

Design and Analysis of Companion Flange

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Abstract - A companion flange is a flange that corresponds to another flange. Companion Flanges can be supplied as assemblies with Universal Drive shafts. The objective of this paper is to design and analyze a companion flange for torque transmission. This work deals with the replacement of carbon steel material companion flange with a stainless steel companion flange. The modeling of the companion flange assembly was done using CREO software. The Companion flange is modeled and simulation using ANSYS 15 Software. The design optimization also showed significant potential improvement in the performance of Companion Flange. In the present work an attempt has been made to estimate the deflection and stresses under subjected loads using FEA. The finite element analysis procedure required in ANSYS simulation is present as a predefine process to obtain accurate results.

Index Terms - ANSYS Workbench, CREO 2.0, companion flange

I. INTRODUCTION

A companion flange is a flange that corresponds to another flange. Having bolt holes that align with another flange is a trait of this type of flange. Companion Flanges can be supplied as individual components or as assemblies with Universal Drive shafts. It allows connection of a flange yoke to another type of connection, for proper torque transfer.

The overall objective of this paper is to design and analyze a companion flange for torque transmission. This work deals with the replacement of carbon steel material companion flange with a stainless steel companion flange. In this present work an attempt has been to estimate the deflection, stresses under subjected loads using FEA.

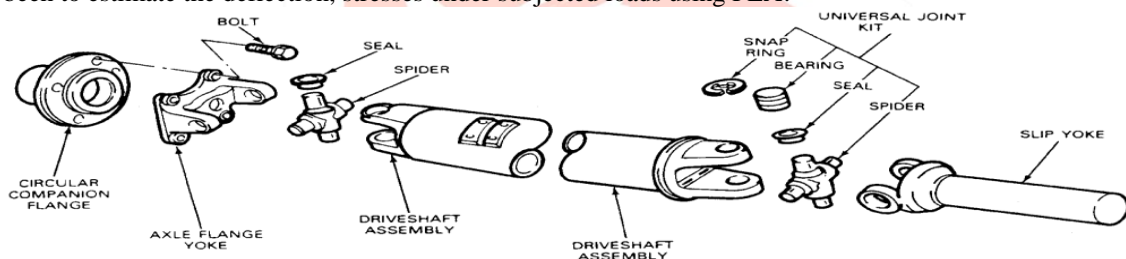


Fig.1 Position of companion flange

II. MATERIALS & METHODS

2.1 Modeling of Companion Flange

The 3D Model of companion flange is done using CREO.



Fig.2 3D model of companion flange.

In this study the mechanical properties of the companion flange are treated to be Isotropic, homogenous and linear elastic. The AISI 204 material is selected for Companion flange which is being compared with SAE 1141, which is used nowadays. The Table shows the properties of the SAE 1141 & AISI 204.

Table 1 Mechanical Properties of SAE 1141

Density	7.8e3 kg m ⁻³
Yield Strength	390 MPa
Tensile Strength	660 MPa
Young's modulus	215 GPa
Poisson's ratio	0.295

Table 2 Mechanical Properties of AISI 204

Density	7.81e3 kg m ⁻³
Yield Strength	415 MPa
Tensile Strength	795 MPa
Young's modulus	201 GPa
Poisson's ratio	0.275

2.2 Finite Element Model

For the present study ANSYS Workbench 15.0 is used. The Companion Flange model is imported in to Workbench. The imported model is meshed using tetrahedral elements.

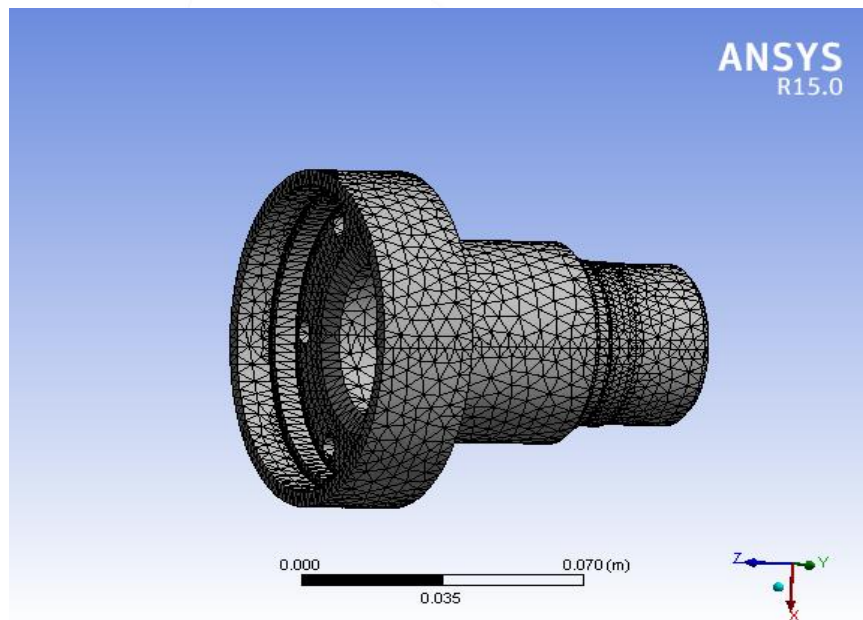


Fig.3 FE model.

2.3 Boundary conditions

Applying three boundary conditions, a Moment of 610 Nm, a force 20333 N and a fixed end.

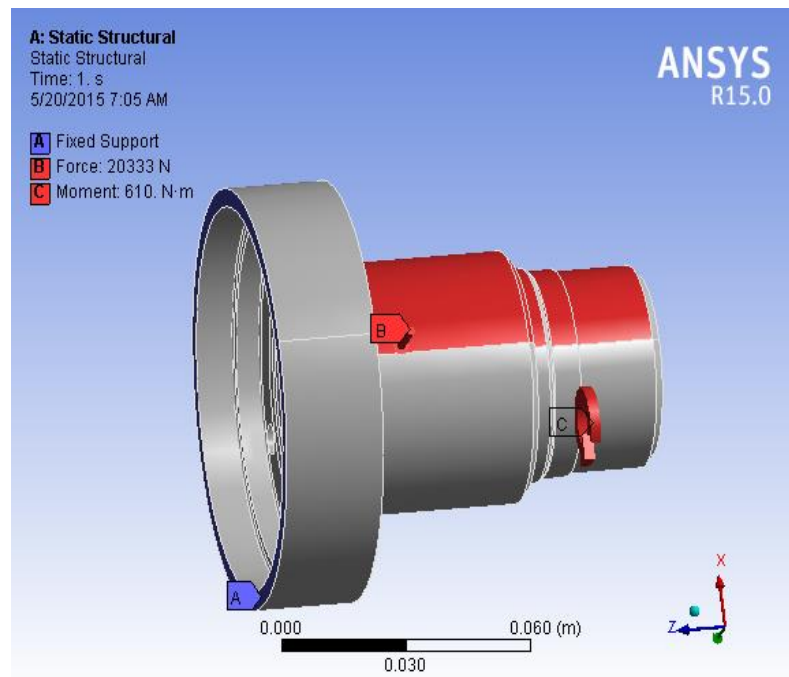


Fig.4 Boundary condition on flange

III. RESULT

In the present FEA study Total deformation & equivalent Stress are considered for evaluating the results. The Total Deformation of the SAE1141.

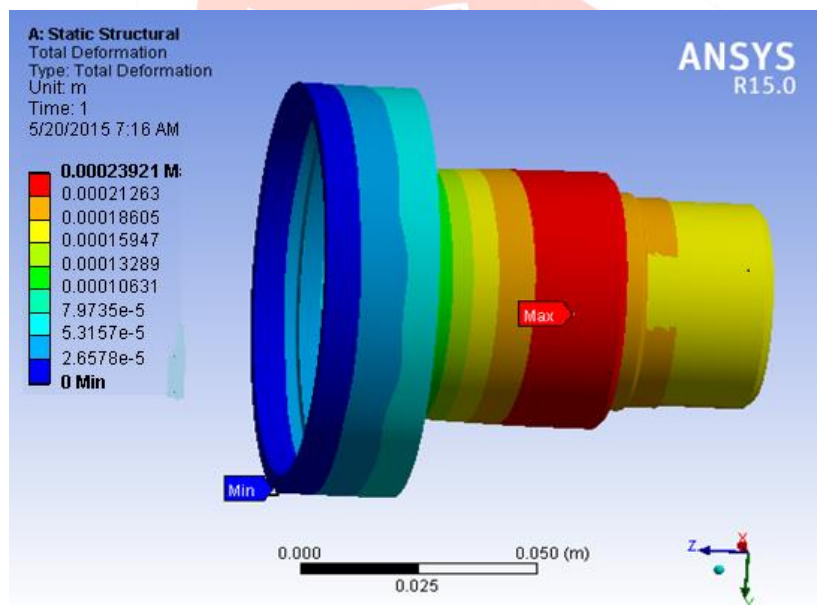


Fig.5 Total deformation SAE 1141

When the load is applied on top side of companion flange which is towards the drive shaft connection. The Total Deformation of the SAE 1141. The values obtained are the Maximum Deformation is 0.2392 mm. The deformation of this part is 0.2392 mm, which can be seen from the above figure 5.

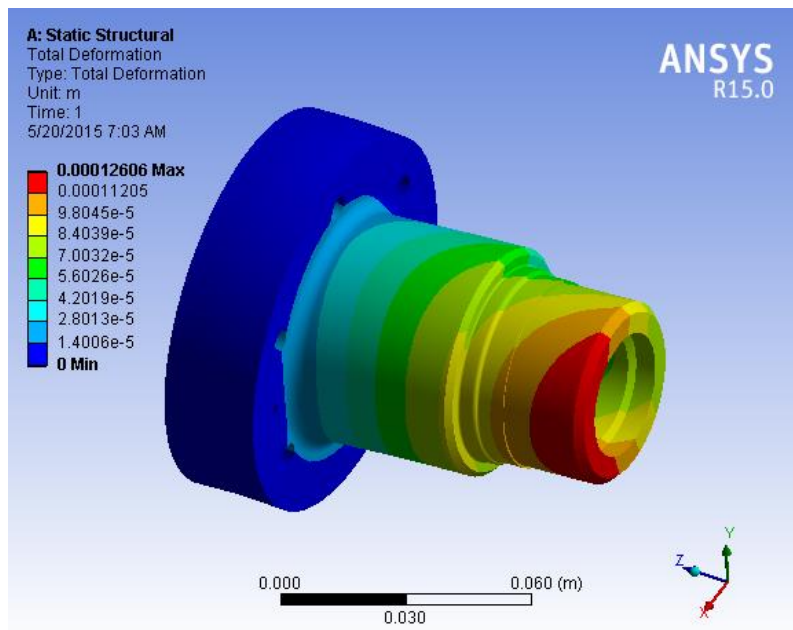


Fig. 6 Total deformation AISI 204

When the load is applied on top side of AISI 204 material flange which is towards the drive shaft connection. The Total Deformation of the AISI 204, the values obtained are the Maximum Deformation is 0.1260 mm. The deformation can be seen from the above figure 6. This deformation is less than SAE 1141.

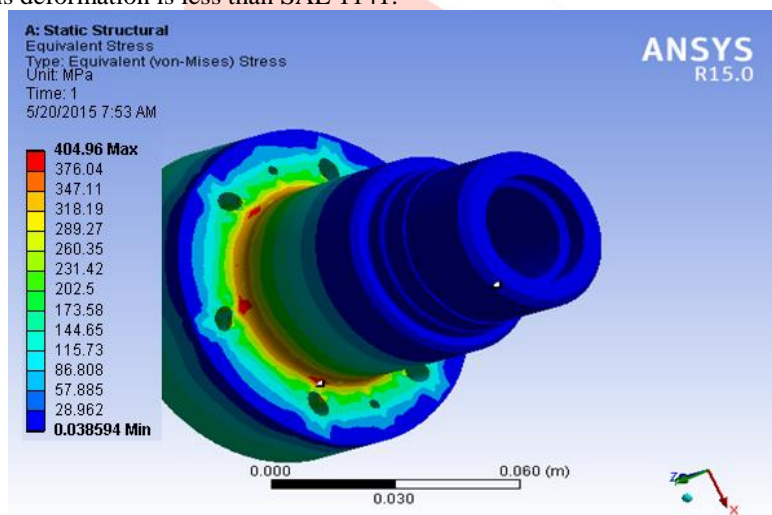


Fig.7 Equivalent Von-Misses Stress Of SAE 1141

The above figure 7 shows equivalent Von-Misses stress of SAE 1141 Material. Here, from the figure we can get clear idea regarding all the stresses induced in the component in static loading condition. The maximum stress induced here is 404.96 Mpa and a minimum of 0.03859 Mpa.

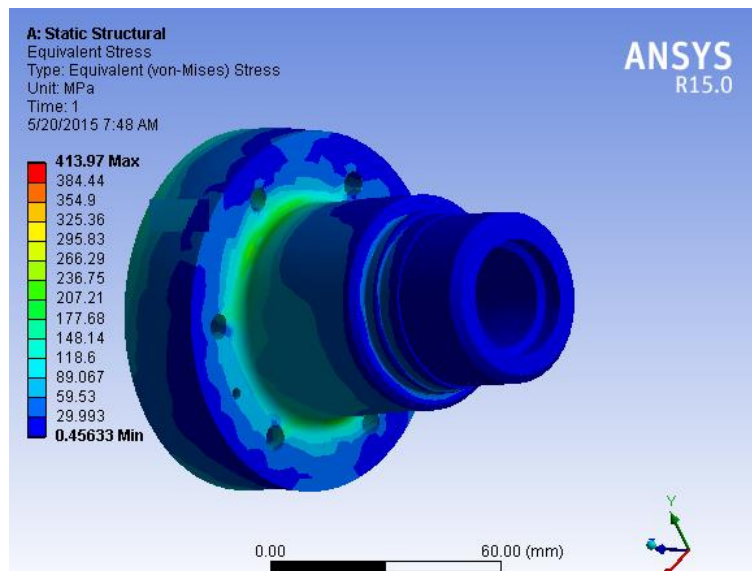


Fig.8 Equivalent Von-Misses Stress AISI 204

The above figure 8 shows equivalent Von-Misses stress of AISI 204 Material. Here, from the figure we can get clear idea regarding all the stresses induced in the component in static loading condition. The maximum stress induced here is 413.97 Mpa and a minimum of 0.45633 Mpa.

Table 3 Optimal design values of Companion Flange Static Structural Analysis

	SAE 1141	AISI 204
Von-Misses stress(max)	404.96 MPA	413.97 MPA
Total deformation (max)	0.2392 mm	0.1260 mm

IV. CONCLUSION

The finite element analysis tool, ANSYS has been used to analyze the companion flange. The results obtained from the static structural analysis shows that AISI 204 steel is better than SAE 1141 steel. It is observed that the AISI 204 steel flange is safe for the required application.

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