Buckling Analysis of Cylinders Subjected to Hydrostatic Pressure

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Abstract: Aluminum alloys are well suited for applications in marine structures, their unique material characteristics make the structural response different than steel. When structural elements are subjected to compressive loads, the buckling and collapse capacity is one of the most crucial factors governing the design.

The objective of the research is to develop the linear buckling analysis of aluminum cylinders subjected to hydrostatic pressure with different thicknesses, effect of axial loads in addition to hydrostatic pressure and study the effect of element optimization on the linear buckling analysis. Typical Aluminium 7075 alloys are investigated. Recommendations will be made based on the study and validation.

Introduction:

Aluminum is an attractive material as it is light, strong, clean, normally ductile, easily formed and fabricated, and readily available. It is recyclable and thus environmentally friendly. The accumulated experience over many years shows that aluminum7075 alloys offer both safety and reliability for use in marine structures. Although aluminum alloys are well suited for some applications in marine structures, their unique material characteristics make the structural response different than steel. When structural elements are subjected to compressive loads, the buckling and collapse capacity is one of the most crucial factors governing the design.

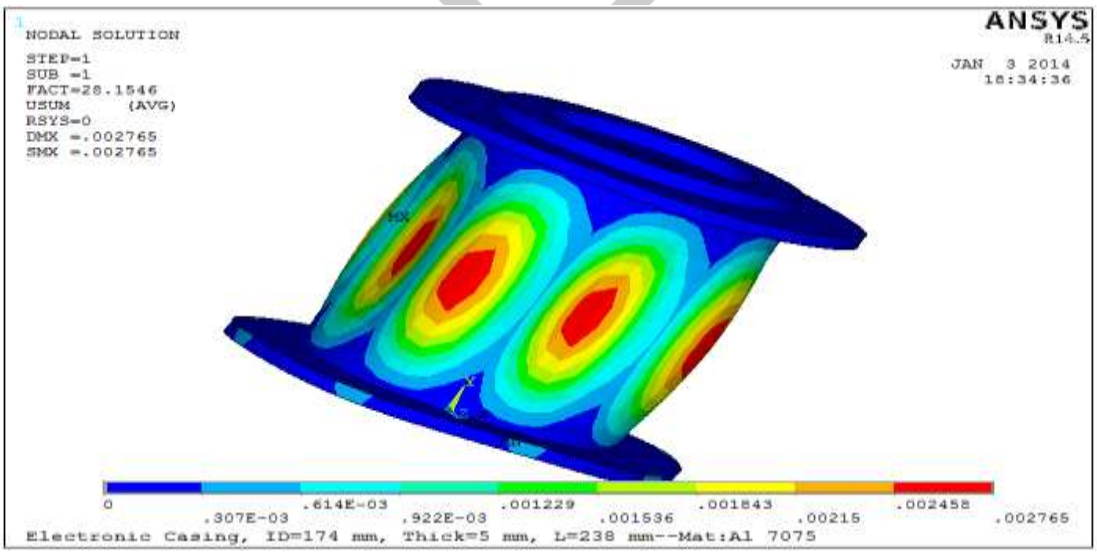
Buckling is a failure mode characterized by a sudden failure of a structural member subjected to high compressive stresses, where the actual compressive stress at the point of failure is less than the ultimate compressive stresses that the material is capable of withstanding.

In linear buckling the material properties are linear and small or finite deflection is considered.

Method:

The FEM was done using ANSYS software.

- For the linear buckling analysis SOLID 186 element was used which is 3D 8-noded structural solid.
- For aluminium of different thicknesses such as 2.5,3,3.5,4,4.5mm
- The element optimization was done for different thickness.
- The buckling analysis of aluminium cylinders with axial loads in addition to hydrostatic pressure was done.



Conclusions:

From the above analysis we can conclude following that:

- As we increase the number of element divisions (i.e decrease in element size) we will get an accurate result.
- Buckling analysis of aluminum cylinders with axial loads confirmed that axial loads have effect on buckling analysis