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FEA Analysis of 5-D Coupling for Parallel Angular Transmission

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Abstract

Five dimensional coupling is a mechanical transmission system used to transmit the mechanical power in parallel as well as angular offset. The main function of coupling is to transmit the power from input shaft to output shaft without any loss. There are many types of couplings used for power transmission. In this transmission system three linear offset & two angular offset are present. Five dimensional coupling gives the step less variation in power transmission. Generally coupling used in power transmission have maximum friction, also power losses. By using five dimensional coupling all losses can be avoided.

This paper explains the detail analysis of coupling is done by using the ANSYS software. This gives the detailed information about the increase or decrease in stresses with respect to input power.

Introduction

A coupling is a device used to connect two shafts together at their ends for the purpose of transmitting power. Couplings do not normally allow disconnection of shafts during operation, however there are torque limiting couplings which can slip or disconnect when some torque limit is exceeded. The primary purpose of couplings is to join two pieces of rotating equipment while permitting some degree of misalignment or end movement or both. By careful selection, installation and maintenance of couplings, substantial savings can be made in reduced maintenance costs and downtime.

Fig. Prototype Model of 5D coupling Software

Modeling & Analysis

FEA Analysis of Input Shaft

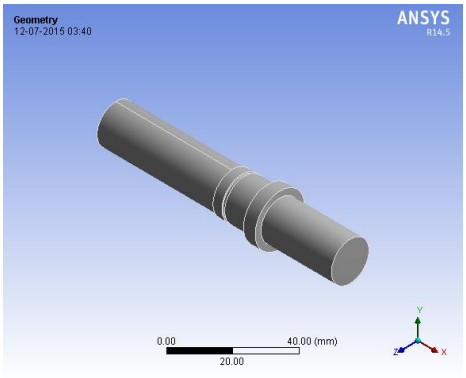

Fig.3D Modeling of Input Shaft

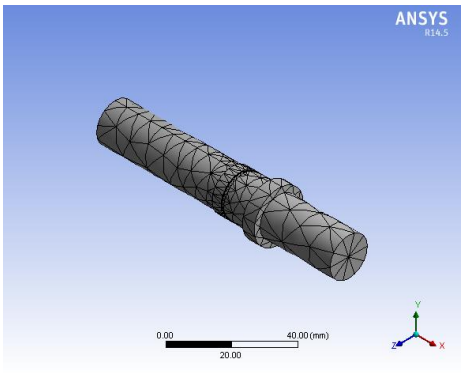

Fig. Meshing of Input Shaft

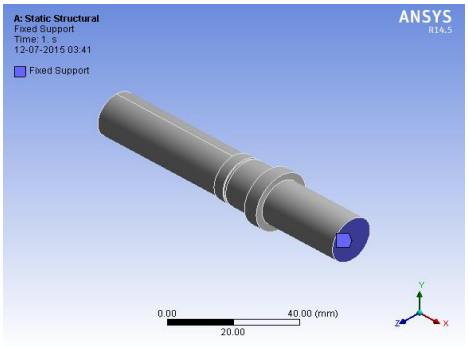

Fig. Fix One End of Input Shaft

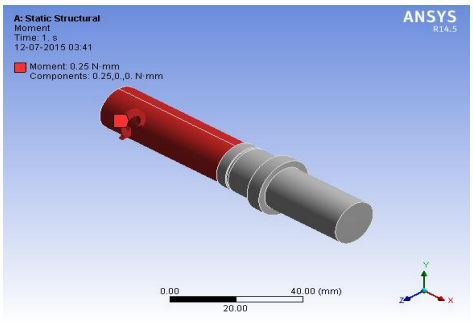

Fig. Apply Force at one End of Input Shaft

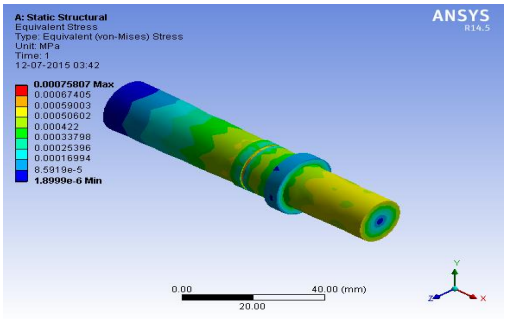

Fig. Equivalent Stresses on Input Shaft

Result & Discussion

Part Name	Maximum theoretical stress N/mm^2	Von-mises stress N/mm^2	Result
INPUT SHAFT	0.310	0.007	safe

Conclusion

Maximum stress by theoretical method and Von-mises stress are well below the allowable limit; hence the ring cage is safe.

FEA Analysis of LH Coupler Disk

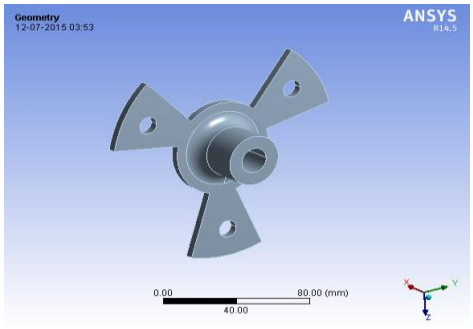

Fig. Modeling of LH Coupler Disk

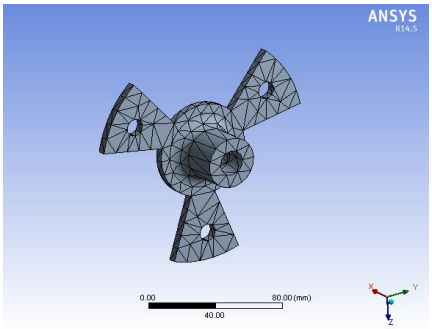

Fig. Meshing of LH Coupler Disk

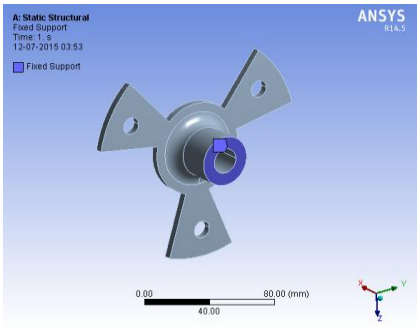

Fig. Fix the LH Side of Coupler Disk

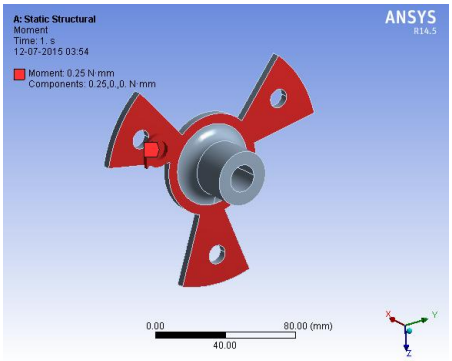

Fig. Apply Force on circumference of Coupler Disk

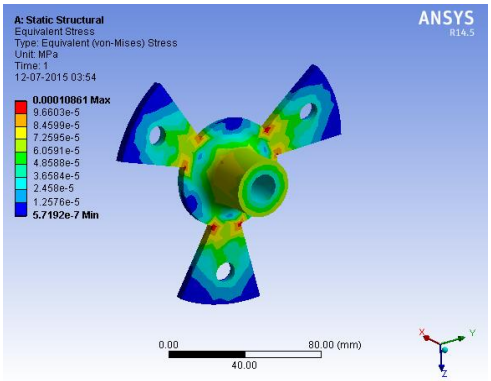

Fig. Equivalent Stresses on LH Coupler Disk

Result & Discussion

Part Name	Maximum theoretical stress N/mm^2	Von-mises stress N/mm^2	Result
LH COUPLER DISK	0.028	0.0001	safe

Conclusion:-

Maximum stress by theoretical method and Von-mises stress are well below the allowable limit; hence the LH COUPLER DISK is safe.

FEA Analysis of Mid Coupler Disk

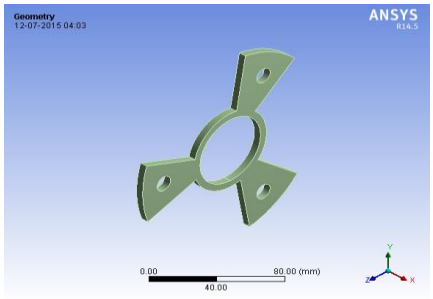

Fig. Modeling of Mid Coupler Disk

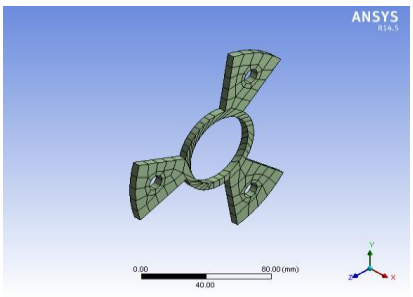

Fig. Meshing of Mid Coupler Disk

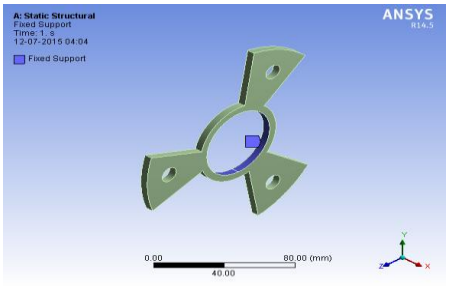

Fig. Fix Inner C/S of Mid Coupler Disk

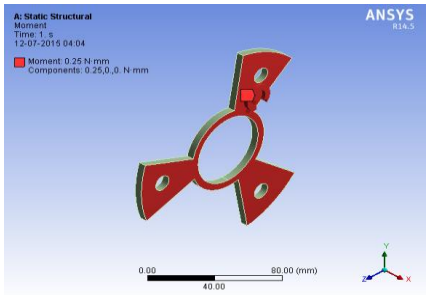

Fig. Apply a force on Circumference of Mid Coupler Disk

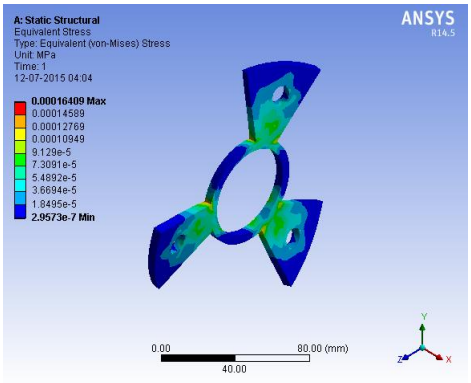

Fig. Equivalent stresses on Mid Coupler Disk

Result & Discussion

Part Name	Maximum theoretical stress N/mm^2	Von-mises stress N/mm^2	Result
Mid-coupler Disk	0.028	0.0001	safe

Conclusion:-

Maximum stress by theoretical method and Von-mises stress are well below the allowable limit; hence the MID COUPLER DISK is safe.

FEA Analysis of Output Shaft

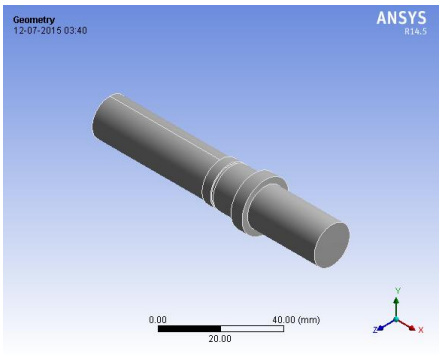

Fig. Modeling of Output Shaft

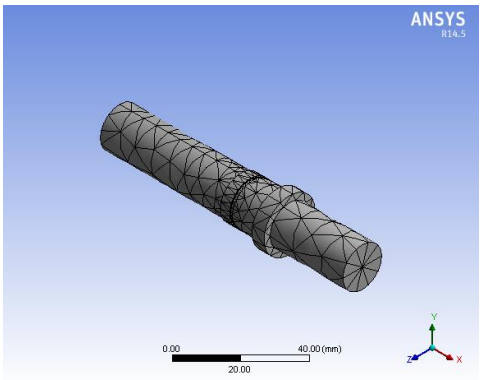

Fig.4.4.2. Meshing of Output Shaft

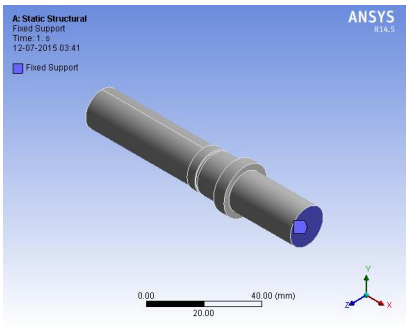

Fig. Fix the one End of Output Shaft

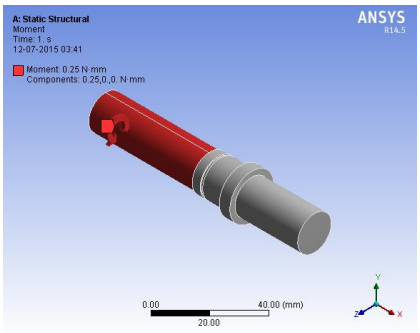

Fig. Apply Force on Output Shaft

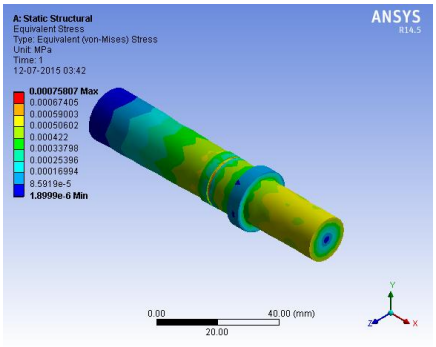

Fig. Equivalent Stresses on Output Shaft

Result & Discussion

Part Name	Maximum theoretical stress N/mm^2	Von-mises stress N/mm^2	Result
OUT PUT SHAFT	0.310	0.007	Safe

Conclusion:-

Maximum stress by theoretical method and Von-mises stress are well below the allowable limit; hence the output shaft is safe

FEA Analysis of RH Coupler Disk

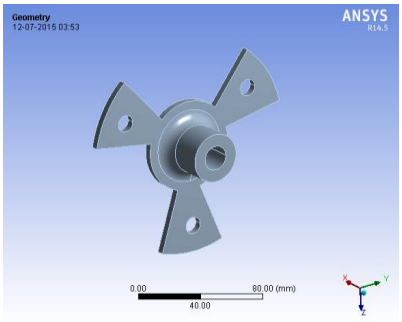

Fig. Modeling of RH Coupler Disk

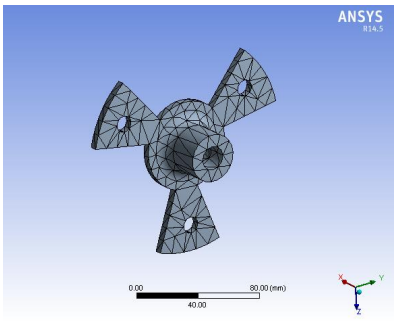

Fig. Meshing of RH Coupler Disk

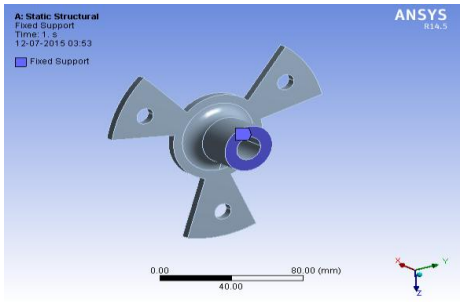

Fig. Fix One End of RH Coupler Disk

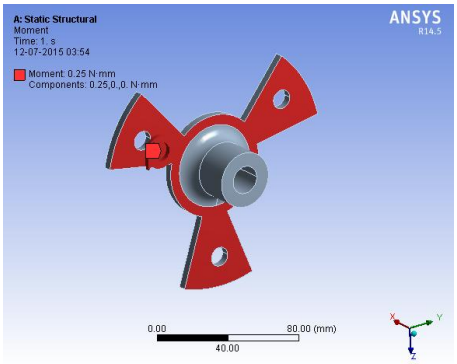

Fig. Apply Force on Circumference of RH Coupler Disk

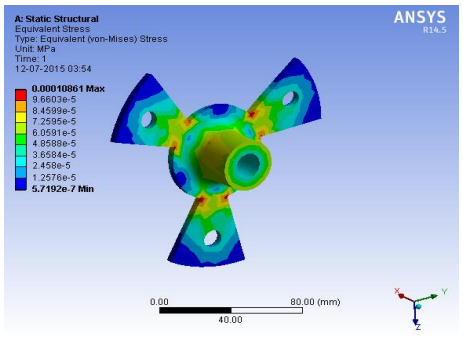

Fig.4.5.5. Equivalent Stresses on RH Coupler Disk

Result & Discussion

Part Name	Maximum theoretical stress N/mm^2	Von-mises stress N/mm^2	Result
RH COUPLER DISK	0.028	0.0001	safe

Conclusion:-

Maximum stress by theoretical method and Von-mises stress are well below the allowable limit; hence the RH COUPLER DISK is safe

4.6. FEA Analysis of Output Link Holder Fixed

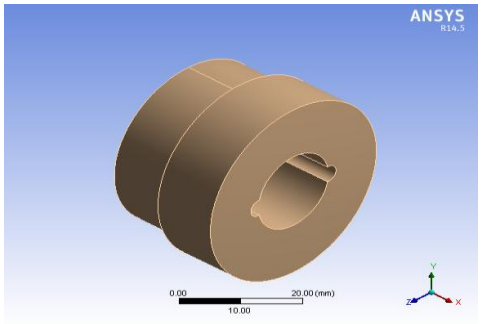

Fig. Modeling of Output Link Holder Fixed

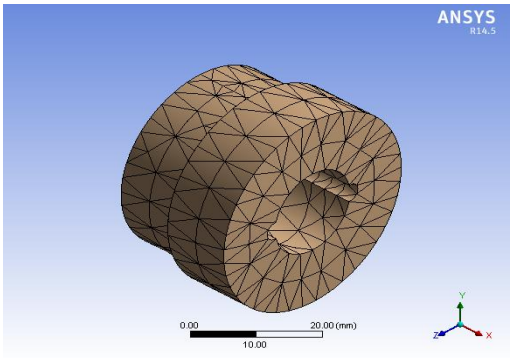

Fig. Meshing of Output Link Holder Fixed

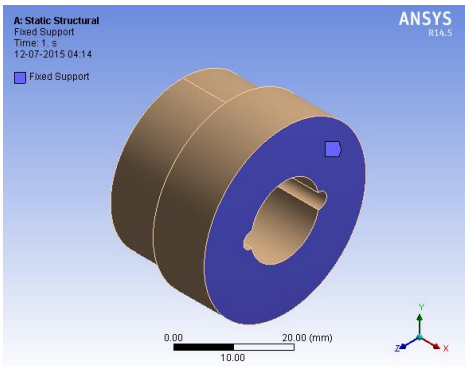

Fig. Fix one End face of Output Link Holder Fixed

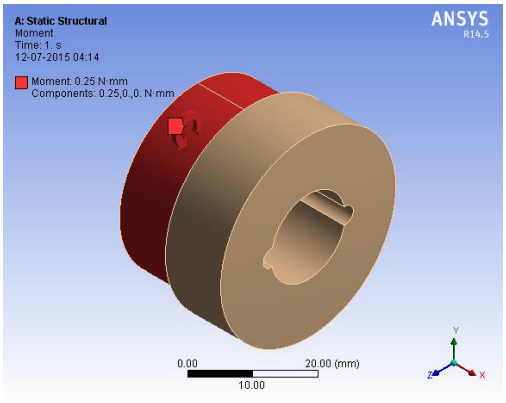

Fig. Apply Force on Circumference of Output Link Holder Fixed

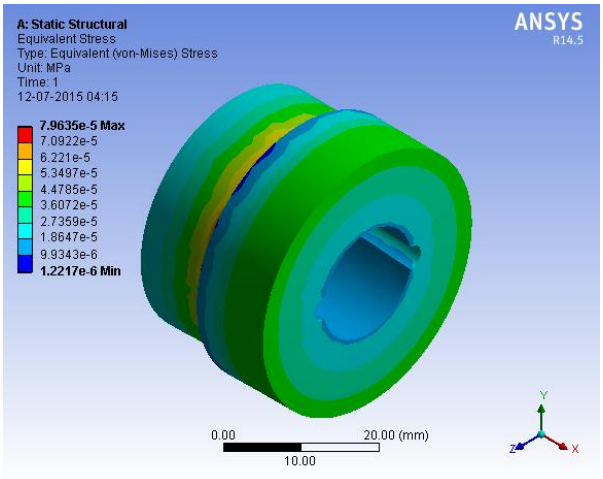

Fig. Equivalent stresses on Output Link Holder Fixed

Result & Discussion

Part Name	Maximum theoretical stress N/mm^2	Von-mises stress N/mm^2	Result
RH COUPLER HUB	0.029	0.0002	safe

Conclusion:-

Maximum stress by theoretical method and Von-mises stress are well below the allowable limit; hence the Output Link Holder is safe.

FEA Analysis of Output link Holder Indexer

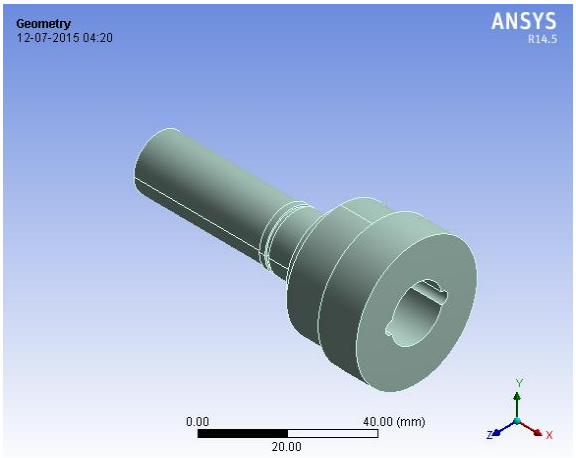

Fig. Modeling of Output Link Holder Indexer

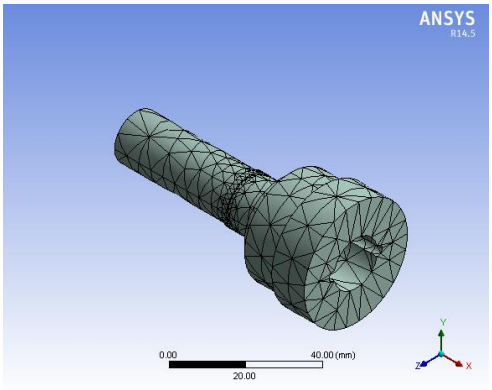

Fig. Meshing of Output Link Holder Indexer

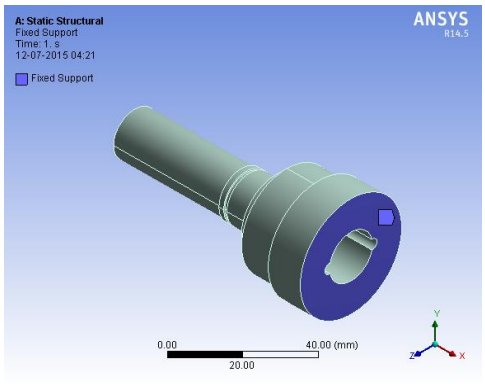

Fig. Fix one end of Output Link Holder Indexer

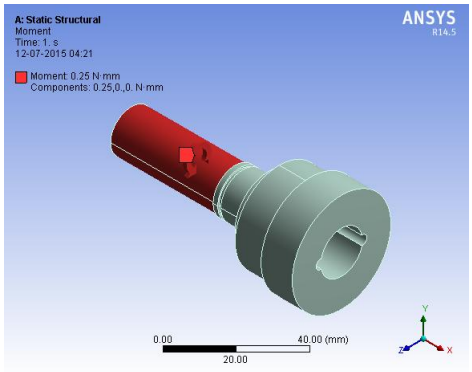

Fig. Apply Force on Output Link Holder Indexer

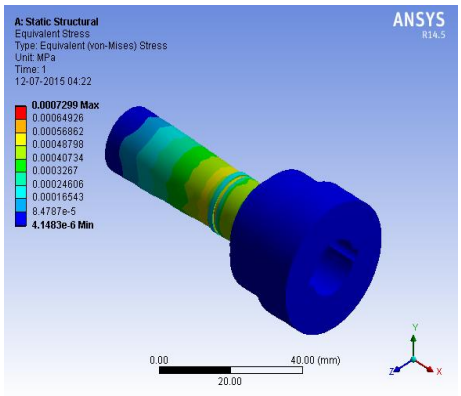

Fig. Equivalent stresses on Output Link Holder Indexer

Result & Discussion

Part Name	Maximum theoretical stress N/mm^2	Von-mises stress N/mm^2	Result
O/plink Holder Indexer	0.028	0.0001	safe

Conclusion:-

Maximum stress by theoretical method and Von-mises stress are well below the allowable limit; hence the Output link Holder Indexer is safe.

FEA Analysis of Angular Transmission Link

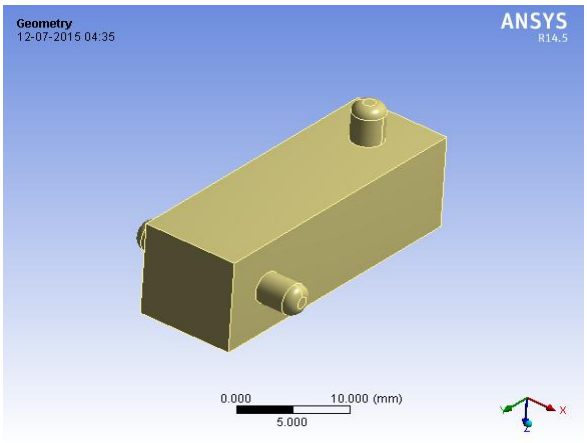

Fig. Modeling Transmission Link

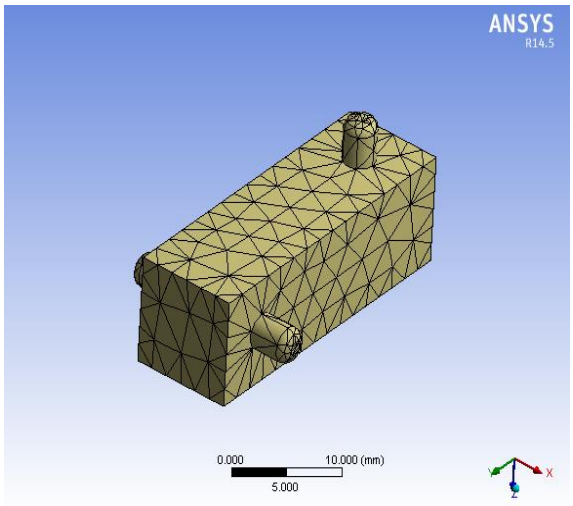

Fig. Meshing of Transmission Link

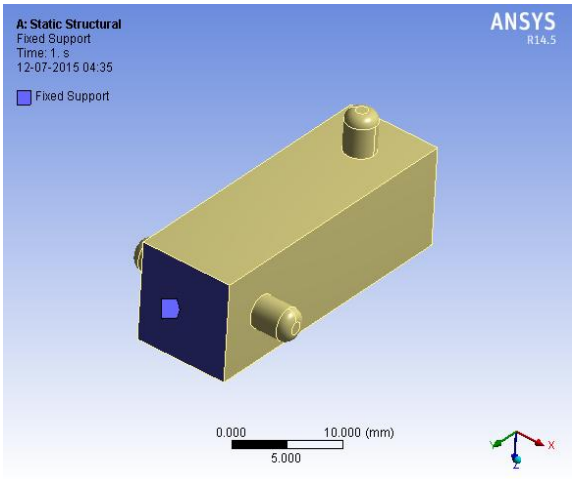

Fig. Fix one end of Transmission Link

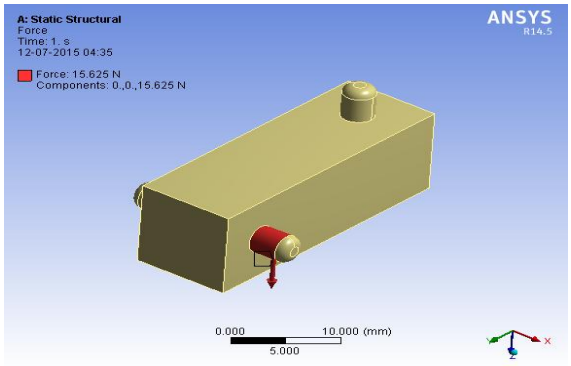

Fig. Apply force on Transmission Link

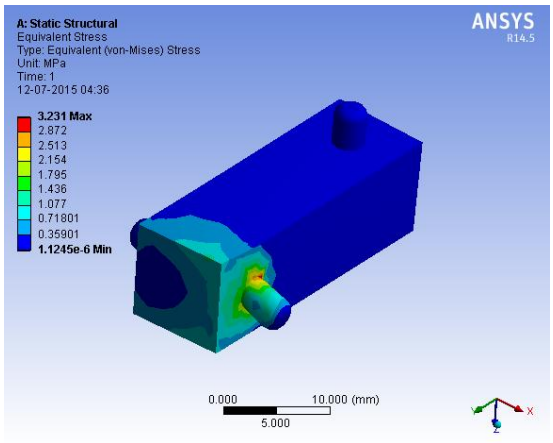

Fig. Equivalent Stresses on Transmission Link

Result & Discussion

Part Name	Maximum theoretical stress N/mm^2	Von-mises stress N/mm^2	Result
Transmission Link	1.94	3.1	safe

Conclusion

Five dimensional coupling is mechanical transmission system use to transmit the maximum power at maximum angular as well as parallel offset. Five dimensional coupling connect two shafts that have three linear & two angular misalignments. Coupling has a maximum power transmission capacity, maximum efficiency, and maximum speed as compared to conventional coupling. This coupling is also known as Schmidt coupling for angular as well as parallel transmission.

Maximum Stress by Theoretical method & Von mises method are well below the allowable limit; Hence the all component used in 5D coupling are safe for transmission of maximum power

Maximum stress by theoretical method and Von-misses stress are well below the allowable limit; hence the Transmission link is safe

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