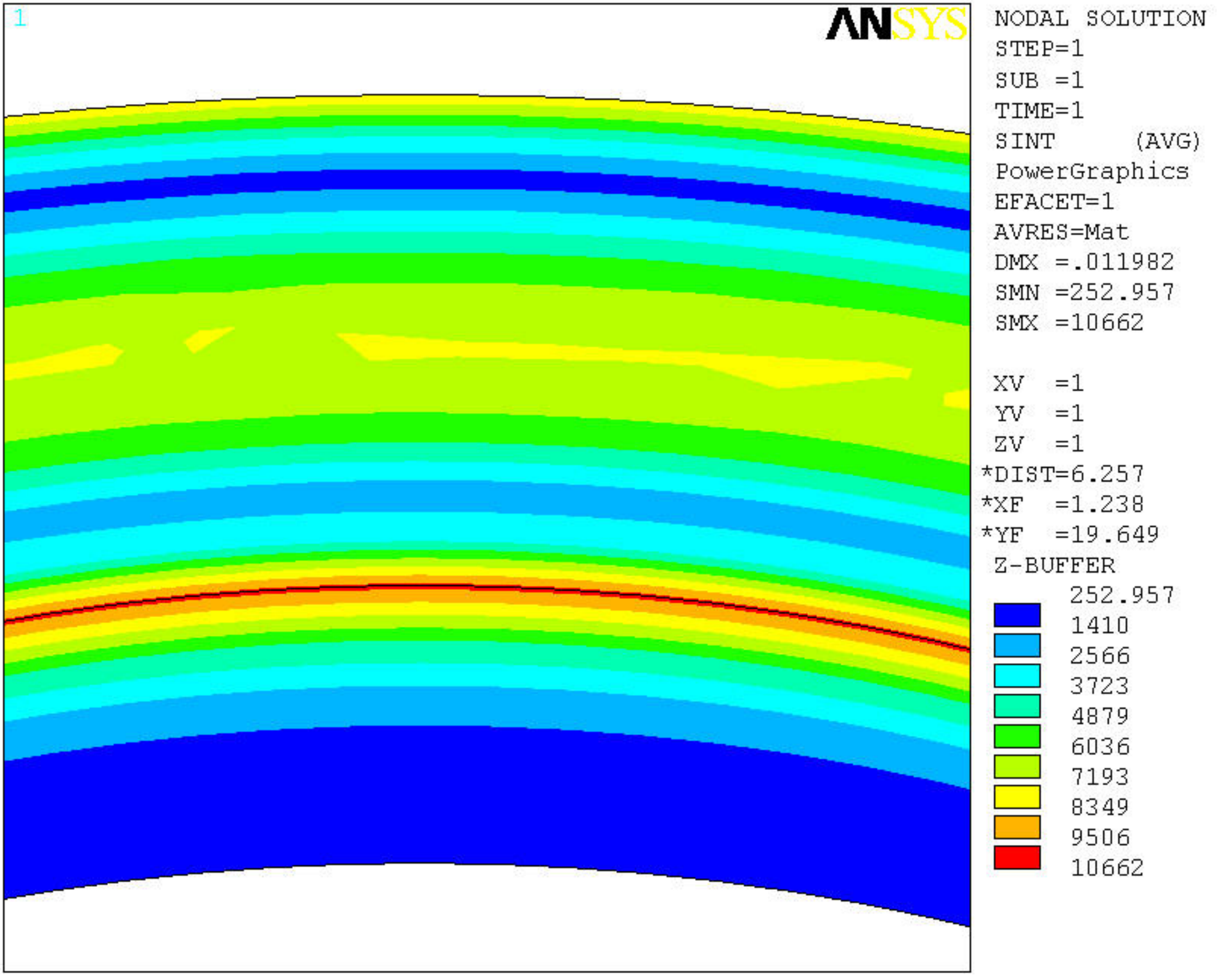
FEA MODEL & RESULTS:

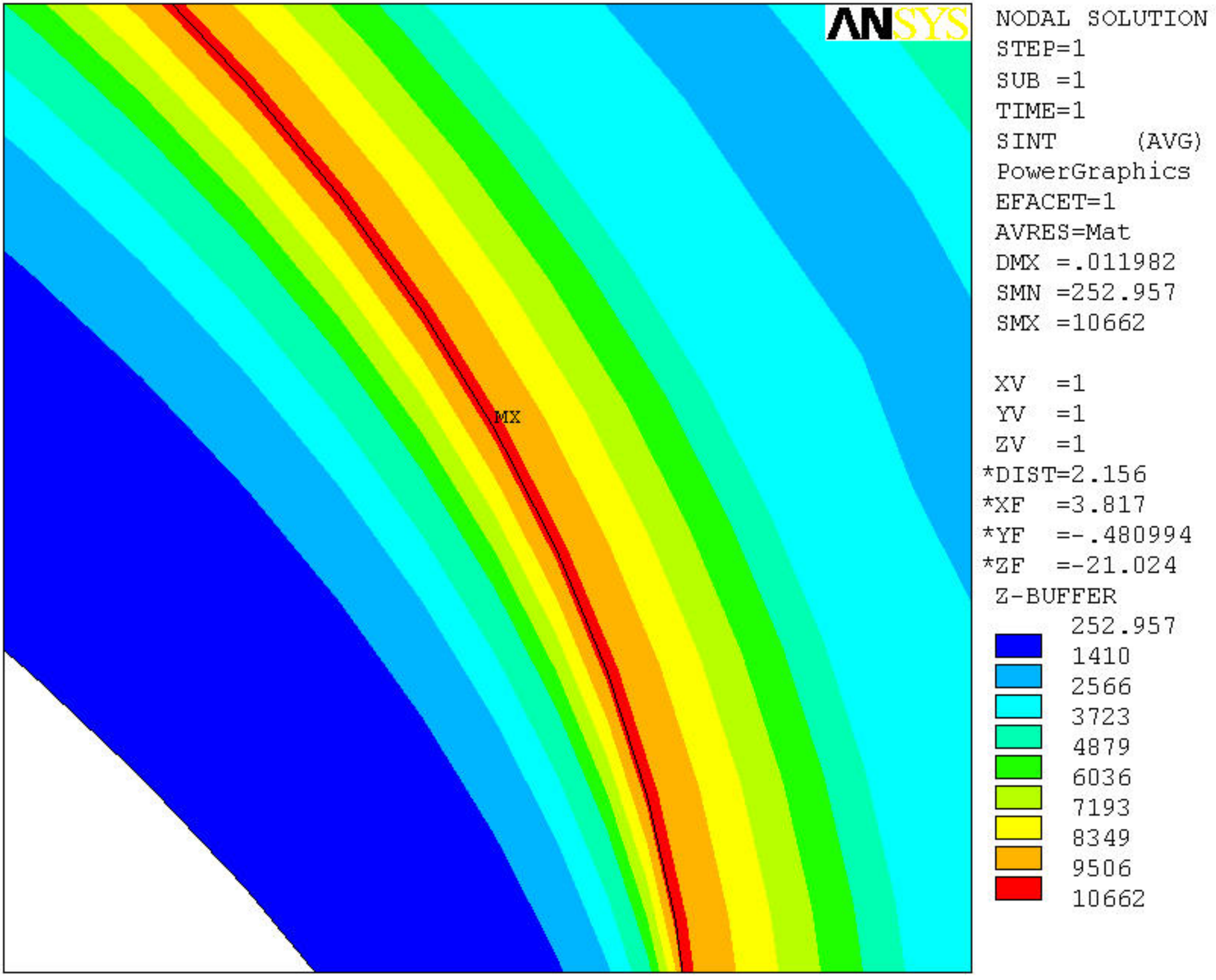
The 3-D FEA model of the top and sides of the rectangular donut chamber was generated using FEA software ANSYS. The pressure loading of 25 psig was applied to the inside of the donut chamber. The appropriate modulus of elasticity was applied to compensate for the design temperature in the model. To simulate the pressure seal at the bottom of the chamber, the bottom edges of the donut chamber were fixed in all the directions.

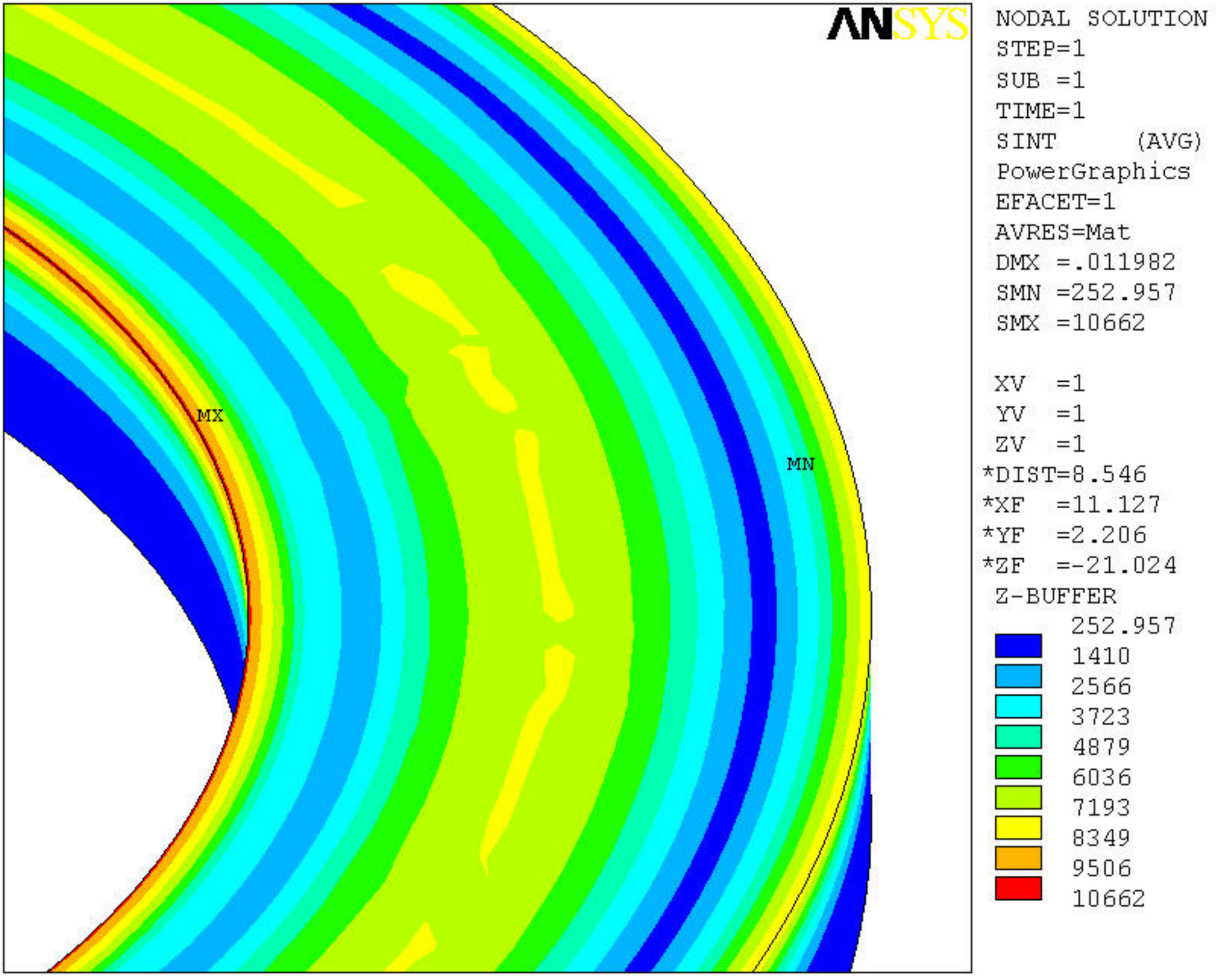
The stress analysis results for the donut chamber were checked against the ASME code, Section VIII, Div.-2, Appendix-4 criteria. Based on the results of finite Element Analysis, all the stresses in the donut chamber were within the Code allowable stress limits for the current design of the donut chamber. The displacement of the top plate of the pressurized donut chamber was also negligible.

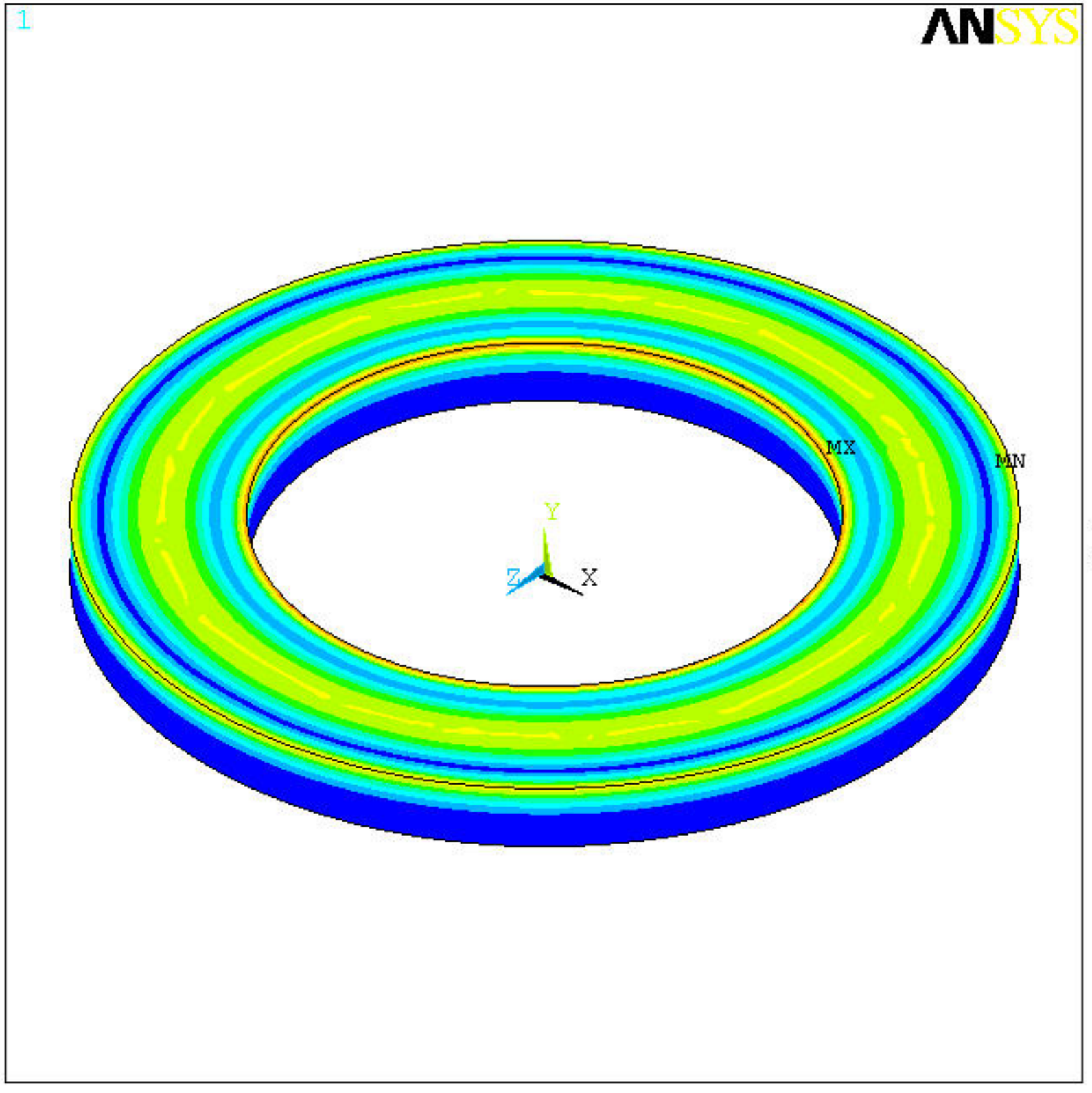
Based on the results of the three dimensional finite element analysis, the current design of the pressurized donut chamber was certified to be in code compliance with ASME B&PV Code, Section VIII, Div.-1.

The attached FEA plots show the FEA model and the results for the donut chamber.


1
ANSYS
NODAL SOLUTION
STEP=1
SUB =1
TIME=1
SINT (AVG)
PowerGraphics
EFACET=1
AVRES=Mat
DMX =.011982
SMN =252.957
SMX =10662
XV =1
YV =1
ZV =1
*DIST=6.257
*XF =1.238
*YF =19.649
Z-BUFFER
252.957
1410
2566
3723
4879
6036
7193
8349
9506
10662


ANSYS
MX
NODAL SOLUTION
STEP=1
SUB =1
TIME=1
SINT (AVG)
PowerGraphics
EFACET=1
AVRES=Mat
DMX =.011982
SMN =252.957
SMX =10662
XV =1
YV =1
ZV =1
*DIST=2.156
*XF =3.817
*YF =-.480994
*ZF =-21.024
Z-BUFFER
252.957
1410
2566
3723
4879
6036
7193
8349
9506
10662

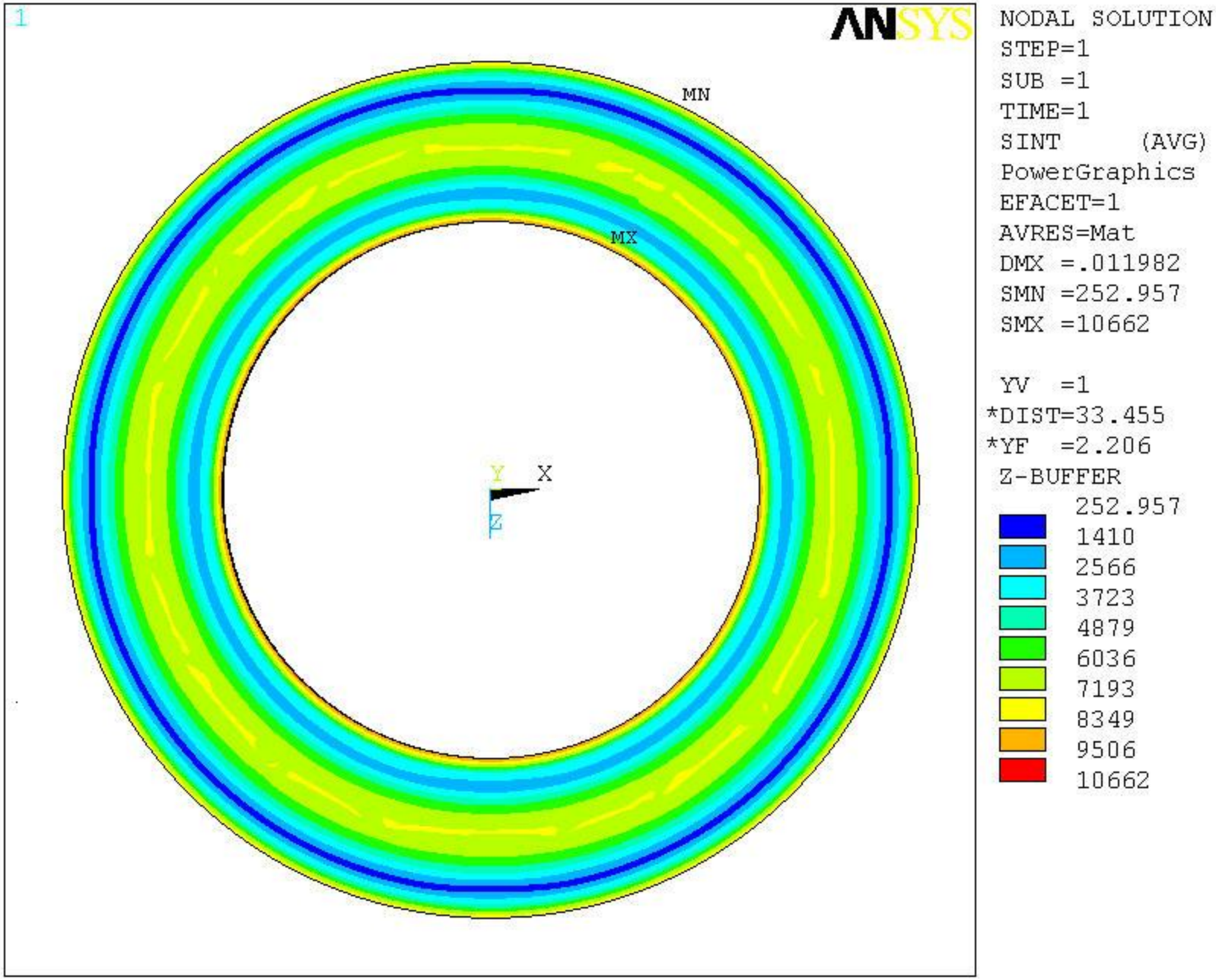

ANSYS
NODAL SOLUTION
STEP=1
SUB =1
TIME=1
SINT (AVG)
PowerGraphics
EFACET=1
AVRES=Mat
DMX =.011982
SMN =252.957
SMX =10662
XV =1
YV =1
ZV =1
*DIST=8.546
*XF =11.127
*YF =2.206
*ZF =-21.024
Z-BUFFER
252.957
1410
2566
3723
4879
6036
7193
8349
9506
10662
MX
MN

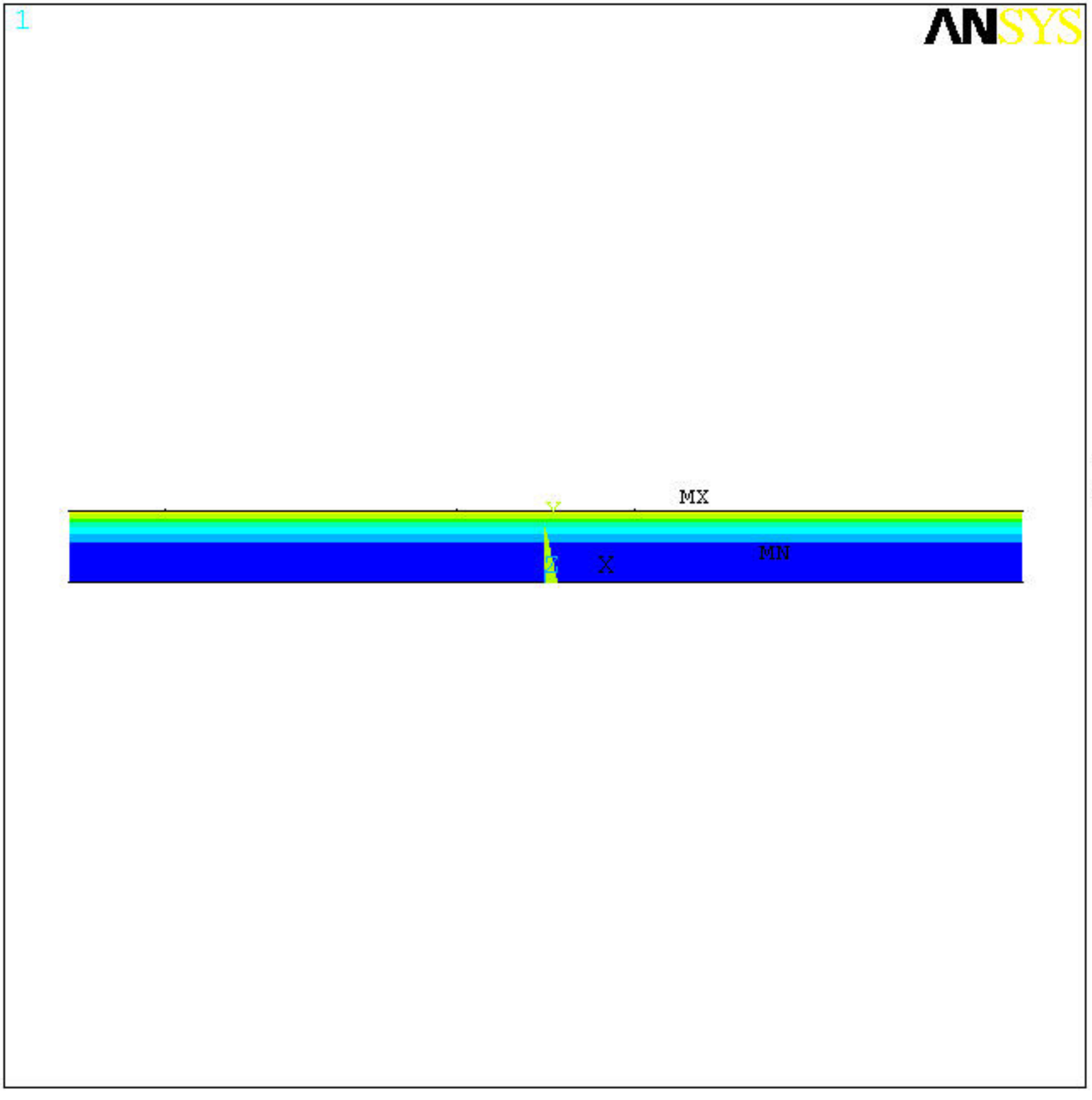


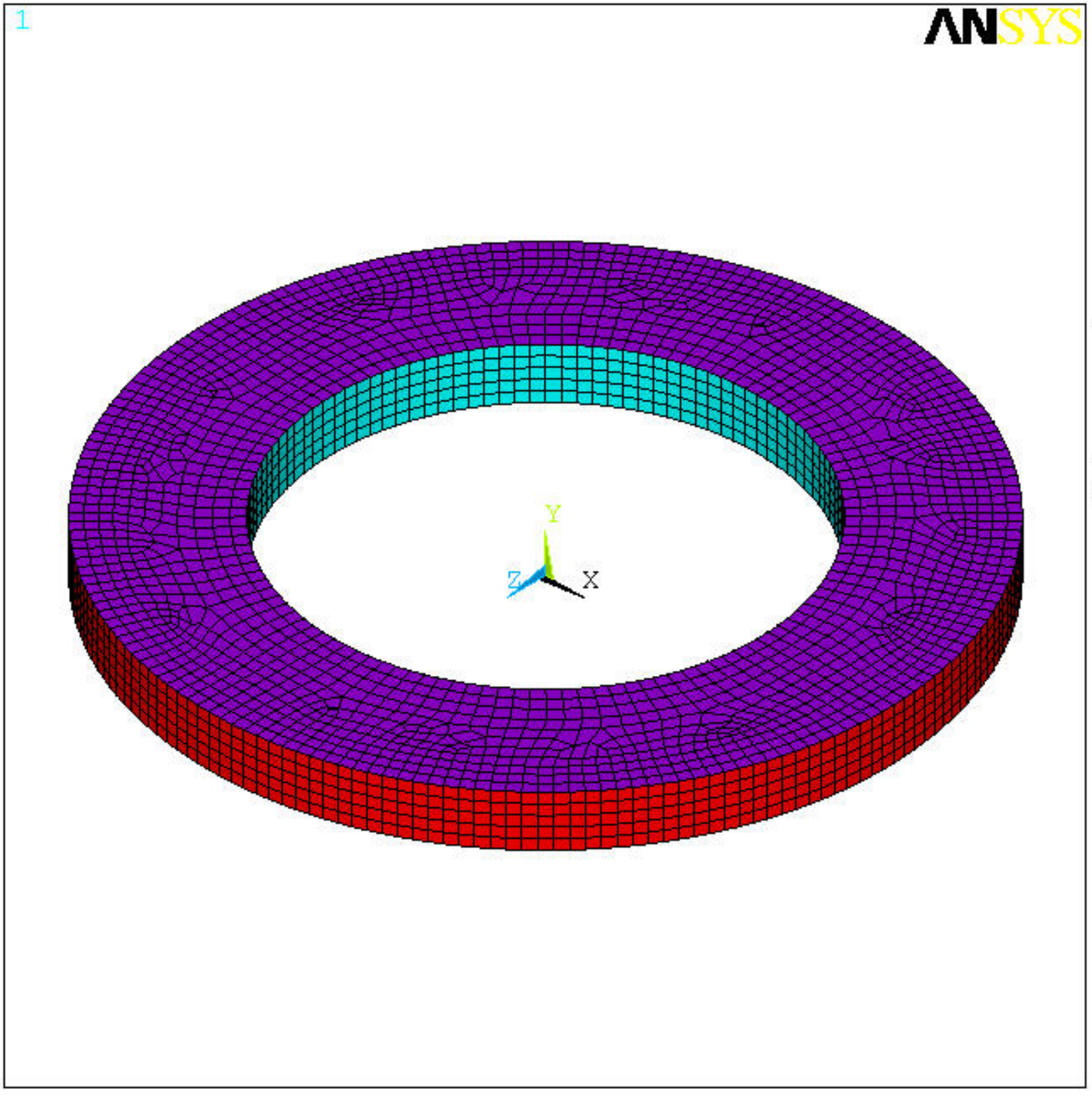
NODAL SOLUTION
STEP=1
SUB =1
TIME=1
SINT (AVG)
PowerGraphics
EFACET=1
AVRES=Mat
DMX =.011982
SMN =252.957
SMX =10662

XV =1
YV =1
ZV =1
*DIST=33.455
*YF =2.206
Z-BUFFER

252.957
1410
2566
3723
4879
6036
7193
8349
9506
10662

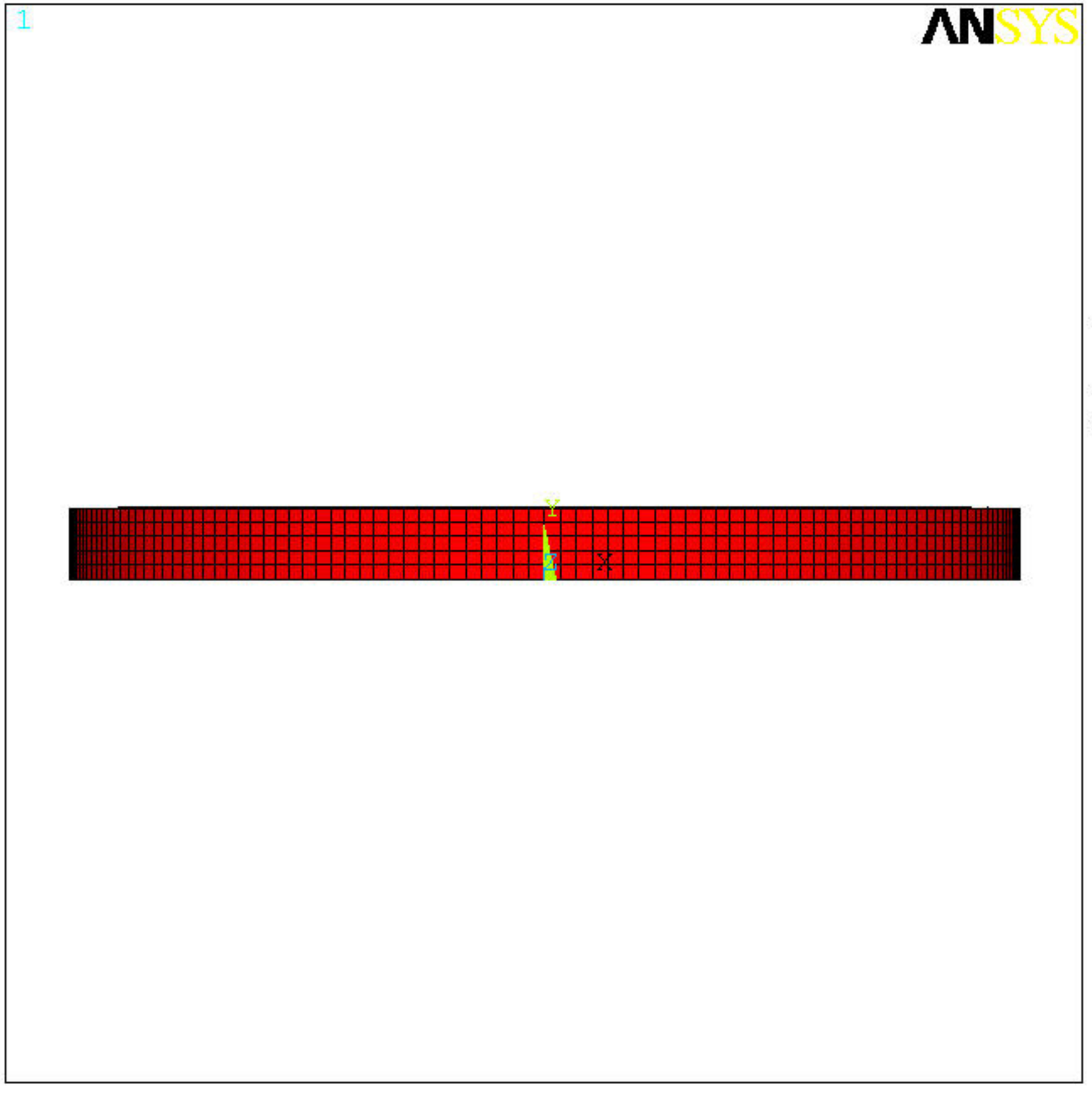

1
ANSYS
MN
MX
Y
X
Z
NODAL SOLUTION
STEP=1
SUB =1
TIME=1
SINT (AVG)
PowerGraphics
EFACET=1
AVRES=Mat
DMX =.011982
SMN =252.957
SMX =10662
YV =1
*DIST=33.455
*YF =2.206
Z-BUFFER
252.957
1410
2566
3723
4879
6036
7193
8349
9506
10662


1
ANSYS
MX
MN
Y
Z
X
NODAL SOLUTION
STEP=1
SUB =1
TIME=1
SINT (AVG)
PowerGraphics
EFACET=1
AVRES=Mat
DMX =.011982
SMN =252.957
SMX =10662
ZV =1
*DIST=33.455
*YF =2.206
Z-BUFFER
252.957
1410
2566
3723
4879
6036
7193
8349
9506
10662



DISPLACEMENT
STEP=1
SUB =1
TIME=1
PowerGraphics
EFACET=1
AVRES=Mat
DMX =.011982

*DSCA=1
XV =1
YV =1
ZV =1
*DIST=33.455
*YF =2.206
Z-BUFFER


1
ANSYS
DISPLACEMENT
STEP=1
SUB =1
TIME=1
PowerGraphics
EFACET=1
AVRES=Mat
DMX =.011982
*DSCA=1
ZV =1
*DIST=33.455
*YF =2.206
Z-BUFFER
Y
Z
X

1

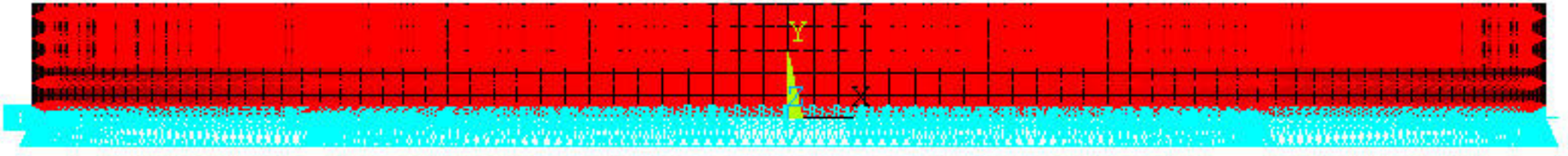
ELEMENTS

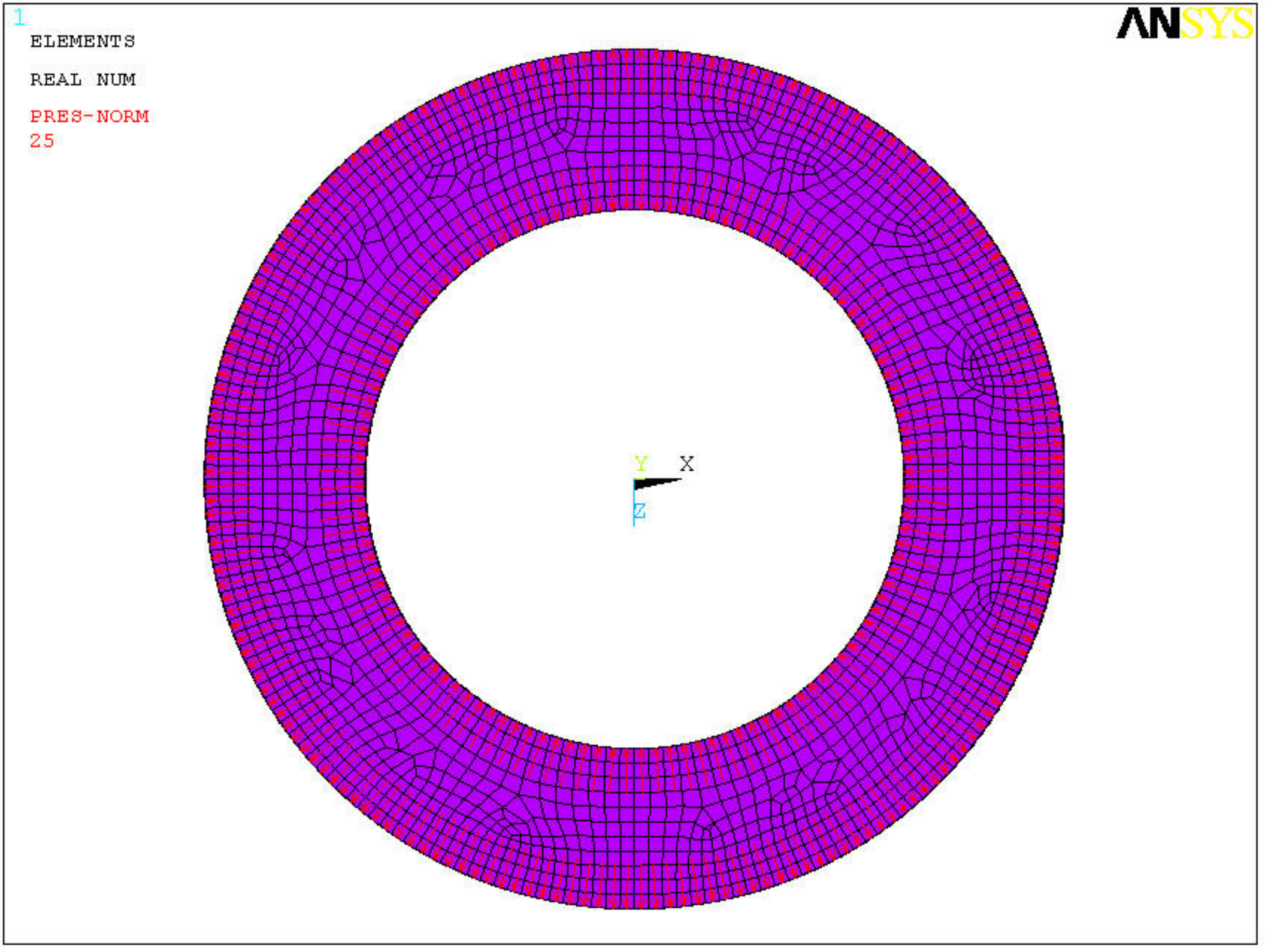
REAL NUM

U

PRES-NORM

25




1
ELEMENTS
REAL NUM
PRES-NORM
25
ANSYS
Y
X
Z

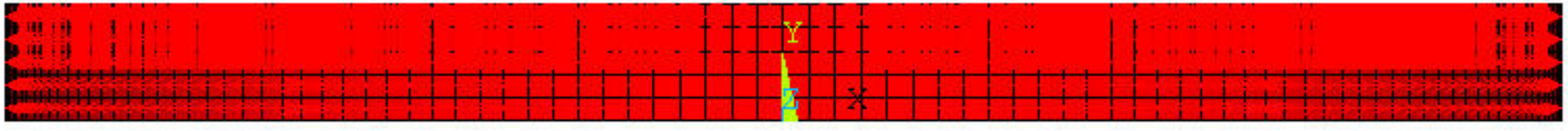
1

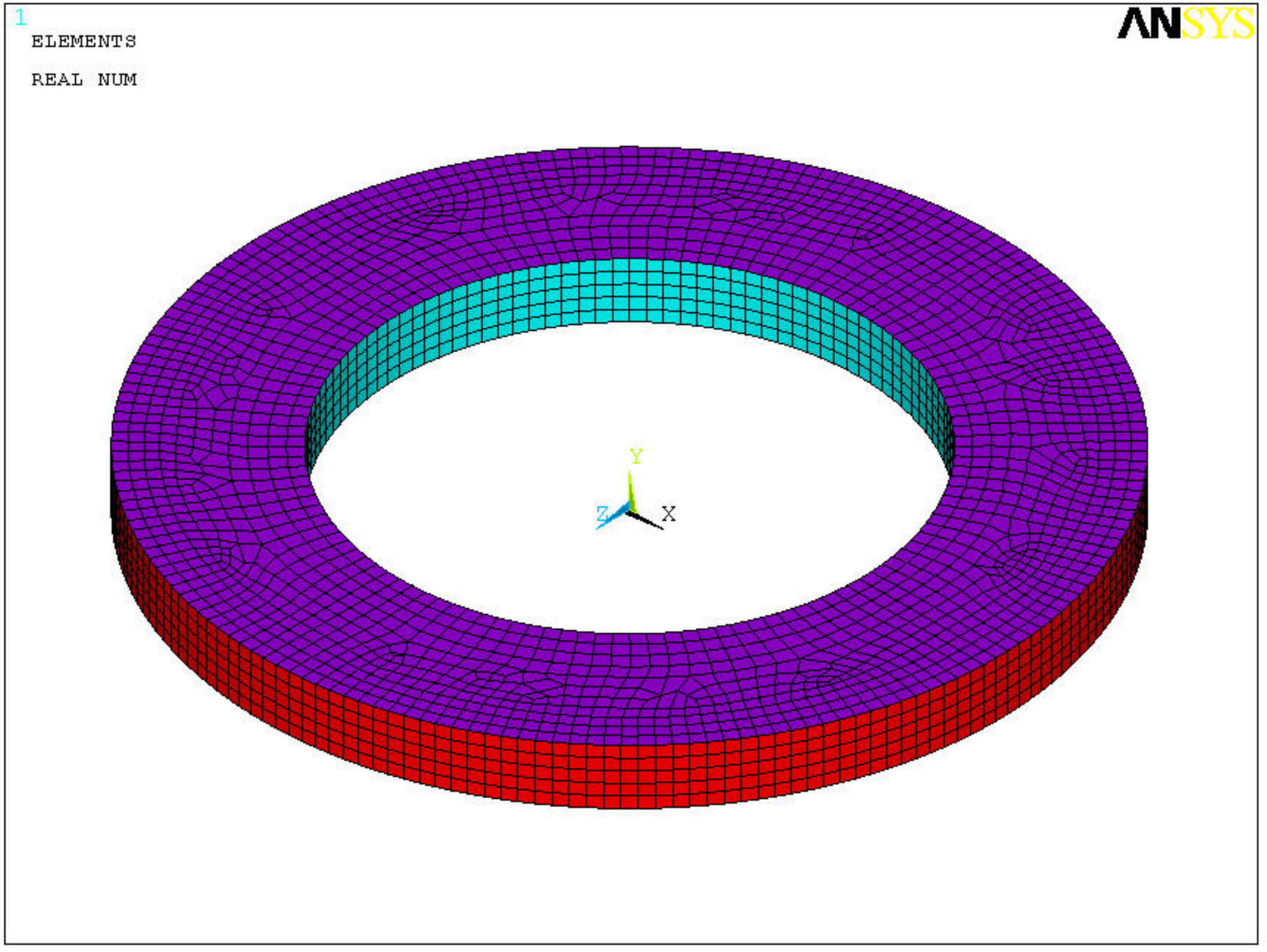
ELEMENTS

REAL NUM

PRES-NORM

25



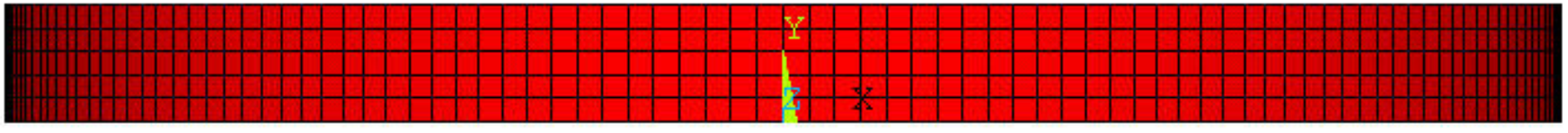

1
ELEMENTS
REAL NUM
ANSYS
Y
Z
X

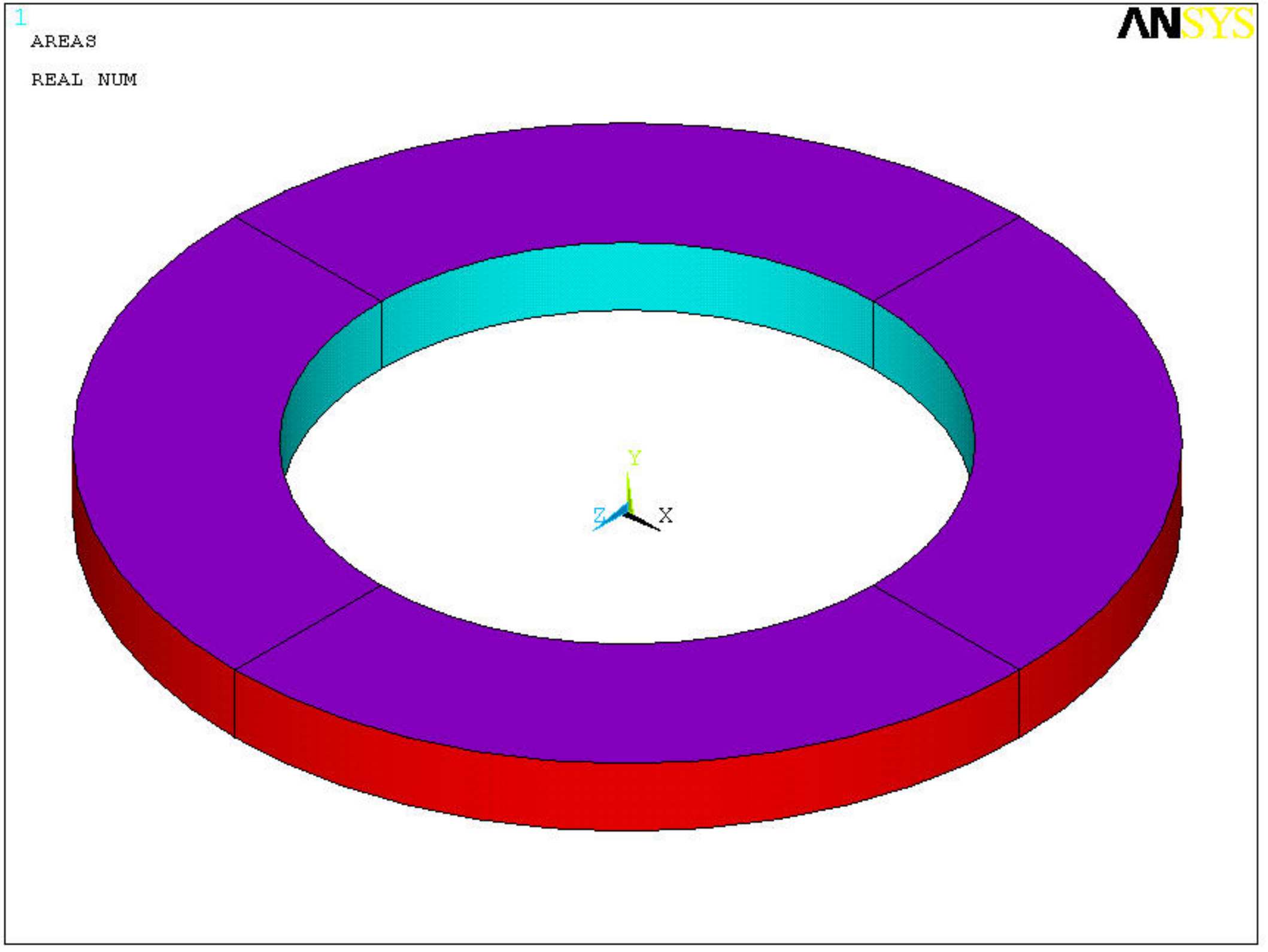
1

ELEMENTS

REAL NUM

ANSYS



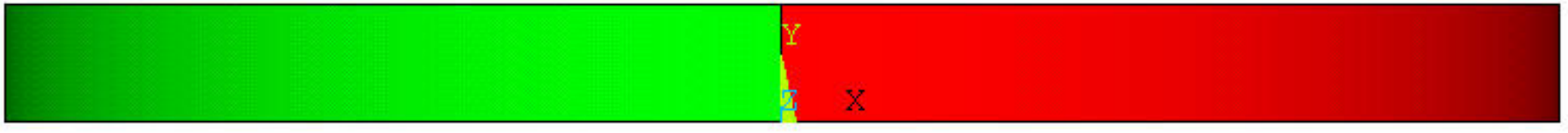

1
AREAS
REAL NUM
ANSYS
Y
Z
X

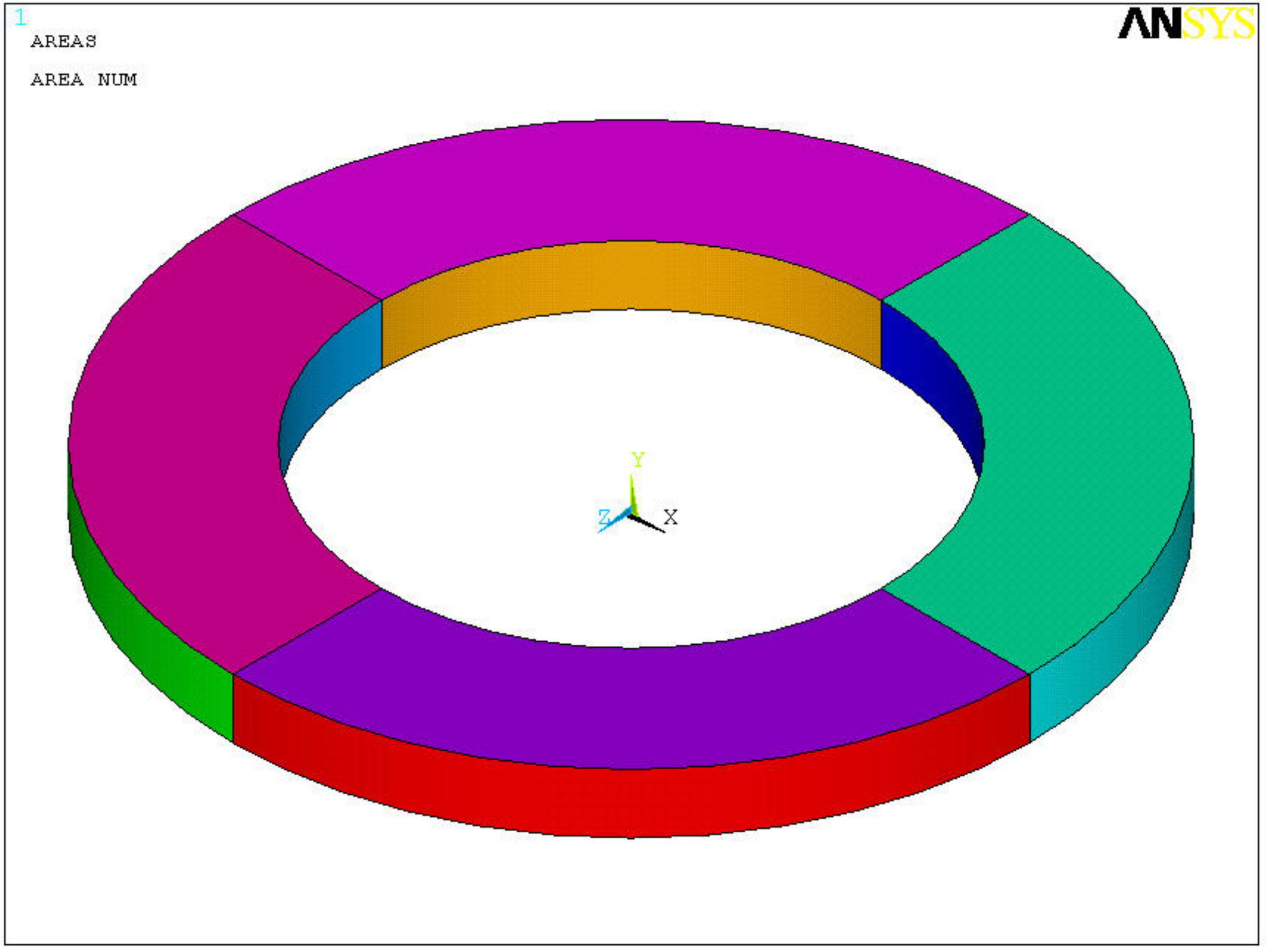
1

AREAS

AREA NUM

ANSYS




1
AREAS
AREA NUM
ANSYS
Y
Z
X

1

AREAS

AREA NUM

ANSYS