DESIGN AND ANALYSIS OF SANDWICH PIPE FOR DIFFERENT CORE SHAPES

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ABSTRACT:- Day by Day Material utilization is increasing in various fields and applications. The effective design may cause for the reduction of the material. The Sandwich structures are the effective designed structure may produce same properties like regular structures.

Sandwich structure is typically found in stiffness critical component that resist buckling. The sandwich structure consists of three layers. They are sleeve layer, core layer and product layer. In the core layer different core shapes are placed.

In the present project Sandwich Pipe Line is designed with different core shapes (Cylinder, and Square) by using Cero. The Analysis is done in ANSYS.

For the study and analysis of strength of Sandwich the two SANDWICH pipes with different core shapes are considered. In order to find out the best core shape among two core shapes the sandwich structure is done using three point bending test. The experiment carried out on the cylindrical core pipe and the result are compared with simulations results.

INTRODUCTION

Sandwich core materials are very important material which produce products with high competitive ness . Due to the core material the products are very durable, faster and strong .structural design used sandwich core shapes to decrease weight and maintain mechanical performance. So Sandwich core shapes are becoming more popular in structural design. By the reduction of weight lot of benefits that are increased range, fuel consumption decreased. Sandwich core shapes have good impact on price and reduced environment problems. The two material are separated by light weight material so structure strength and stiffness were increased. The sandwich core compare with other designs it reduce weight of the component. The combination of sandwich principle save energy and enables effective solutions in many areas. Sandwich composites provide high strength and speed for the sports equipment segment. In industry: small robots used sandwich component to perform fast. In construction: sandwich composite used for a bridge designed for effective installation.

LITERATURE REVIEW

Design aspects and edges of sand wich pipes for radical deepwater is analysis by the Harold Rivas leon, sege farid estefn and missionary Castello. Adhesion strength for the steel is evaluated by AN experiment. Sandwhich pipelines that are utilised in offshore production are analyzed numerically to guage the final word strength by applying AN external pressure. Results indicated up to fifteen higher resistance once layers are warranted and half-hour when no adhesion is taken into account. Once the temperature impact on the inner radius of compound layer is taken into account, the collapse mode is ruled by outer pipe and also the helpful impact is reduced. The installation procedure will have an effect on results additionally, as a result of bending and on a reel ship will have an effect on outer pipe roundness and alter the relative ovality performance. SP element D750 is as thermally economical as PIP, employs subsequent API 5L such outer pipe diameter and seventy three of steel weight. All SPs were designed with unfavorable one.5% initial imperfectness for each inner and outer pipes.

APPLICATIONS

In on NGC normal pipes are used so that when high pressure is transferred through the pipes. It may brake. In this reason it damage pipe due to that gas is leaked it harmful to atmosphere. To prevent this damage. Iam prefer to use sandwich pipe so the sandwich pipe is vary strong and high strength and high stiffness. Due to this it will not brake while transferring high pressure fluid

EXPERI MENTAL ANALYSIS OF SANDWIICH STRUCTURE LOADED IN 3 – POINTBENDING

Sample mathematical calculation

Length of the pipe = 150mm

Diameter of the core pipe = 6mm

Load = 18000N

STRESS=L/A

A= 7.065mm^2

σ = 2547.7 N/mm ^{2}

Deformation = stress × length/'E

Δl = σ×l/'E

Δl = 4mm

Stiffness of cylinder core shape

K= Load/Deformation

Stiffness of cylinder core shape k_c = 4500N/mm

The error is occur between practical and numerical is 10%

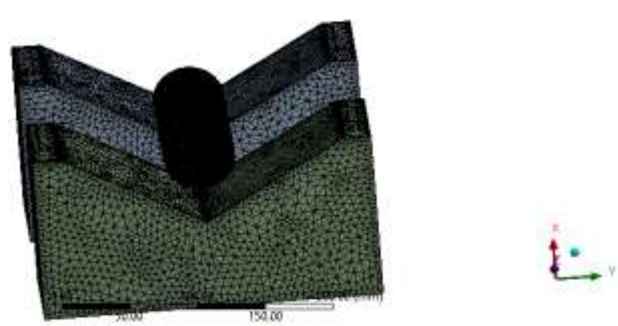
NUMERICAL SIMULATION OF PIPE ASSEMBLY

A design model of a Steel Sandwich hallow pipe is generated by cero .it assembling four sandwich pipes modeled. The dimensions of the modeled Stainless steel hallow pipe(52.5mm outer 51mm inner diameter , 150mm length and1.5mm wall thickness) taken an outer layer known as sleeve pipe, Stainless steel hallow pipe (39mm outer 37.5mm inner diameter , 150mm length and1.5mm wall thickness) taken inner layer known as product pipe. Mild steel and copper hallow pipes (6mm outer 5mm inner diameter, 150mm length and1mm wall thickness) for core. The designed pipe can be used as deep water. Model is imported into Ansys workbench which is design by cero software.

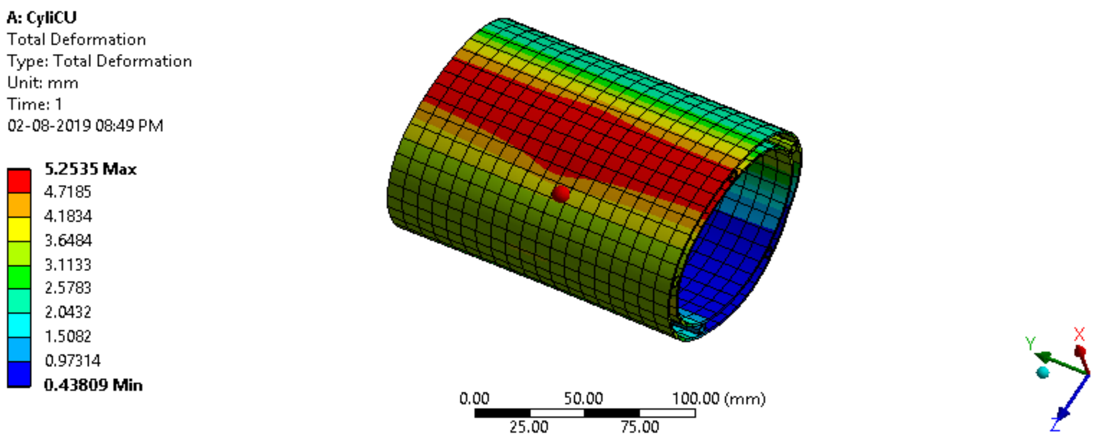
The pipe is placed on two supports and tested by using three point bending test

COMPARIS5ION BETWEEN DIFFERENT CORE SHAPES

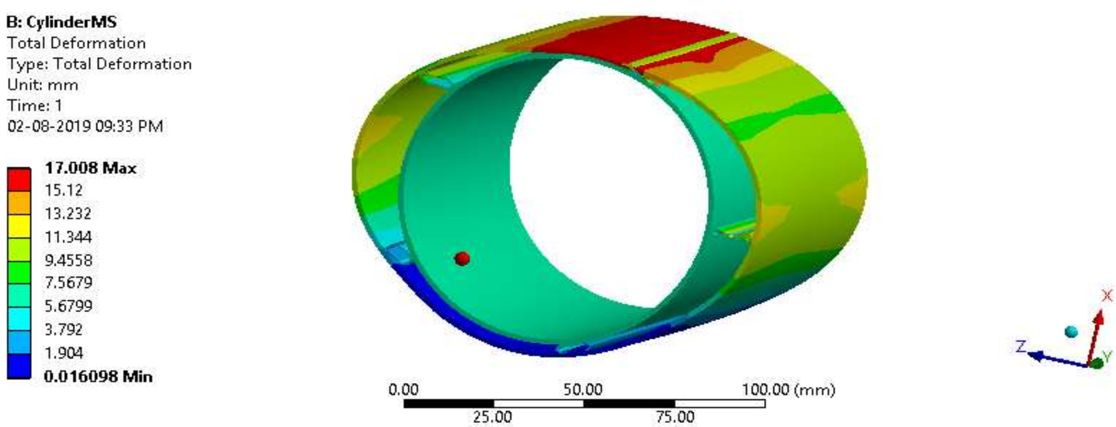
Here we compared cylindrical copper core shapes of deformation and square copper shapes of deformation. Among this two core shapes the cylindrical copper core shape is better because of it get the high stiffnes value. The values are shown bellow



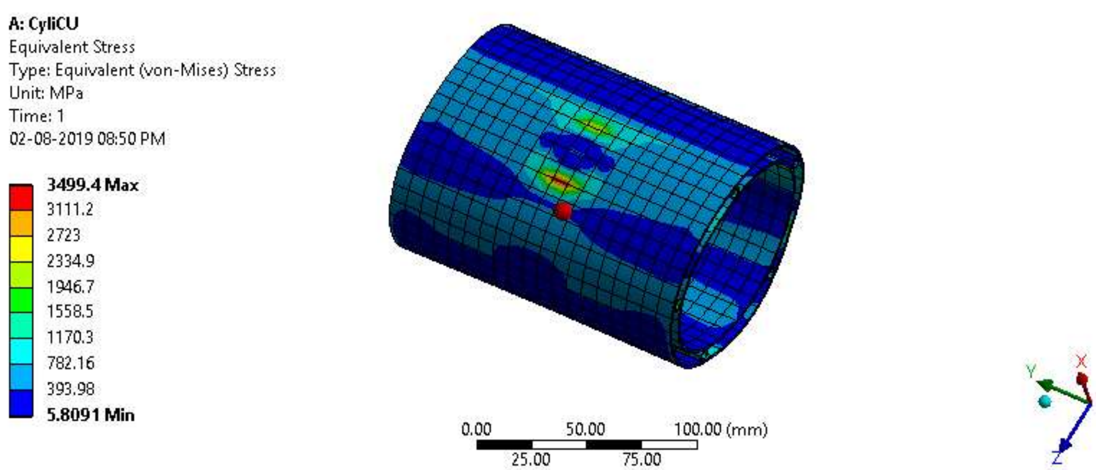
Cylinder as a Core Shape



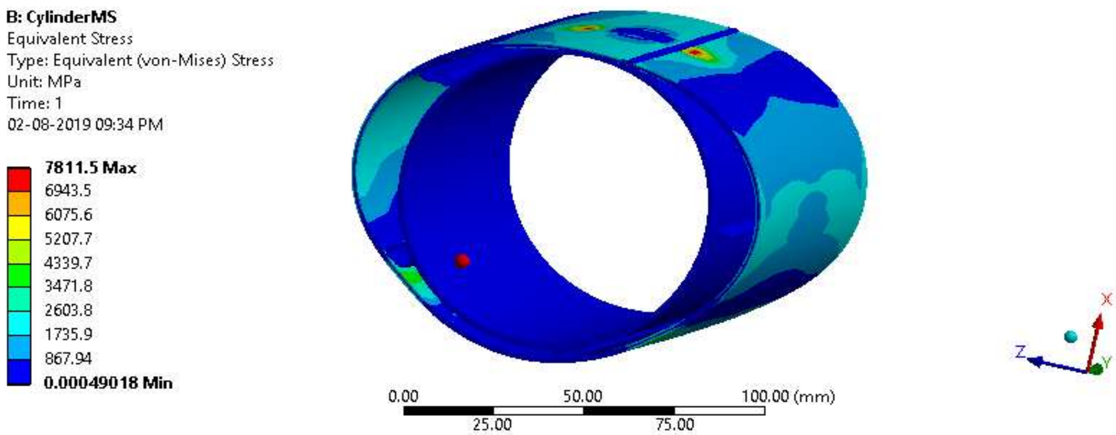
Deformation Analysis On copper Using Cylinder as Core Shape



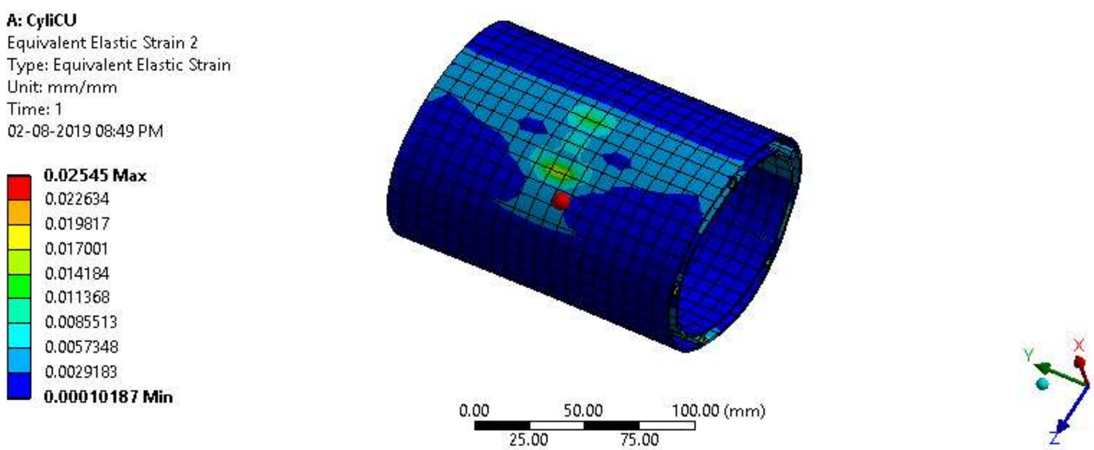
Deformation Analysis on Mild Steel Using Cylinder as Core Shape



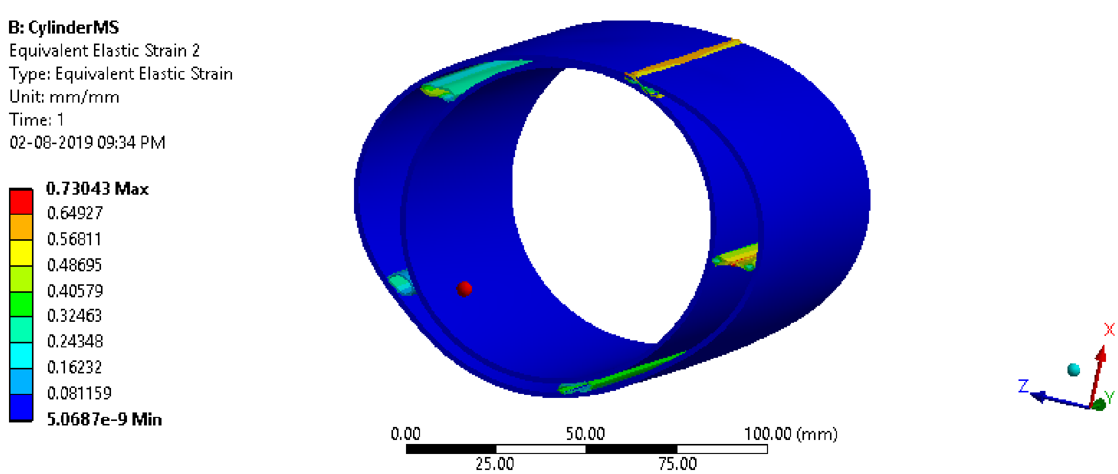
Stress Analysis On copper Using Cylinder as Core Shape



Stress Analysis on MildSteel Using Cylinder as Core Shape

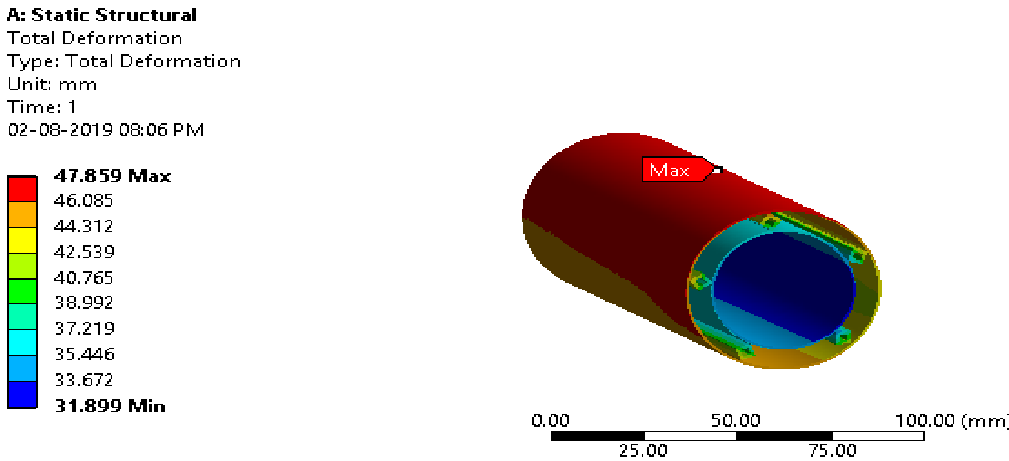


Strain Analysis on Copper Using Cylinder as Core Shape

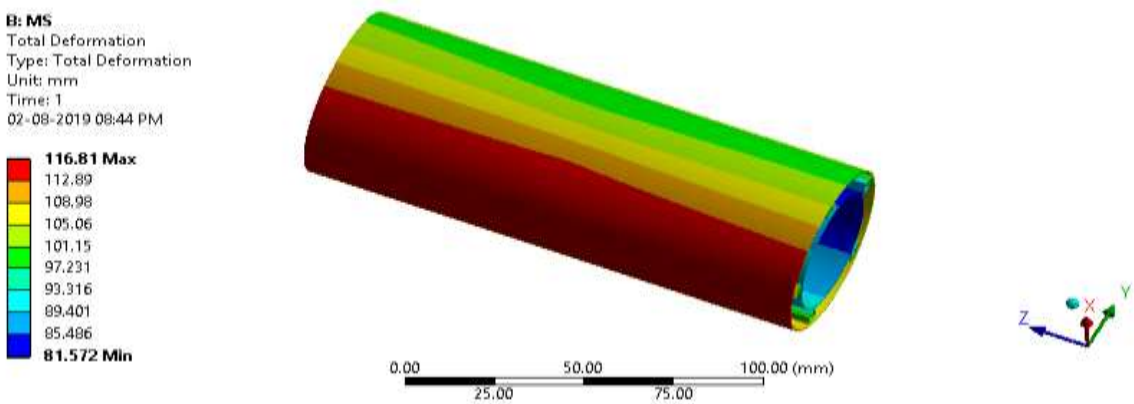


Strain Analysis on Mild Steel Using Cylinder as Core Shape

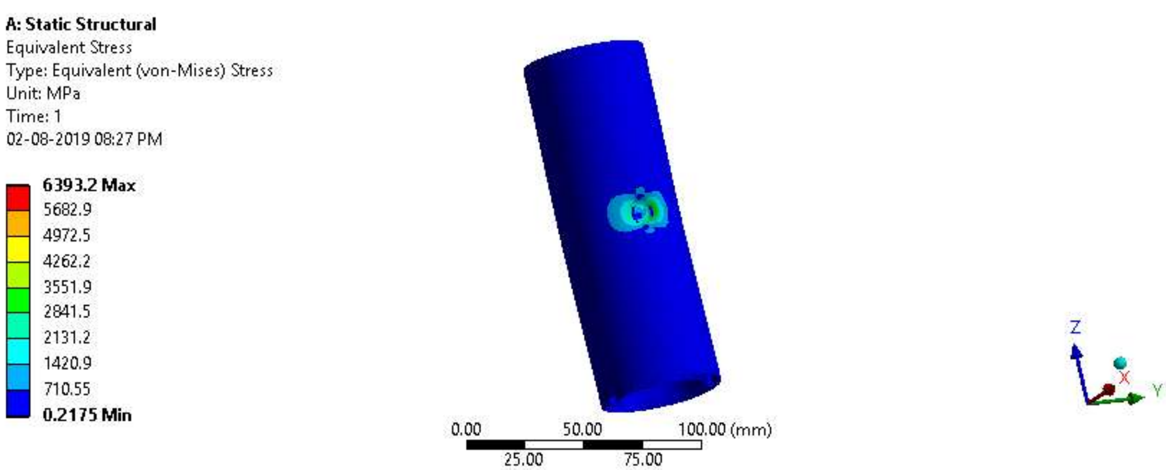
Square as a Core Shape



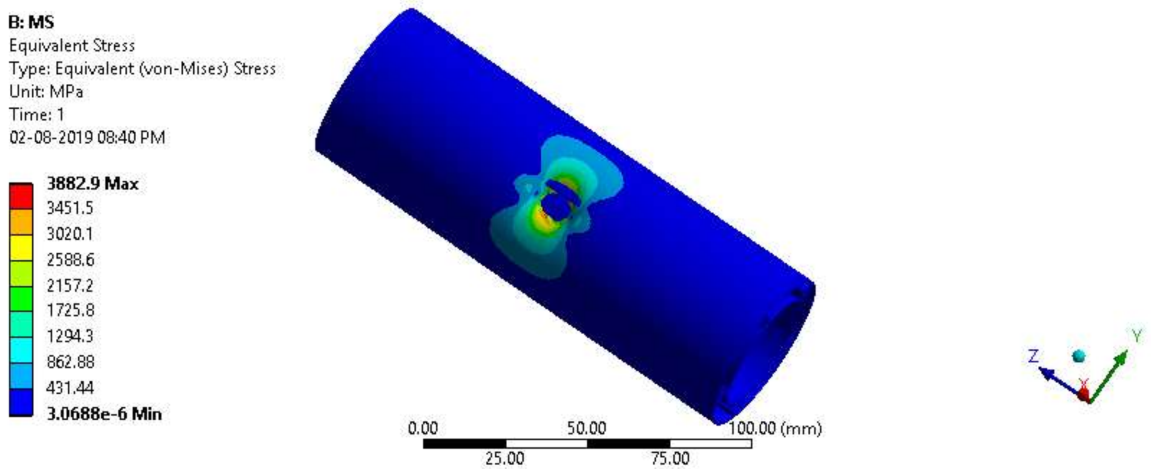
Deformation Analysis Copper Using square As Core Shape



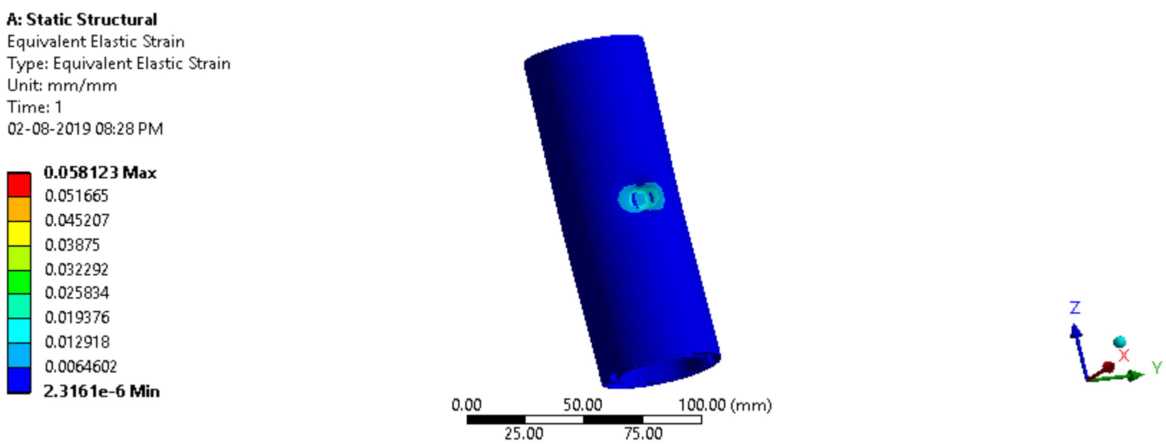
Deformation Analysis on Mild Steel Deformation Analysis on Mild Steel



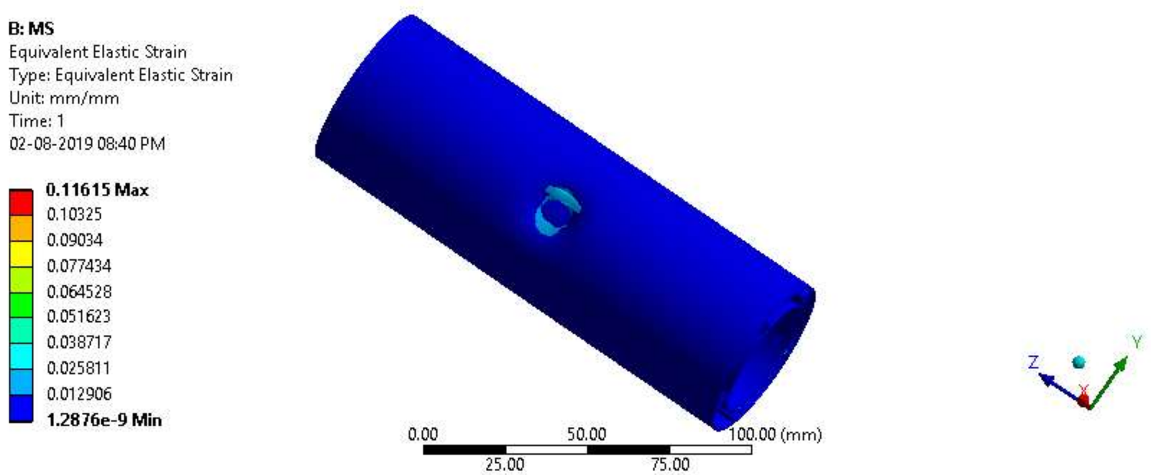
Stress Analysis On coppe using Square as Core Shape



Stress Analysis on Mild Steel Using Square as Core Shape



Strain Analysis on Copper Using Square as Core Shape



Strain Analysis on Mild Steel Using Square as Core Shape

RESULTS

SHAPE	MATERIAL	DEFORMATION (mm)	STRESS (Mpa)	STRAIN
CYLINDRICAL	copper	5.2535	3499.4	0.02545
	Mild Steel	17.008	7811.5	0.73043
SQUARE	copper	47.859	6393.2	0.058123
	Mild Steel	116.81	3882.9	0.11615

Based on stiffness of both cylinder core and square core computed at maximum allowable load. The pipe stiffness is given by

$$k = \frac{Load}{Deformation}$$

The above relation shows,

Stiffness of cylinder core pipe ,k_c=3426.28723715 N/mm

Stiffness of square core pipe k_s = 376.1048078731N/mm

CONCLUSIONS

- The sandwich pipes are wont to offer high strength to weight quantitative relation to supply strength properties
- Obeserving from the experimental testing the failure of cylinder core shape pipe occurred at a load of 18KN
- The Sandwich pipe line was designed two Core shapes Cylinder and square these are model by Cero software.
- Performance of three point bending test we found that the cylinder core gave more stiffness value when compare with square core.
- The numerical results of cylinder core are compare with experimental results

REFERENCES

[1] Pentti Kujala "Steel Sandwich Panels – From Basic Research To Practical Applications" 2 Vol.16/ISSN 0784-6010 year - 2002

[2] Jukka Säynäjäkangas and Tero Taulavuori, Outokumpu Stainless Oy, Finland "A review in design and manufacturing of stainless steel sandwich panels "stainless steel world Oktober 2004

[3] O.T. Thomson et al. (eds), sandwich structures 7; advancing with Sandwich Structure and materials, 3-12.

[4] Sixth frame work programme sustainable surface transport LITEBUS modular light eight sandwich bus concept ` executive summary in Sep-2009.

[5] Martti vilpas and antero kyrolainen -Novel stainless steel solutions in bus structures -Industrial systems review-2002

[6]Best Practice Guide for Sandwich Structures in Marine Applications Prepared by the SAND.CORe Co-ordination Action on Advanced Sandwich Structures in the Transport Industries Under European Commission Contract No. FP6-506330.

[7]Steel Sandwich Panel Construction, APRIL 2012, http://www.dnv.com

[8] Kujala Pentti and Klanac Alan- Analytical and Numerical analysis of non – symmetrical all steel sandwich panels under uniform pressure LOADInternational design conference - design 2002 dubrovnik, may 2002.

[9] Romanoff, J, Kujala, P., "Formulations for the Strength Analysis of All Steel Sandwich Panels", Helsinki University of Technology, Ship Laboratory, Otaniemi, 2002, M-266.Sandwich, "http://sandwich.balport.com/", Nov 2001.

[10] Narayan Pokharel" Behaviour and Design of Sandwich Panels Subject to Local Buckling and Flexural Wrinkling Effects " NOV-2003

[11] Pentti kujala, Alan Klanac," Steel Sandwich Panels in Marine Applications" PrihvaÊeno, May 2005

[12] Davies J. M., , "Lightweight sandwich construction." Blackwell Science, Iowa, USA, 2001 http://www.ccs.org.cn, Alenius, M., Hänninen, H., Fabrication and properties of stainless steel sandwich structures, Helsinki University of Technology Laboratory of Engineering Materials, Publication TKK-MTR-2/99s Kujala,P., Romanoff, J., Salminen, A., Varis, J.,Vilpas, M., Teräksiset kerroslevyrakenteet (title in English: All Steel Sandwich Panels), Metalliteollisuuden keskusliitto, MET, 2003 Kujala, P., Metsä, A. & Nallikari, M., "All Steel Sandwich Panels for Ship Applications", Shipyard 2000: Spinoff Project, Helsinki University of Technology, Ship Laboratory, Otaniemi, 1995, M-196. Zenkert, D., "An Introduction to Sandwich Construction", Chameleon Press LTD, London, 1995