MODELLING AND STRUCTURAL ANALYSIS OF PRESSURE HULL SHIP UNDER CORROSION

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Abstract - *Ship is the complex geometry which undergoes a combination of loadings such as hydrostatic, hydrodynamic, wind, wave etc. at sea and therefore adequate strength in a ship has always been one of the most challenging tasks for the ship designers. Thus, structural analysis is needed to calculate the overall strength of hull, and the means in this regard are based on finite element method which may be applied either local or global aspect of the ship. I like to carry out the structural analysis of a ship in whole body aspect using ANSYS software to locate the most stress concentration and deformed area, which will have ultimate effect on fatigue fracture.*

Key Words: Hydrostatic, Hydrodynamic, Global aspect, ANSYS

1. INTRODUCTION

The function of a ship is to transport commodities or people from one place to another. There are different classification of ships such as cargo carriers, passenger carriers, industrial ships, service vessels and container ships. Analyzing ship as a whole is quite tedious and time consuming. Normally observations are carried out on individual primary structural members for various cases. Deckships are open deck ships because of the fact that there are large hatch openings in the deck to permit the stowage of containers in the holds. The hatchways are enclosed by flush hatch covers and additional containers are stored on the deck. The fact that a large portion of the deck is cut away, it creates structural problems, and it is often necessary to use high strength steel to obtain the required structural strength. Container ships are much faster than normal cargo ships. A submarine may have to operate for a period of time with local corrosion damage in the pressure hull if a suitable repair method is not in one hand distance or too expensive for implementation.

1.1 BACKGROUND

Background describes the collapse tests on twenty ring-stiffened aluminium cylinders, conducted to study the effect of corrosion damage on hull strength and stability. Artificial hull thinning is done to reduce the collapse strength of experimental models through high local stresses in the corroded region, leading to early onset of yielding and 2 inelastic buckling. Bending is with the eccentricity due to one-sided thinning was found to further increase the local stresses in the hull. Overall collapse pressures were severely affected by corrosion damage than interframe collapse pressures. The percentage reduction in overall collapse pressure, presence of intact experimental models, was found to be closely related to the percentage depth of thinning. The accuracy of conventional collapse pressure predictions for the models was significantly better.

2. SHIP STRUCTURE

Hull is generally known as the foundation of the ship. It withstands extremely harsh climatic and weather conditions. Hull should be designed in such a way that it cannot be affected by the different forces that acts on it while the ship is sailing. The hull of the ship that requires extra concern during design and construction. In the history of naval architecture, hull designs have evolved over a period of time, from cylindrical wooden shanks to steel columns. Engineers have been innovating hull designs to provide greater structural strength. As hull is continuously in contact with water, it is under the effect of different of forces acting at the same time. Not only that, a hull requires high durability and resistance to prevent structural damage in case ofcollision or grounding.

2.1 TYPES

2.1.1 Light Hull

The double closed hull of a submarine is different from a ship's double hull. The external hull, which actually forms the shape of submarine, which is called the outer hull, casing or light hull.

2.1.2 Pressure Hull

Inside the external hull there is a strong hull, or pressure hull, which actually withstands the outside pressure and has normal atmospheric pressure inside

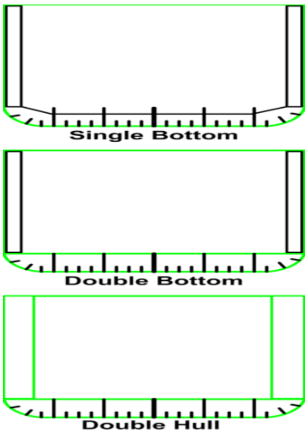

Chart -1: Name of the chart

3. PRESSURE HULL WITH CORROSION

3.1 General

Corrosion represents one of the largest through life cost component of ships. Ship masters and operators recognized that combating corrosion significantly impacts the vessels reliability, availability and through life costs.

3.2 SINGLE CORROSION HOLE

3.2.1 Corrosion Holes of 2mm

3.2.1.1 Hydrostatic Pressure

The concept of hydrostatics and stability can be deemed as one of the most important areas of focus in ship design and operation. Figure shows the hydroststic pressure of **6.326 MPa.**

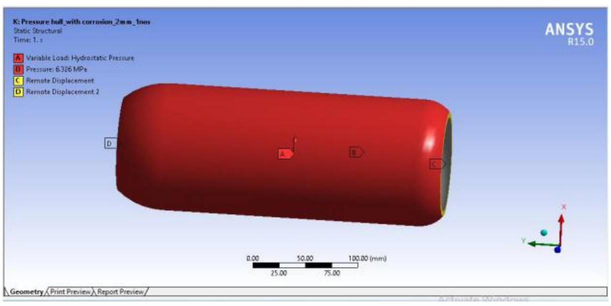

Fig -1: Static Pressure

3.2.1.2 Meshing

Meshing is a discritisation method. Converting the whole object to finite elements in node and element mode.

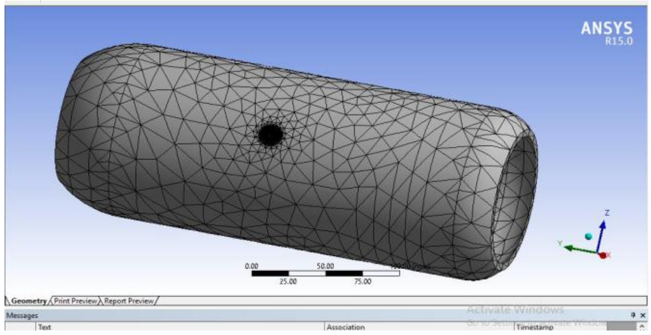

Fig-2: Meshing of Pressure Hull

3.2.1.3 Modelling

Model of the pressure hull with **2 mm** widen corrosion hole using Ansys.

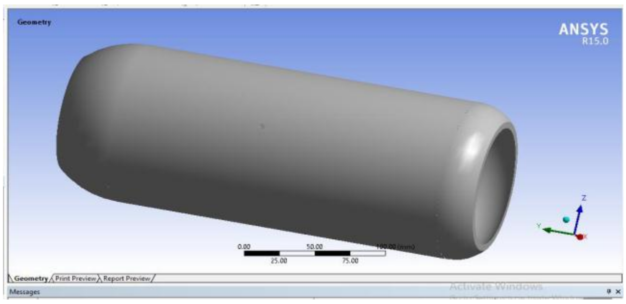

Fig-3: Model of Pressure Hull

3.2.1.4 Equivalent Elastics Strain

Effective plastic strain grows whenever the material isactively yielding, i.e., whenever the state of stress is on the yield surface.

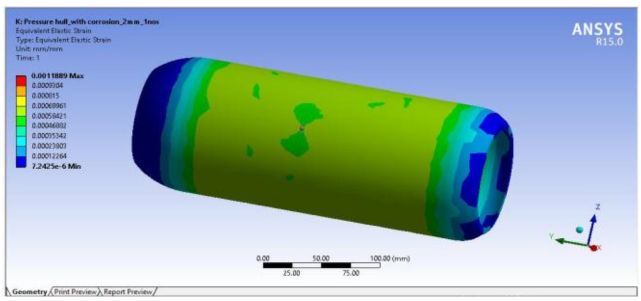

Fig -4: Equivalent Elastic Strain of pressure hull

3.2.1.5 Equivalent Stress

Equivalent stress provides proper result beyond failure. **249.06 Max**.

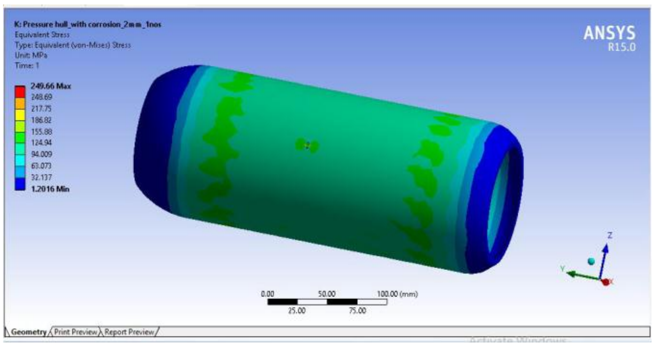

FIG-5: Equivalent Stress of Pressure Hull

3.2.1.6 Total Deformation
Without considering the axis. **0.04 Max.**

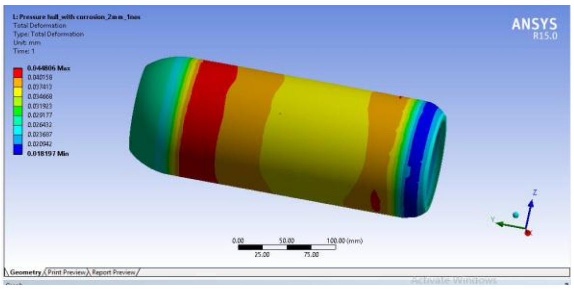

Fig 3.2.1.7 Total Deformation of Pressure Hull

4. CONCLUSION

The designed model is exported to ANSYS and designed the whole cargo holds on ANSYS design modeler as per rules and validated the model by POSEIDON. After the modeling using ANSYS we have prepared the FE model and done some structural analysis for the model. In this thesis the ship hull structure different mode shapes at natural frequencies are analyzed with modal analysis. Different stress parameters like equivalent stress, normal stress, principal stress, shear stress, total deformation and life of ship hull structures are analyzed in structural analysis by using Ansys15 soft wares.

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BIOGRAPHY

I'm NIDHI G NAIR, PG student. "Modelling and structructral analysis of pressure hull under corrosion and wave action" is my thesis paper. This is only a portion of my thesis