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Design and Analysis of Washing Machine Drum

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ABSTRACT

In this paper a Washing Machine Drum is built in solid works 22016 design software and analysed in ANSYS 14.5 software. The aim is to help Askoappliances for conducting similar analysis for future manufacturing of high capacity drums by reducing experimentation. The analysis is mainly concerned with an evenly distributed load at a constant angular velocity. The load is applied with the help of lead plates instead of clothes. The three dimensional model of the Drum is created using the solid works software. The model is imported to ANSYS 14.5, where the boundary conditions, loads and constraints are given and the analysis is made.

INTRODUCTION

Washing machines are commonly used in almost every home worldwide. These appliances make it easy to clean clothing; a process that time ago was heavy and unpleasant. The performance of these machines is based on the rotation of the clothes inside a cylinder while they are mixed with water and some kind of cleaning powder or soap. It is not hard to imagine that the load of these clothes, when they are soaked in water can create big reaction forces in the cylinder when they are rotating. This situation makes it very important to calculate accurately and for safety side the mechanical characteristics of the cylinder mentioned and the tripod that transmits the turning forces to the cylinder.

LITERATURE REVIEW

- Cristiano Spelta et al, in his work explained about the analysis and design of a control system for the reduction of the mechanical vibration and the perceived acoustic noise in a washing machine.
- Ms. NehaVirkhare and Prof. R.W. Jasutkar described about the washing machine system consists of the neuro - fuzzy and fuzzy techniques that will help the system to take its own decisions like release of water and washing powder as per need of cloth.
- FengTyan et al, in his work explained about the multibody dynamic model is developed for a front loading type washing machine in details.
- Sunil Patel and S.A. Kulkarni explained about the optimization of crosspiece of washing machine.
- SeiichirouSuzuk in his work described the vibration simulation result of the washing machine.
- A.K.Ghorbani-Tanha et al, describes about the Operation of home appliances like washing machines can produce undesirable vibrations and noise and their purpose of this study is to analyze and develop a control system for vibration reduction of washing machines employing smart materials.
- MorioMitsuishi and Yutaka Nagao describes how a Finite Element Analysis model of washing machine dehydration dynamics were developed and validated with operating test measurement results.
- Sichani et al, in his work explained about the structures which are excited during their

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normal operation can be studied with operational modal analysis (OMA) methods.

SOLID WORKS

Solid works mechanical design automation software is a feature-based, parametric solid modeling design tool which advantage of the easy to learn windows ™ graphical user interface. We can create fully associate 3-D solid models with or without while utilizing automatic or user defined relations to capture design intent.

Parameters refer to constraints whose values determine the shape or geometry of the model or assembly. Parameters can be either numeric parameters, such as line lengths or circle diameters, or geometric parameters, such as tangent, parallel, concentric, horizontal or vertical, etc. Numeric parameters can be associated with each other through the use of relations, which allow them to capture design intent.

CREATION OF 3D MODEL

By using various commands in solid works 2016 design software we modeled the washing machine drumThe different views of the model are shown in below fig:

Fig 1: washing machine drum

PREPARATION OF MODEL

The modeled drum is converted to IGES File, so that it is imported to Ansys to perform the stress analysis. ANSYS Workbench Platform is used for the same.

INPUTS TO ANSYS

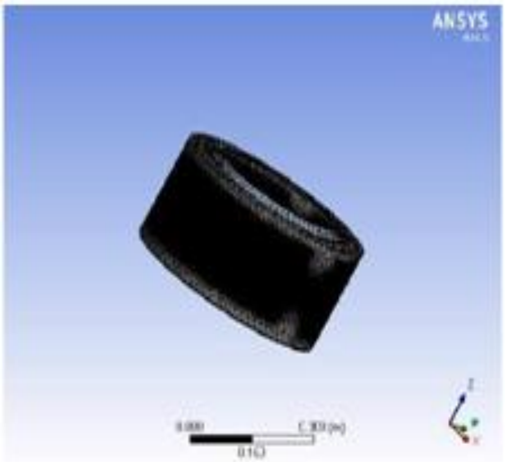
The part exists; define a library of the materials (Stainless Steel) that compose the object being modeled. This includes thermal and mechanical properties**.**The Properties of stainless steel is given in Table 1.

Material Data

Density	7.75e-006 kg mm^-3
Young's Modulus Pa	1.93e+005
Poisson's Ratio	0.31
Coefficient of Thermal Expansion	1.7e-005 C^-1
Specific Heat	4.8e+005 mJ kg^-1 C^-1
Thermal Conductivity	1.51e-002 W mm^-1 C^-1
Resistivity	7.7e-004 ohm mm

Meshing

Meshing the entire drum is done by small tetrahedral pieces called elements that share common points called nodes. Ansys suggests a global element size and tolerance for meshing. The size is only an average value, actual element sizes may vary from one location to another depending on geometry. It is recommended to use the default settings of meshing for the initial run. For a more accurate solution, use a smaller element size. The meshed model is shown in figure



Load & Constraint

Once the system is fully modelled, the last task is to burden the system with load and constraints, such as physical loadings or boundary conditions. The analysis is mainly concerned with an evenly distributed load at

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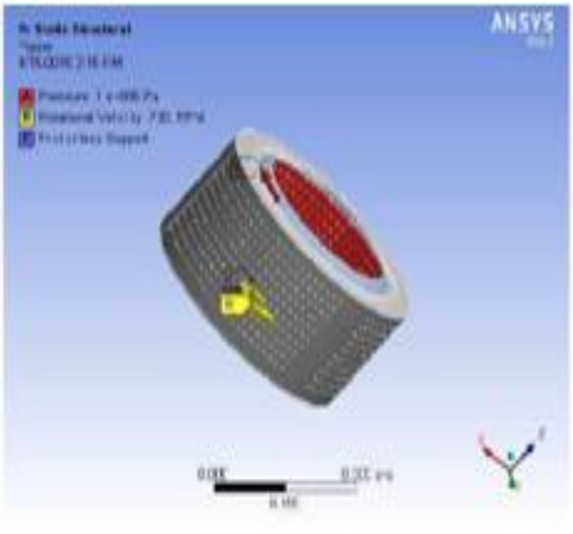
a constant angular velocity. The load is applied with the help of lead plates instead of clothes. Pressure, Rotational Velocity 700RPM, Frictionless Support of Drum are exposed in figure

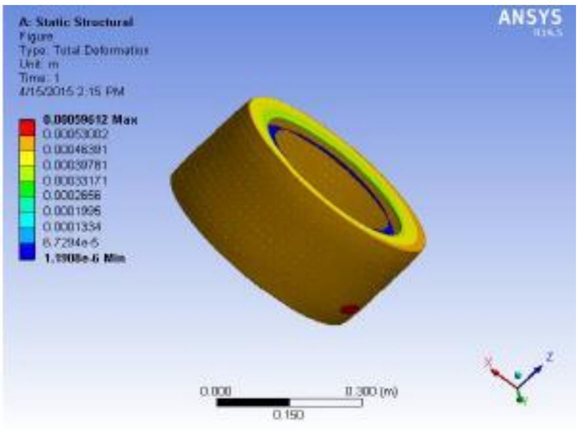


Pressure, Rotational Velocity, Frictionless Support are applied to the drum.

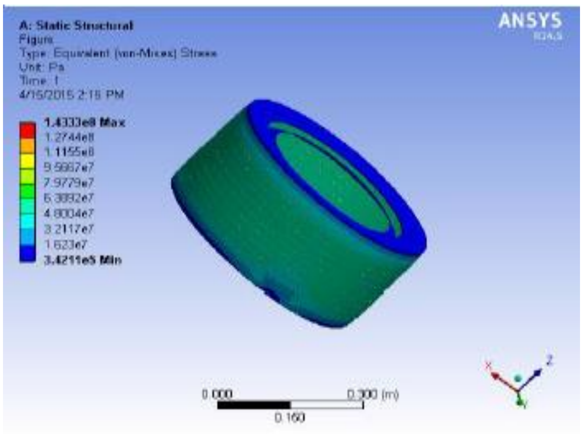
RESULTS

The Total Deformation, Equivalent Stress Distribution, Normal Stress Distribution, Normal Elastic Strain Distribution, Shear Stress, Shear elastic strain Distribution, Stress intensity and Elastic Stress intensity of the washing machine Drum was shown below.

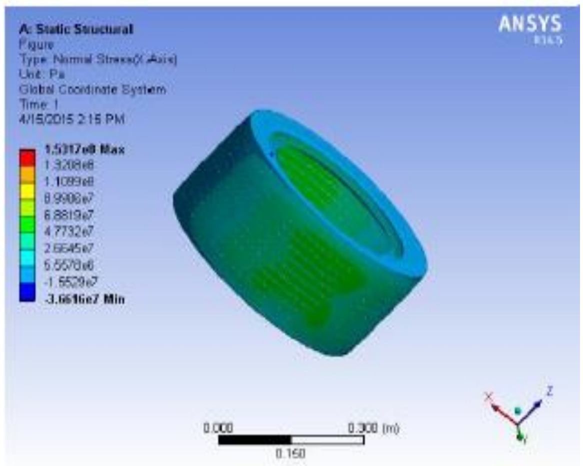
Total Deformation



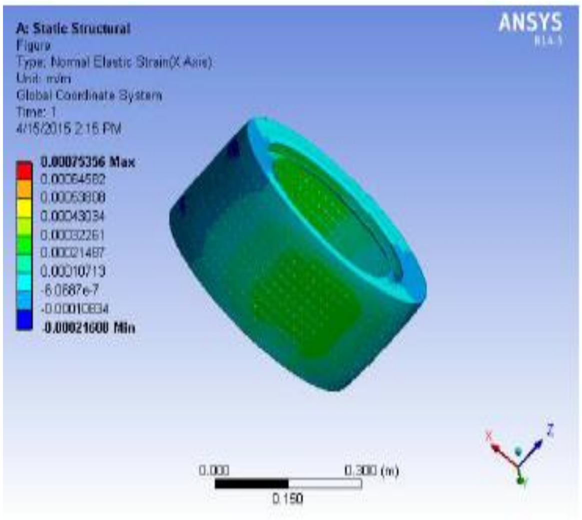
Equivalent Stress Distribution



Normal Stress Distribution



Normal Elastic Strain Distribution



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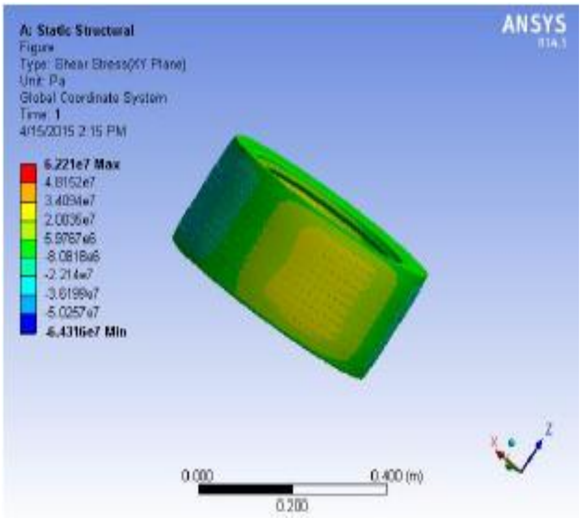
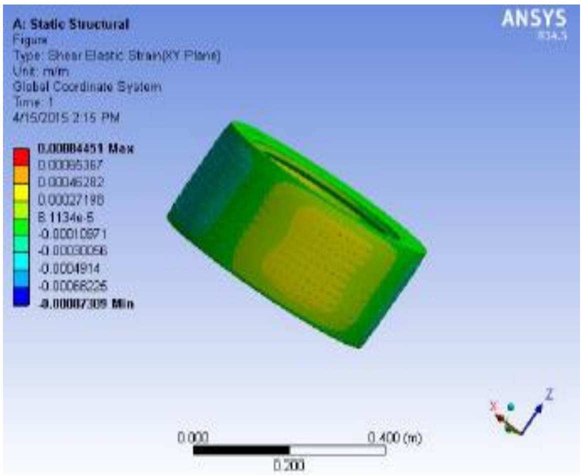
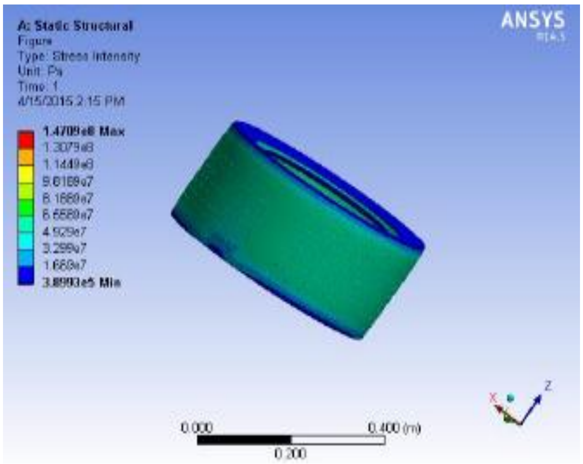
Shear Stress



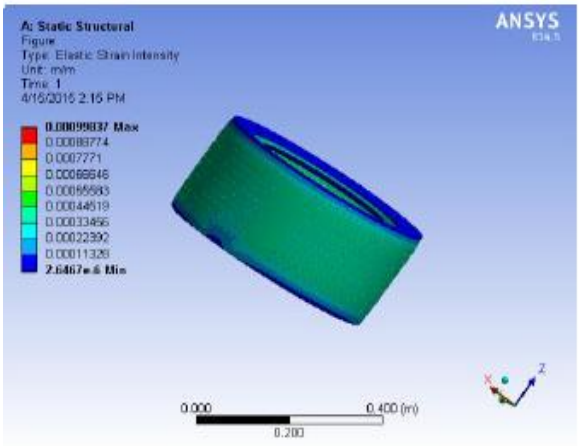
Shear elastic strain Distribution



Stress intensity



Elastic Stress intensity



APPLICATIONS

The steel's resistance to corrosion and staining, low maintenance and familiar luster make it an ideal materialfor many applications. There are over 150 grades of stainless steel, of which fifteen are most commonly used. The alloy is milled into coils, sheets, plates, bars, wire, and tubing to be used in cookware, cutlery, household hardware, surgical instruments, major appliances, industrial equipment (for example, in sugar refineries) and as an automotive and aerospace structural alloy and construction material in large buildings. Storage tanks and tankers used to transport orange juice and other food are often made of stainless steel, because of its corrosion resistance. This also influences itsuse in commercial kitchens and food processing plants, as it can be steam-cleaned and sterilized and does not need paint or other surface finishes. For the drum is usually subjected to water and soap solutions the stainless steel is a right choice.

CONCLUSION

- The 3D model is prepared in solidworks 2016 design software by using various commands
- Then the file is converted to igs to import in ansys software
- Then CAE analysis is performed using ANSYS-14.5.
- Material properties are studied
- About the design software and fem are discussed

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- Fine meshing is done through the ansys software
- The Total Deformation, Equivalent Stress Distribution, Normal Stress Distribution, Normal Elastic Strain Distribution, Shear Stress, Shear elastic strain Distribution, Stress intensity and Elastic Stress intensity of the washing machine Drum was found.

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