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FINITE ELEMENTS ANALYSIS OF REACTOR BOTTOM HEAD

PROBLEM DESCRIPTION:

The 51.5” dia. reactor bottom head fabricated out of 3-1/2% Nickel alloy experienced significant generalized corrosion and pitting. The concern was if the bottom head needed immediate replacement or can it be operated for some more time.

This is a gusseted head designed to take weight, impact and thrust loading from the axial flow pump mounted in the 31.5” dia. opening in the center of the reactor head. In addition to the direct pressure on the head, additional loading due to pressure on the pump also needs to be considered.

The fitness-for-service evaluation was performed using Finite element analysis to check for continued future operation of the reactor bottom head.

FEA MODEL & RESULTS:

The Finite elements analysis was performed using FEA software ANSYS. The appropriate weight, impact, thrust and pressure loadings were applied in the model. Based on the results, it was found that the maximum stresses were present in the gusseted region of the head. Based on the available thickness, the bottom head was not in compliance with ASME code for new construction purposes. However, the guideline thicknesses for the head plate (2” away from the gusset) were specified which allowed the bottom head to be fit-for-service for some more operating life. The cost saving as a result of this conclusion multiplied as there were a number of such reactors in the plant experiencing the same corrosion problem.

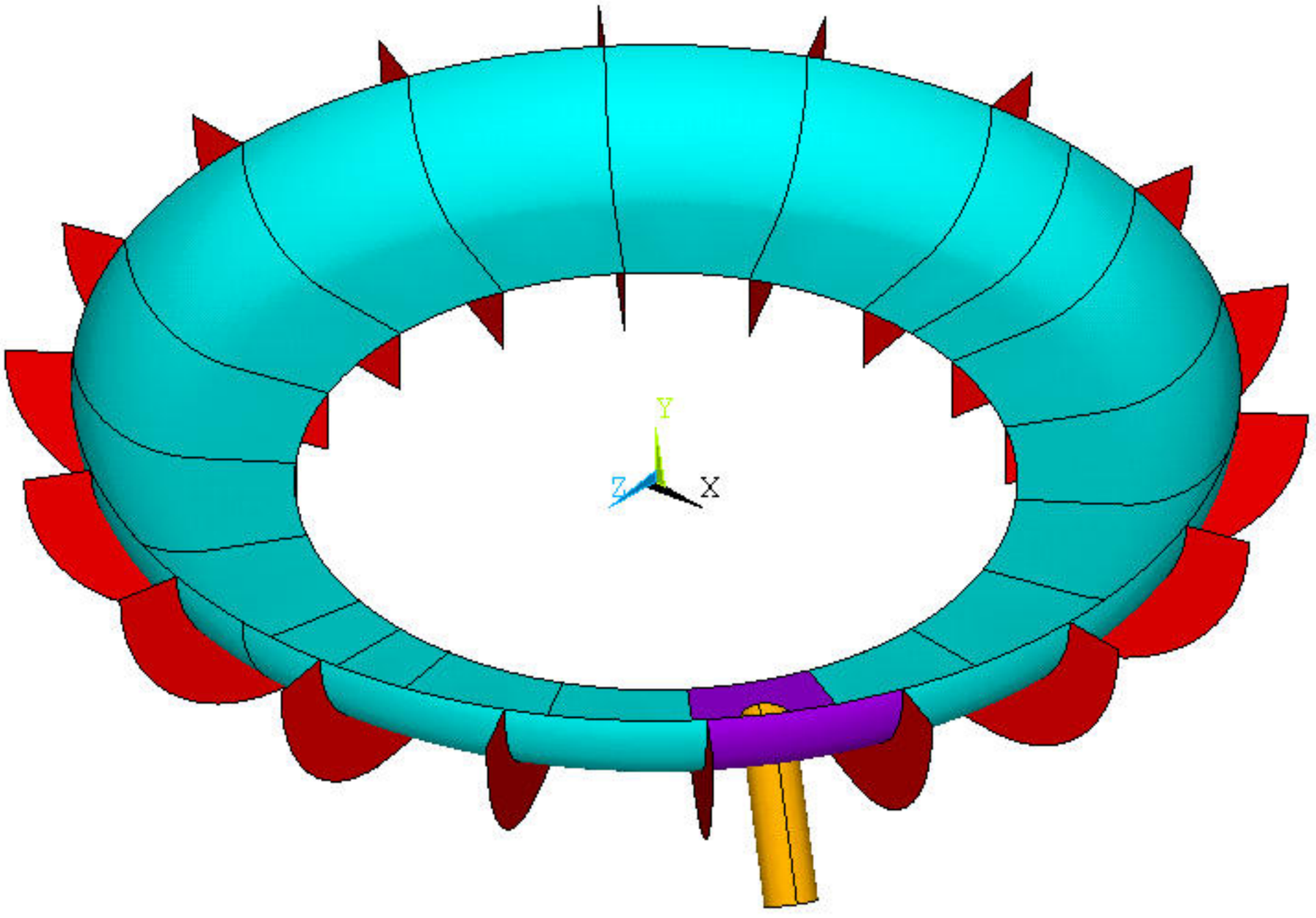
The attached FEA plots show the model and results for one of the cases analyzed.

1

ANSYS

AREAS

REAL NUM



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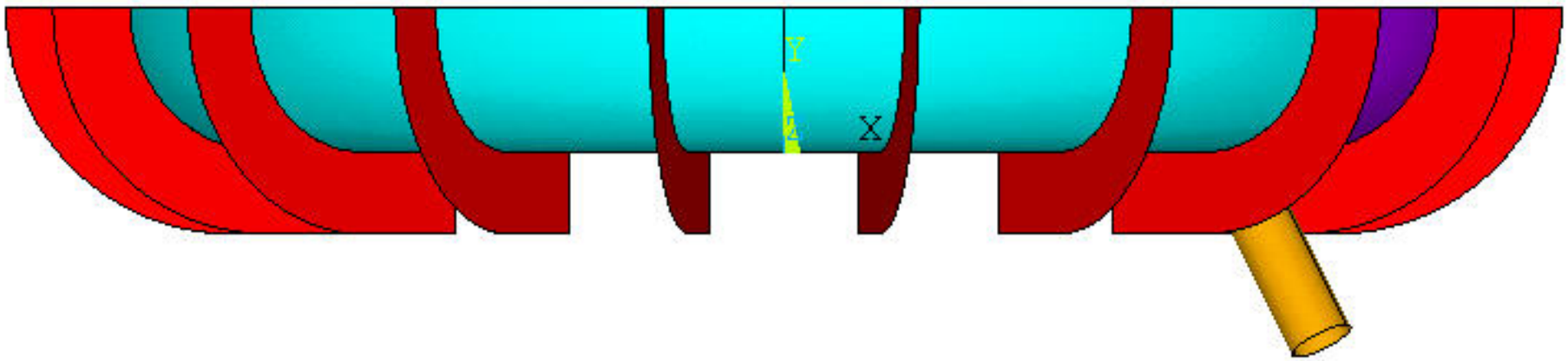

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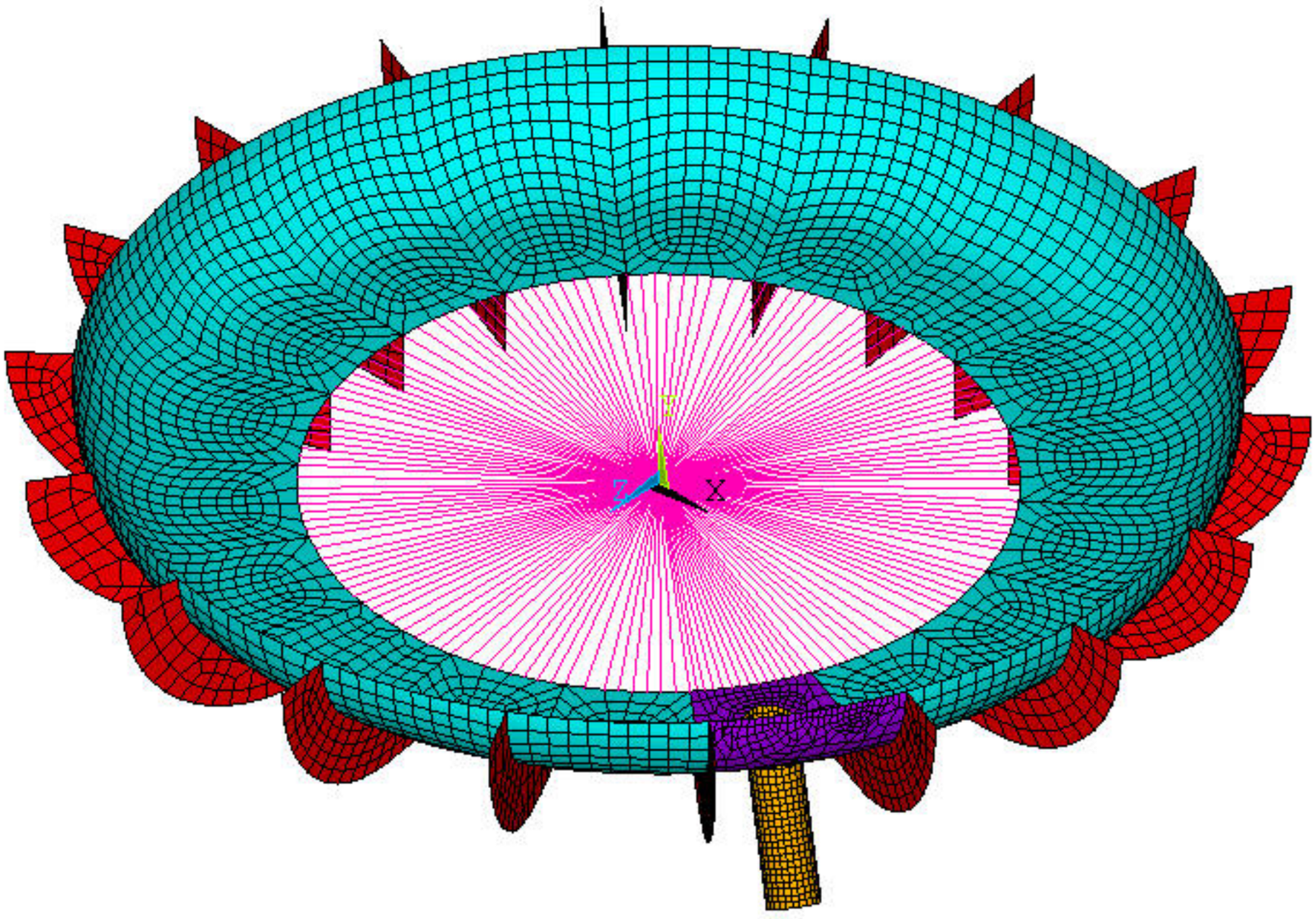
ELEMENTS

REAL NUM

ANSYS



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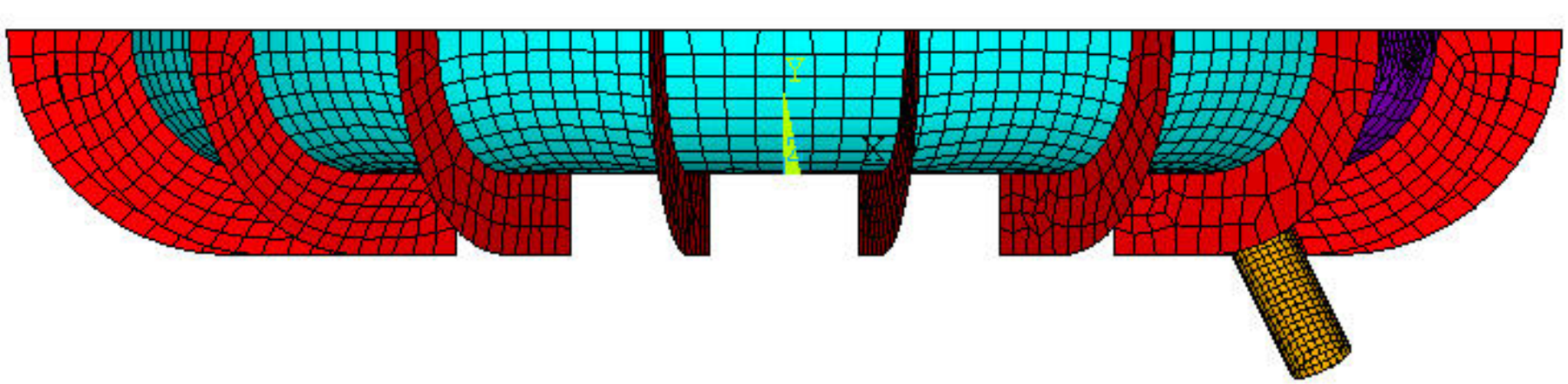
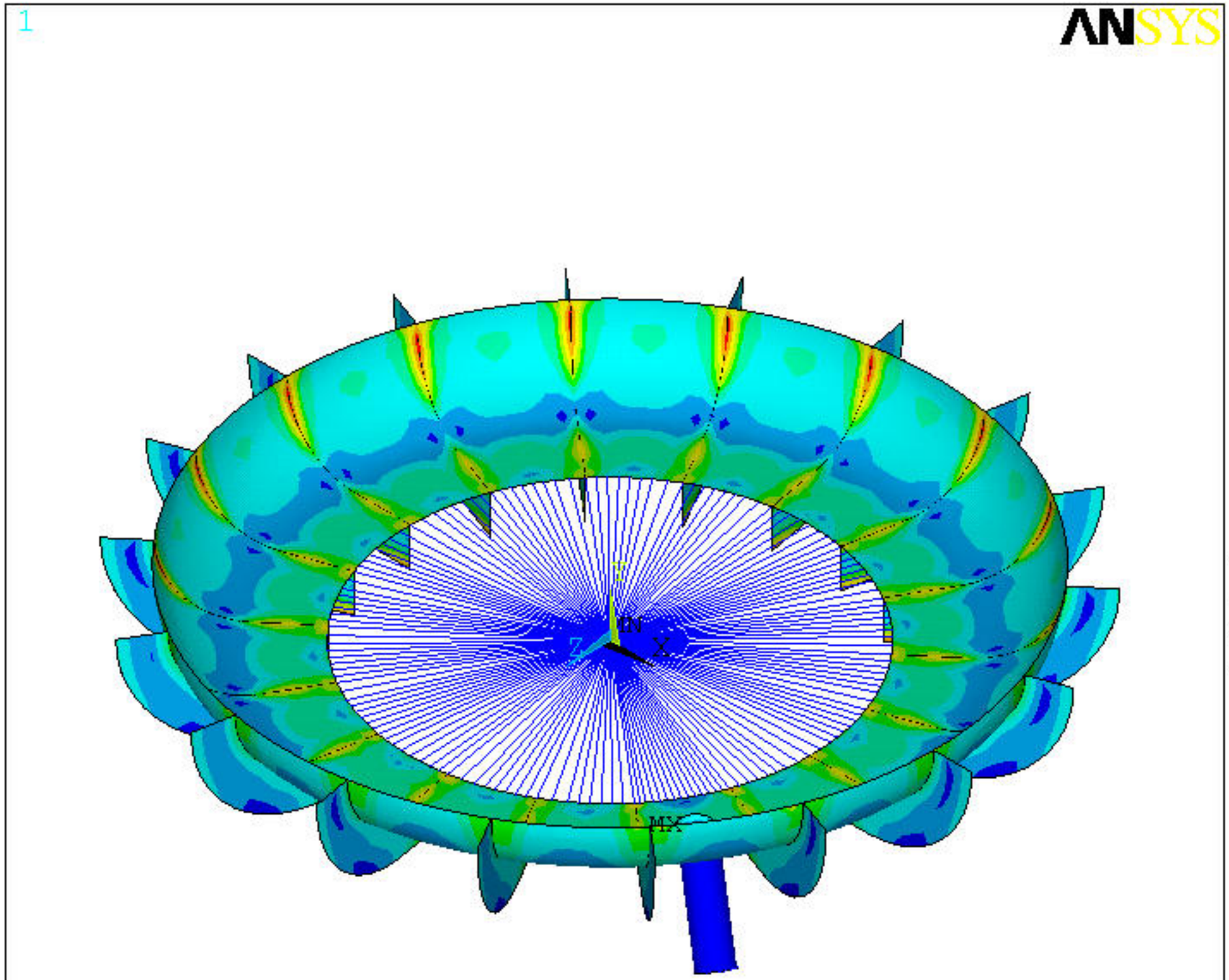
ANSYS

ELEMENTS

REAL NUM





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EFACET=1
AVRES=Mat
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SMN =38.691
SMX =32370

XV =1
YV =1
ZV =1
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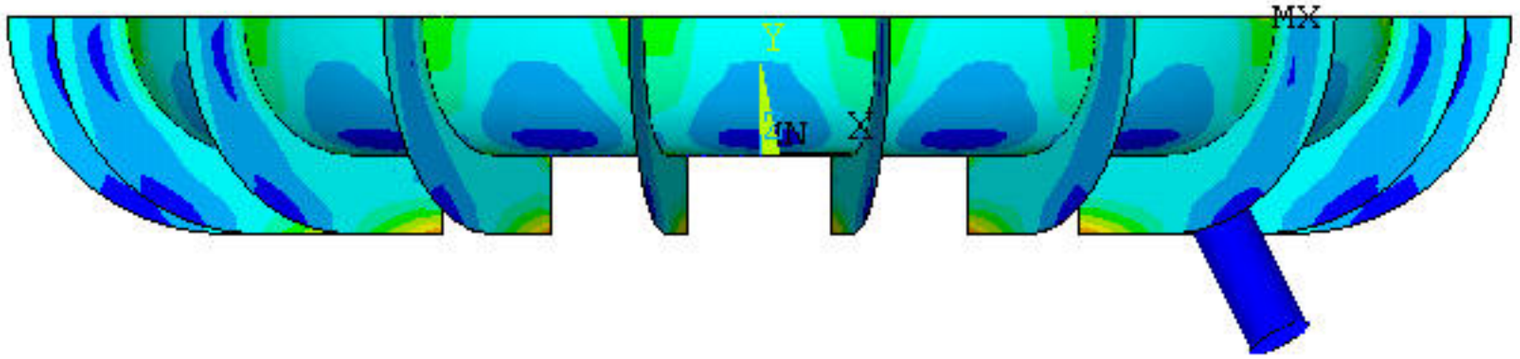
*XF =.367635
*YF =2.006
*ZF =.167E-04
Z-BUFFER

1

ANSYS



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3631
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