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Static structural analysis of split muff coupling under maximum load conditions

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ABSTRACT

The split muff coupling is also called as compression coupling. It is a rigid coupling, the main advantage of this coupling is that it runs at heavy load with a moderate speed. In current paper static structural for the coupling is done using Ansys Workbench 2019 and the CAD model is created using Solidwork . This paper deals with Static Structural analysis of Split Muff Coupling under maximum torsional load condition. Static Structural is much needed and monitoring that for maximum loading conditions for Split Muff Coupling approach can be used for prophecy purpose.

Keywords: *Ansys, Coupling, Workbench, Split Muff Coupling, Static Structural.*

1. INTRODUCTION

The devices which are used to connect the shafts which are normally coaxial with slight or no misalignment are known as Couplings. In practical scenario applications there arise several cases where two shafts have to be connected so that power from driving shaft is transmitted to driven shaft without any change of speed having efficiency 100%. Several types of couplings are used in practice. Muff or sleeve coupling is the simplest form of a coupling. It consist a steel or cast iron sleeve fitted on the ends of shaft to be connected. The sleeve is connected to the shaft by means of keys. Split Muff coupling has the features like simplicity of construction due to very few components, ease in assembly and dismantling, simple and easy to maintain as their high torque capabilities make them suitable for high transmission applications, no lubrication is required due to rigid connection, low operational cost as no lubrication is required and maintenance is minimal, operational cost is very low and smooth and quiet operation due to no moving parts a thus noiseless operation.

RULES AND CONSTRAINTS FOR THE SPLIT MUFF COUPLING A Split Muff Coupling acts as a connector between the driver and driven shaft. The power is been transmitted using muff coupling. The halves of the split muff are made of cast iron. One-half of the muff is fixed from below and the other half is placed from above. The two halves of sleeve are clamped together by means of mild steel studs or bolts and nuts. This coupling may be used for heavy duty and moderate speeds. Shafts are designed on the basis of torsional shear stress induced because of the torque to be transmitted. Shear stress induced in shaft for transmitting torque. Rigid coupling are torsional stiff couplings with virtually zero windup under torque loads. If any deviation is present in the system unbalanced forces will cause the shafts, bearings or coupling to fall prematurely. Rigid couplings are mostly not suitable to run at high rpm because of it cannot compensate any static structural changes in the shaft due to high rpm , however in the situation where deviation or misalignment can be fully controlled rigid couplings often excellent performance characteristics. Hence, a proper analysis of the split muff coupling has carried out which tend to withstand and adapt to the maximum load condition.

2. METHODOLOGY

The methodology goes with material selection, secondly cad modeling using Solid Works 2018 and thirdly analysis using Ansys Workbench 2019.

3. MATERIAL SELECTION

The material used to manufacture the coupling also affects its performance and sustainability. Materials are typically aluminum alloy ,stainless steel, mild iron and carbon steel . Here I this research we have used structural steel as the material

MILD STEEL		
QUANTITY	**VALUE**	**UNIT**
Density	**7.87**	**g/cm3**
Tensile strength Ultimate	**440**	**MPa**
Tensile Strength, yield	**370**	**Mpa**
Youngs Modulus	205	Gpa
Poisson Ratio	0.29	

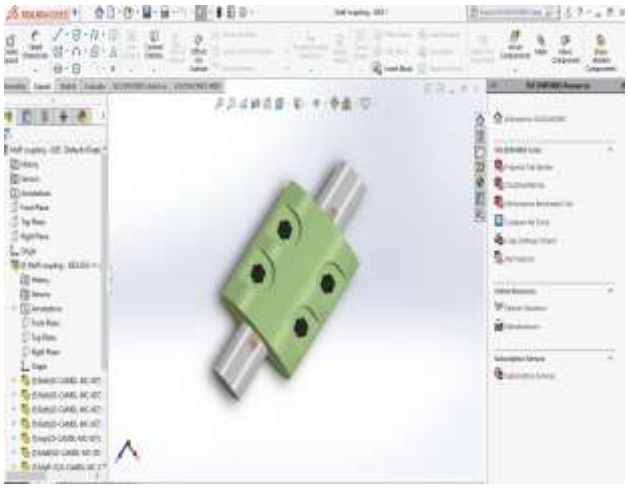
Forces on Coupling

Power transmission couplings are widely used For modification of stiffness and damping in Power transmission systems. The torsional force acting on the coupling. It's a moment around

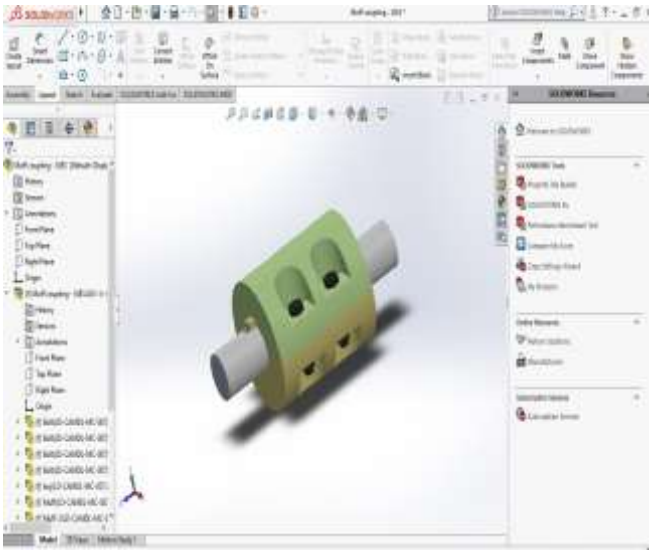
when one shaft is been fixed and is given 70000N/mm torque.

4. CAD MODEL

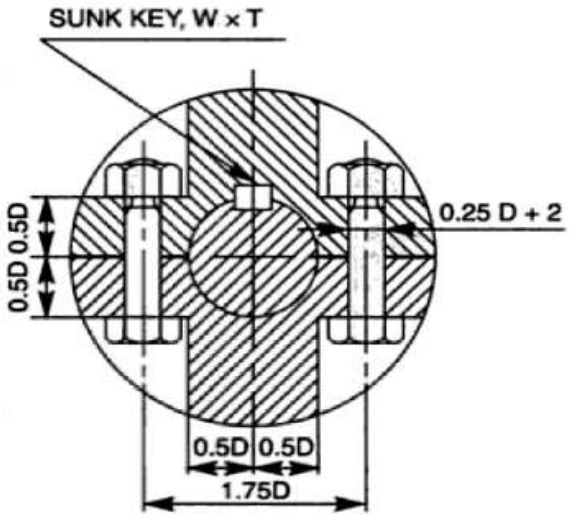
The Split Muff Coupling was designed in 3D modeling software namely Solidworks 2018. According to the above forces taken into consideration, the design is made. The volume for the given part is 5.123e+005mm^3. And the mass is 4.0215 kg. Figure 3.1 3.2 and 3.3 represents the CAD model.

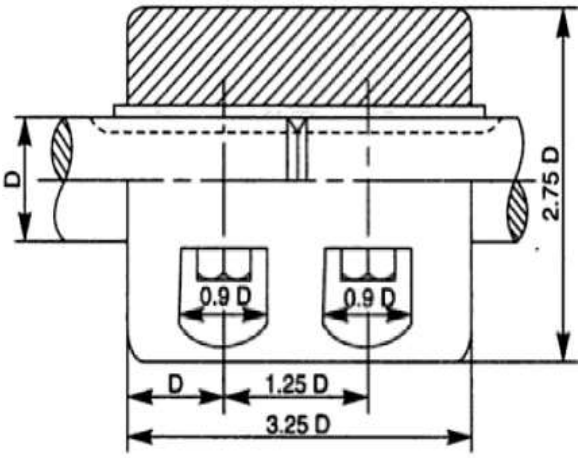


3.1



3.2





3.3

The reason for choosing Solidworks as the modeling software is because its mechanical design products allow the user to create parts in a highly productive and intuitive environment, to enrich existing mechanical part design with wireframe and basic surface features. There are a lot of build in application which help the creator to design efficiently. Solid works also provides advanced drafting capabilities through the associative drawing generation from 3D part and assembly designs. Mechanical Design products can address 2D design and drawing production requirements with a stand-alone state-of-the-art 2D tool Interactive Drafting. One can create any type of 3D part, from rough 3D sketches to fully detailed industrial assemblies. The unbreakable relational design - a new way to manage links between objects and related behaviors in configured assemblies. It also enables a smooth evolution from 2D- to 3D-based design methodologies.

5. ANALYSIS

It plays a vital role in engineering design as the results of the analysis of the analysis of the split muff coupling CAD model is been carried out in ANSYS Workbench 2019. The main aim of the analysis is to find the stress formation on the hub during the action of load in all condition. Static Structural Analysis is used to determine the effect of loads on the physical bodies. Applied mechanics, Mathematics, Material Science is used to compute the deformation, stresses, forces, reactions and stability of the object. object are used to verify its fitness and effectiveness for use.

The Ansys setup for the given part is done as follows:
Firstly the geometry selection for the given part is done. Then model for the cad of the coupling is been imported and it is loaded to the system. As soon as the model is loaded, the mesh setup is done. The meshing sizes were selected as 1 and 2mm. Also, the mesh type is selected as default triangular. For application of the force, static structural is selected and the face selection is done with required faces. Finally after applying total deformation and total stress the diagrams are been generated by the software.

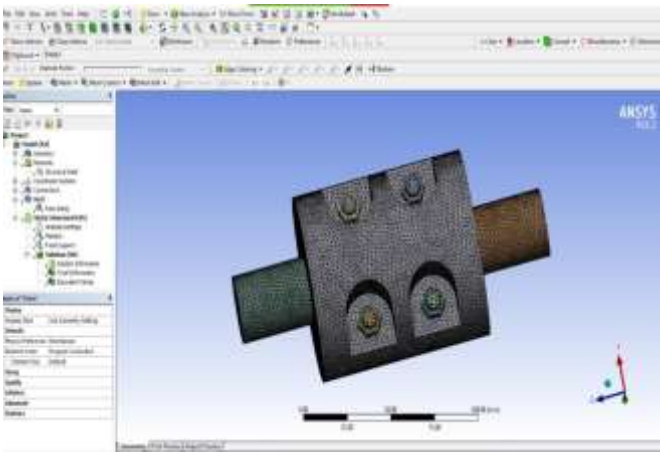
6. MESHED MODEL

The main work of meshing is to divide the part into number of domains known as elements, over which the further process is been implemented. These equations approximately represent the governing equation of interest via a set of polynomial functions defined over each element. As these elements are made smaller and smaller, as the mesh is refined, the computed solution will approach the true solution. The selected element is a three-node beam element in 3-D. With default settings, six degrees of freedom occur at each node; these include

translations in the x, y, and z directions and rotations about the x, y, and z directions.

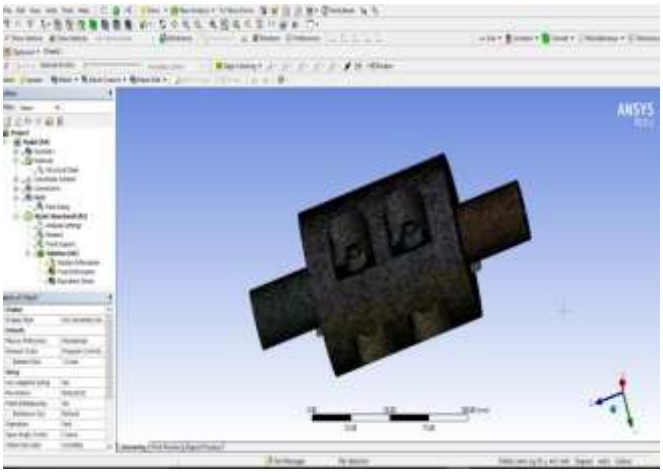
Here, we make use of tetrahedral mesh since there are a lot of curvatures. The images for the meshed model are also attached.

For 1mm Mesh



4.1

For 2 mm Mesh

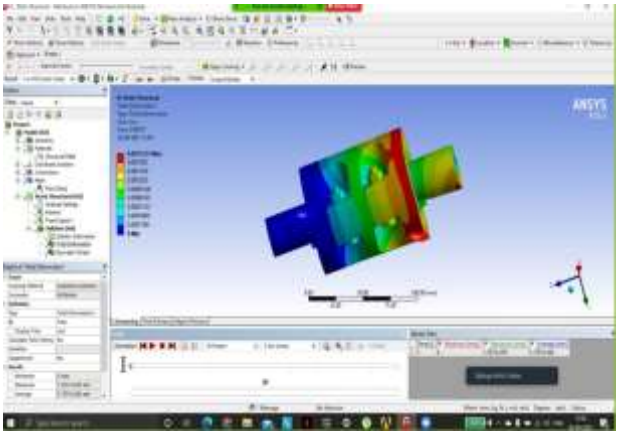


4.2

3C.B ANALYSIS RESULTS

The part was forced with a moment force . The moment force of 70000 Nmm was applied with one of the shaft fixed.
The analysis results for the meshed coupling is as follows:

For 2mm

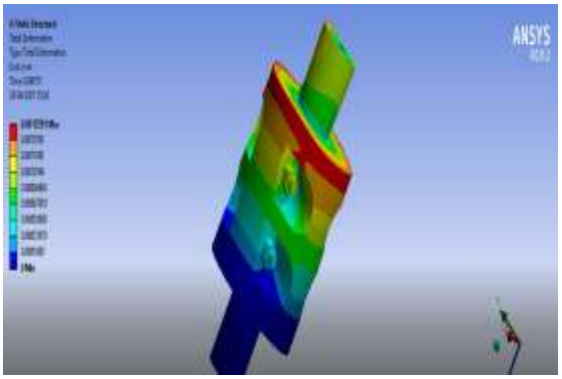


5.1

Parameters	Values
Analysis Type	Structural Analysis
Meshing Method	Beam Method
Element Type	Default triangular
Element Size	2 mm
Mesh Type	3D
Solver	Sparse Direct

Parameters	Values
Analysis Type	Structural Analysis
Meshing Method	Beam Method
Element Type	Default triangular
Element Size	1mm
Mesh Type	3D
Solver	Sparse Direct

For 1mm



5.2

7. CONCLUSION

In this paper we have completed the static structural analysis of split muff coupling for 2mmand 1mm meshing size with 70Nm moment force doesn't gives us more deformation**. (**The deformation didn't exceeded the elastic limit**)** From all above experiment work it is proved that split muff coupling is safe for use as higher load Factor of safety for split muff coupling can vary between 4-5 .

8. REFERENCES

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