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Effect of Gear Teeth Crowning on the Performance of a Gear Coupling Using Finite Element Analysis

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ABSTRACT

The gear couplings are used in heavy machinery to transmit very high torques between the shafts with the ability of compensating for angular, parallel and axial misalignment. They can undergo edge loading, higher contact stress, non-uniform load distribution, excessive wear and gear tooth failure during operation. The gear tooth crowning is a common modification made on the gear coupling teeth which allows a slight convexity on the gear tooth face width along its length. This modification is done to get a better load distribution and to reduce the stress concentration on the gear tooth. The main objective of the project is to evaluate the performance of a gear coupling with varying gear tooth crowning values using Finite Element Analysis. The 3D model of the gear coupling is constructed in SolidWorks. Different crowning values are made on the gear tooth and the Finite Element Analysis is performed in ANSYS Workbench. The material properties, boundary conditions and other details is taken into account to evaluate the performance of the gear coupling with different crowning values.

The performance of these gear couplings is estimated by comparing the equivalent (Von Mises) stress, contact pressure, and transfer torque. The optimum gear tooth crowning value is identified from the results obtained. This project gives design recommendations for gear coupling used in power transmission.

Keywords: Gear Coupling, Gear Tooth Crowning, Finite Element Analysis, SolidWorks, ANSYS Workbench, Von Mises Stress, Contact presuure.

I. INTRODUCTION

Mechanical power transmission systems transmit rotational motion and torque between rotating parts. Gear couplings transmit high torque from one rotating shaft to another with a certain degree of misalignment between the two shafts. The gear coupling has a range of misalignment and is subjected to uneven load distribution, contact stress, vibration, and gear tooth wear due to misalignment. The gear tooth crowning is a process of gear tooth surface crowned to certain amount of material removal from the gear tooth surface. The gear tooth crowning is intended for the reduction of the edge contact stress during gear tooth engagement by distributing the load zone over a larger area. The purpose of this study is to investigate gear coupling performance under crowning using Finite Element Analysis. A three-dimensional gear coupling model is built in the SolidWorks environment and imported into the ANSYS Workbench platform where the torque and the shaft misalignment are applied to evaluate the stresses, contact pressure and transfer torque.

II. PROBLEM IDENTIFICATION

Gear couplings are exposed to different operating conditions during power transmission. Misalignment of the shafts can cause irregular contact of the mating gear teeth in practice. This causes localized contact loading which may have a negative impact on the performance and life of the coupling.

The use of gear tooth crowning can improve the contact condition by modifying the tooth geometry along the face width. However, the performance of a gear coupling depends on the amount of crowning provided. An inappropriate crowning value can result in inadequate load distribution or excessive reduction of the effective contact region. Therefore, a need exists to investigate the effect of different gear tooth crowning values on the performance of a gear coupling under specified torque and misalignment conditions. In this project, different crowning configurations are developed and analysed using Finite Element Analysis to compare their performances and determine the for the considered operating condition.

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III. LITERATURE REVIEW

This work has previously been studied by examining factors such as contact mechanics, load distribution and stress distribution. Guo et al.[1] studied the effect of alignment, torque, and friction on contact mechanics. This showed how the operating conditions are critical in influencing the load distribution and local stresses. Vondra et al.[2] used finite element analysis to examine contact pressure and stress.

This showed how angular misalignment can cause uneven load distributions and concentrated contact at the edges of the teeth. Guan et al.[3] [4] [6] [10] looked at contact mechanics, crown profile and wear in different ways. This showed how the crown profile and misalignment are critical in the contact position, interference and load distribution. Prajapati et al.[5] looked at how materials affect torque and stress. Wang et al.[7] looked at how the structure can be designed for a high torque crown gear coupling. Alfares et al.[8] looked at the tooth backlash. Iñurritegui et al.[9] used analytical methods, FEA and experimental data to look at optimising the geometry of a gear coupling for large angular misalignment.

It can be concluded that different tooth profiles, crown profiles, materials, torques and angular misalignments affect the performances of gear couplings. In this work 4 different crown values will be compared whilst keeping the same torque and misalignment. The reaction torque, contact pressure and tooth stresses will be the main outputs.

IV. METHODOLOGY

4.1 Three-Dimensional Modelling

The three-dimensional gear coupling geometry was developed using SolidWorks. The initial model represented the uncrowned configuration, and additional models were prepared with crowning values of 0.06 mm, 0.08 mm, and 0.10 mm. The geometry was imported into ANSYS
Workbench for finite element analysis.

4.2 Material Properties

Alloy Steel 4118 was selected as the coupling material. The material properties were assigned in ANSYS Workbench before performing the structural simulations. The final draft should contain the actual elastic modulus, Poisson's ratio, density, and yield strength that were used in the simulation.

4.3 Meshing and Contact Definition

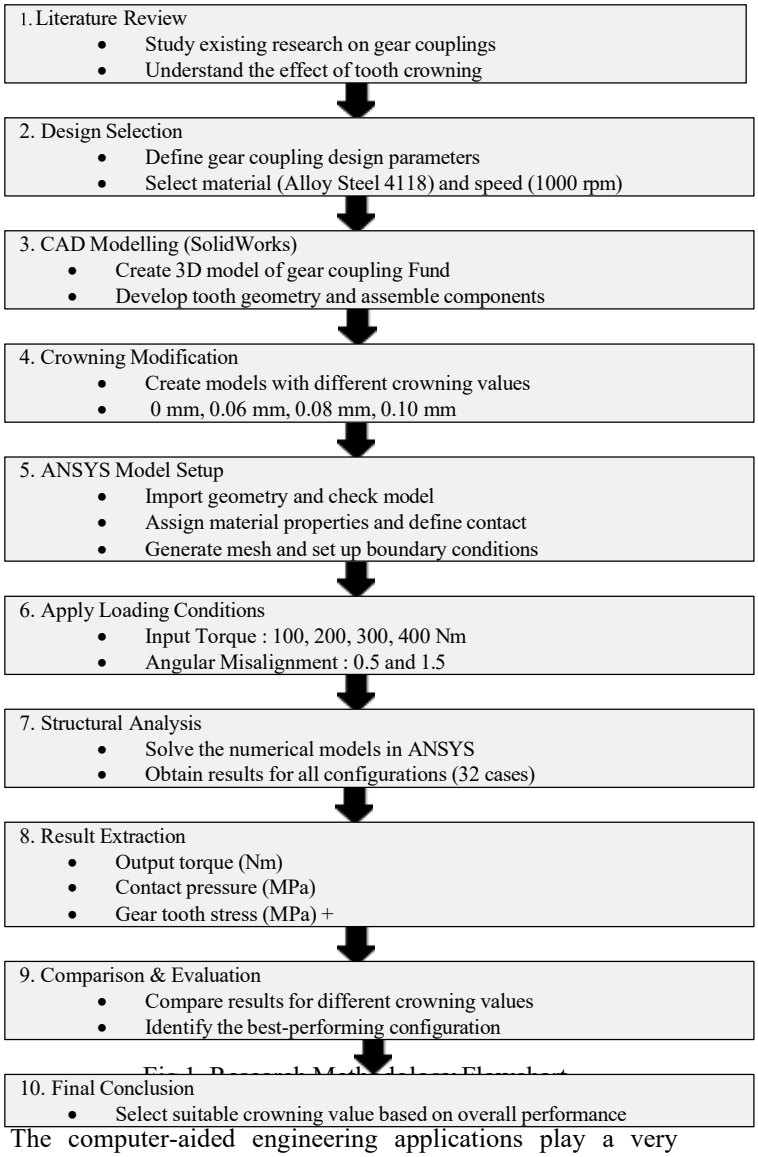
The imported geometry was discretised into finite elements. Particular attention was given to the tooth contact regions because contact pressure and local tooth stress were important outputs of the investigation. Contact interactions were defined between the relevant mating components.
The information about the type of element, size of the element, meshing convergence method, type of contact interaction, and friction factor of the actual model must be stated in the final paper. It is required to achieve reproducibility of results.

4.4 Loading and Boundary Conditions

The simulations involved four different input torque and two angular misalignment cases. Input torque was taken as 100, 200, 300, and 400 N·m, while angular misalignments were chosen to be 0.5° and 1.5°.

4.5 Result Extraction

The obtained result data include reaction torque, contact pressure, and tooth stress. Contact pressure and tooth stress were expressed in MPa, while torque was expressed in N·m. The exact stress measure and the reaction torque extraction location should be stated in the final manuscript.



The computer-aided engineering applications play a very crucial part in design and analysis of mechanical parts. It enables the engineer to form three-dimensional models and assess the geometry of the component along with analyzing its behavior under operation conditions prior to the production of physical prototype.
In the current project, SolidWorks is utilized in order to create the three-dimensional gear coupling models for various crowning. The ANSYS workbench is applied in order to analyze these models at certain torque and misalignment values.
As a result of the utilization of these computer-aided engineering programs it becomes possible to compare the different crowning designs using the same numerical methodology. The resulting data will be structured in order to analyze the behavior of output torque, contact pressure and tooth stress.

SOLIDWORKS

The SolidWorks is a computer-aided design (CAD) program which is commonly utilized in design of three-dimensional mechanical components, assemblies and engineering drawings.

SolidWorks software is used in this project to make the gear

coupling geometry as well as to set up the various tooth crowning designs for analysis purposes.

ANSYS WORKBENCH

It is a simulation tool that provides a facility for preparing and analyzing numerical models. The models are analyzed by performing engineering simulations with respect to applied loads, material, and boundary conditions on mechanical parts. For the present project, ANSYS Workbench is used to conduct analysis for the response of various models of gear couplings with different crowning values. The geometry prepared from CAD is used, and the analysis model is prepared with required results for comparison.

For the study of gear tooth crowning, a four three-dimensional tooth models is developed and compare their performance under identical boundary conditions.

Table 1. The following six models would provide a useful starting point.

Model	Crowning amount	Description
Model 1	0 mm	Uncrowned reference tooth
Model 2	0.60 mm	Intermediate crowning modification
Model 3	0.80 mm	Higher crowning modification
Model 4	0.10 mm	Highest crowning modification in the proposed study

I. DESIGN OF GEAR COUPLING

For this project, a gear coupling used in overhead cranes is taken into consideration [5].Considering the straight teeth initially and then adding crowning values along teeth surface. The details of a gear coupling is as follows:

Table 2 Dimensions

Modul	4
No of teeth	48
Pitch diameter	192 mm
Dedendum	5 mm
Addendum	4 mm
Face width of hub tooth	35
Addendum circle diameter	200 mm
Thickness of tooth	6.28 mm
Height of the tooth	9 mm
Working depth of the tooth	8 mm
Shaft diameter	60 mm
Material	Alloy Steel 4118

Table 3. Material Properties

Properties	**Value with Unit**
Tensile Strength, Ultimate	725 Mpa
Elastic Modulus	210 Gpa
Poisson's ratio	0.28
Tensile Strength Yield	621 Mpa

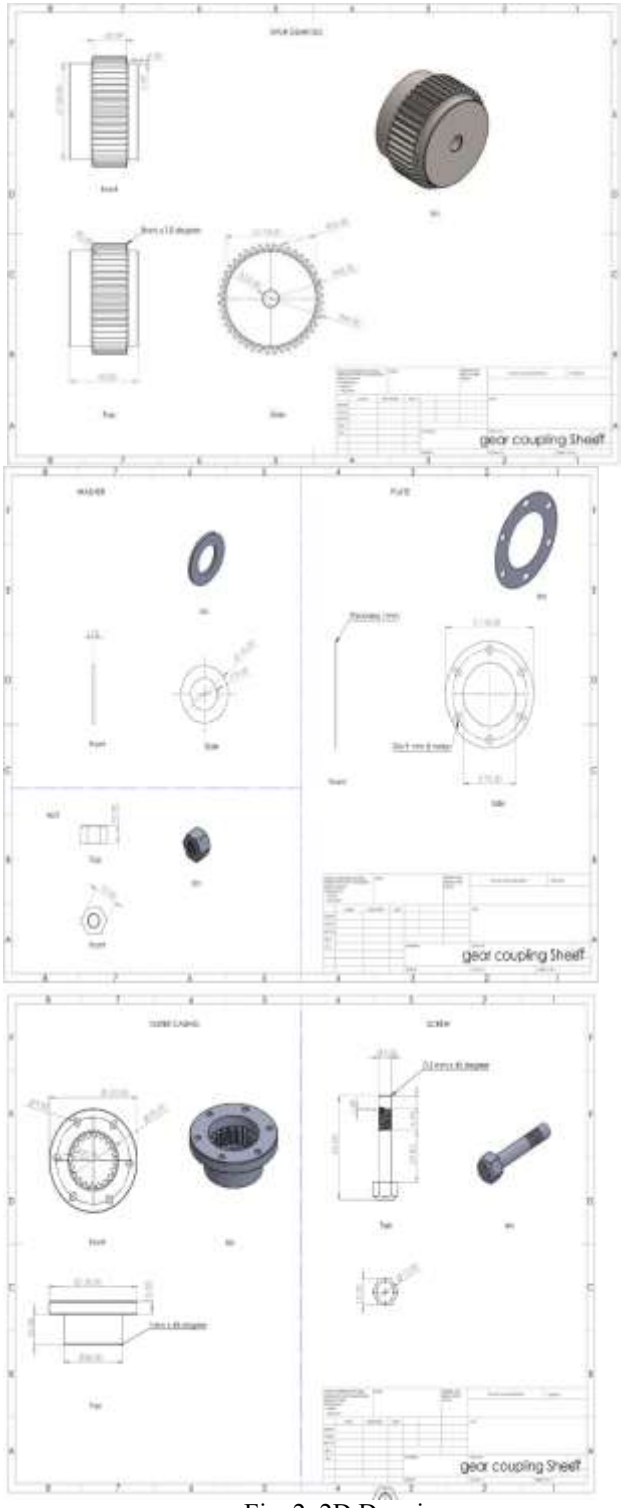


Fig. 2. 2D Drawing

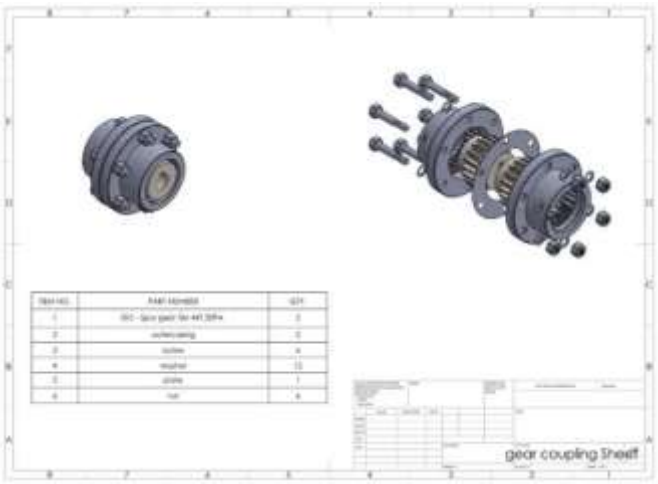
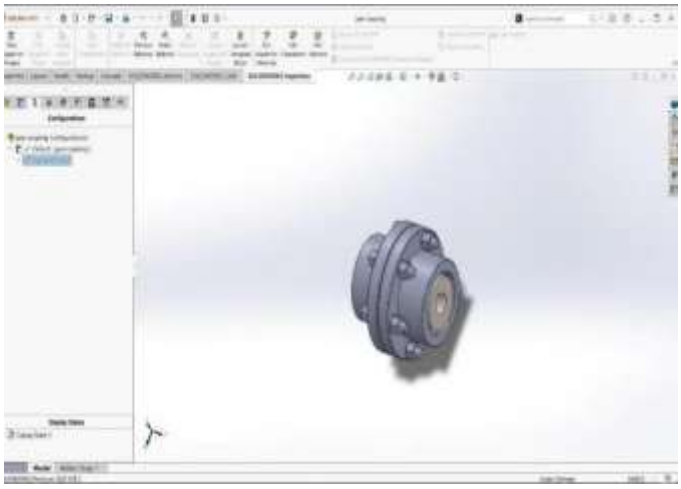


Fig. 2.1. 2D Drawing



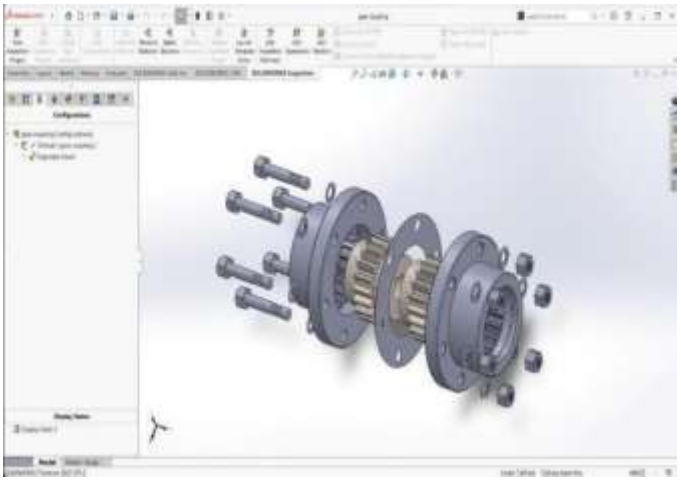


Fig. 4. 3D Drawing

VI. RESULTS AND DISCUSSION

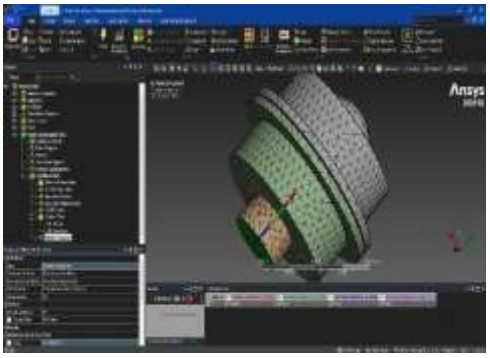


Fig. 5 Output Torque

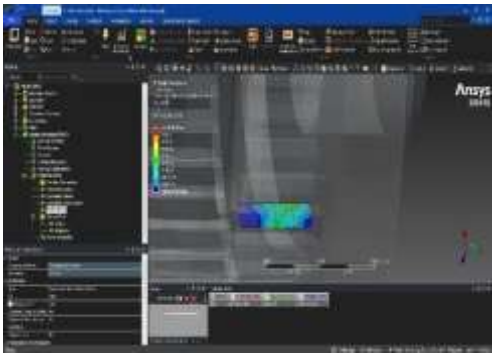


Fig. 6 Teeth Stress

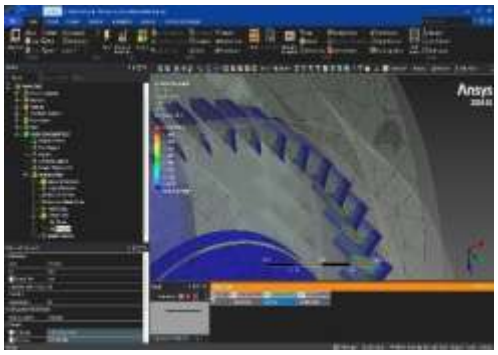


Fig 7. Contact Pressure

RESULTS OF ZERO CROWNING

Zero crowning was considered the base case to compare the results with the modified tooth profile. In this case, there is no crowning intentionally used along the tooth face width.

The output torque increases as the input torque increases. For 0.5° misalignment, the output torque goes up from 76.74 Nm for an input torque of 100 Nm to 306.98 Nm for an input torque of 400 Nm.

The same trend is observed for 1.5° misalignment.

The contact pressure and tooth stress are observed to increase with the input torque in the recorded results. For 400 Nm input torque and 0.5° misalignment, the contact pressure is 2.68 MPa and the tooth stress is 1.20 MPa.

RESULTS OF THE 0.06 mm CROWNING

At 0.5° of misalignment condition, the output torque for the second setup of crowning is lesser than that of the given baseline at all levels of input torque. However, the values of contact pressure and tooth

stress have also reduced as compared to those in the given data for the baseline setup.

For the 1.5° misalignment situation, a different trend is present for this configuration. For example, the output torque varies from of 79.43Nm at 100Nm of input torque to 317.75Nm at 400Nm of input torque. Furthermore, the contact pressure is found to be low in the given data.

For 400Nm of input torque and 1.5° of misalignment situation, the considered setup has an output torque of 317.75Nm and Nm and a contact pressure of 0.76 MPa.

Therefore, the 0.06 mm configuration appears promising under the 1.5° misalignment condition, based on the recorded results.

RESULTS OF THE 0.08 mm CROWNING

In case of 0.5° misalignment, the output torque increases with the increase in input torque, achieving the value of 304.02 Nm when the input torque is 400 Nm. This result is very close to that of the baseline output torque, although it is slightly lower compared to the one for 0.10 mm crowning.

Contact pressure increases with the increase in input torque and achieves the value of 5.05 MPa with 400 Nm of input torque and 0.5° misalignment. When the misalignment is 1.5°, the value of contact pressure is 6.49 MPa.

These are the highest values of contact pressures out of all four crownings in consideration for 400 Nm at their respective misalignments. Based on the results, it can be concluded that the 0.08 mm model does not give the minimum contact pressure under the tested conditions.

Tooth stress values have comparatively low magnitude in some of the cases. Nevertheless, the large difference between tooth-stress values and contact-pressure values in these four configurations needs to be compared with the exact output definitions and result extracting method of ANSYS.

RESULTS FOR 0.10 mm CROWNING

In the 0.5 degree case, the only gear with a maximum output torque for all the four cases is the 0.10 mm model. When the input torque is 400 Nm, the output torque will be 308.09 Nm.

The contact pressure in this case will be 0.72 MPa which is lower than the contact pressures in the other three cases. Considering the high output torque with low contact pressure, this 0.10 mm model is a good one when there is a 0.5 degree misalignment.

However, when there is a 1.5 degree misalignment, the output torque is lower than the output torque in the 0.06 mm case. With an input torque of 400 Nm, the 0.10 mm case has the lowest tooth stress value of 0.44

MPa among the four cases.

Thus, it shows that the ranking of performance changes according to the misalignment as well as the performance parameter considered.

It means that the 0.10 mm case should not be automatically selected as the best unless all factors are considered.

Table No. 4 Parameters used for analysis

Parameter	Value
Material	Alloy Steel 4118
Input torque	100, 200, 300 and 400 Nm
Crowing values	0, 0.06, 0.08 and 0.10 mm
Angular Misalignment	0.5° and 1.5°
Output torque	ANSYS reaction torque, Nm
Contact pressure	MPa
Tooth stress	MPa
CAD software	SolidWorks
FEA software	ANSYS Workbench

Table 5 Comparison of output torque at 400 Nm input torque

Crowning (mm)	Output torque at 0.5° (Nm)	Output torque at 1.5° (Nm)
0	306.98	306.13
0.06	268.35	317.75
0.08	304.02	273.28
0.10	308.09	282.32

Table No.6.Comparison of contact pressure at 400 Nm input torque

Crowning (mm)	Contact pressure at 0.5°	Contact pressure at 1.5°
0	2.68	2.46
0.06	0.86	0.76
0.08	5.05	6.49
0.10	0.72	1.17

Table No. 7. Tooth stress comparison at 400 Nm input torque

Crowning (mm)	Tooth stress at 0.5° (MPa)	Tooth stress at 1.5° (MPa)
0	1.20	0.51
0.06	0.79	0.62
0.08	0.10	0.49
0.10	0.71	0.44

0 Crowning 0.5º Misalignment: 100 Nm Torque

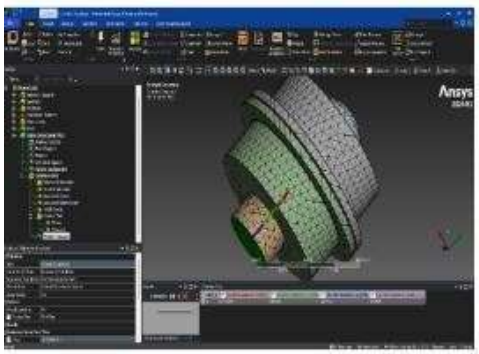


Fig. 6.3.1 Output Torque



Fig. 6.3.2 Teeth Stress



Fig. 6.3.3 Contact Pressure

0 Crowning 0.5º Misalignment: 200 Nm Torque

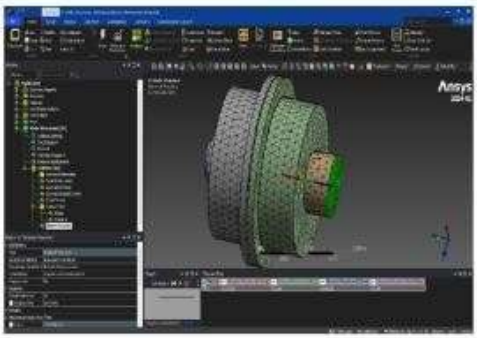


Fig. 6.3.4 Output Torque

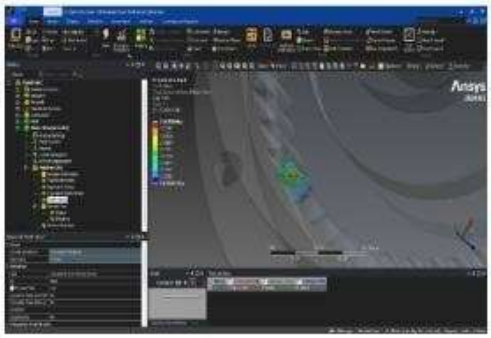


Fig. 6.3.5 Teeth Stress



Fig. 6.3.6 Contact Pressure

0 Crowning 0.5º Misalignment: 300 Nm Torque.

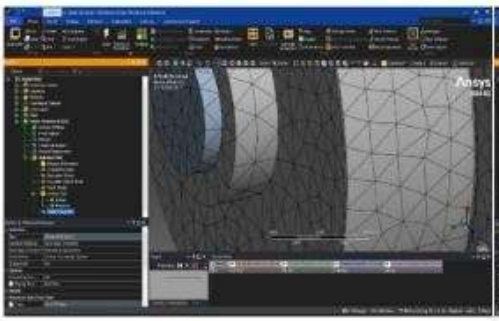


Fig. 6.3.7 Output Torque



Fig.6.3.8 Teeth Stress

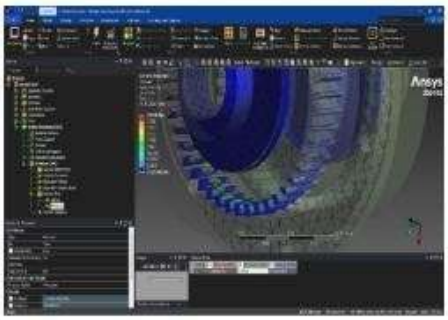


Fig. 6.3.9 Contact Pressure

0 Crowning 0.5º Misalignment: 400 Nm Torque.

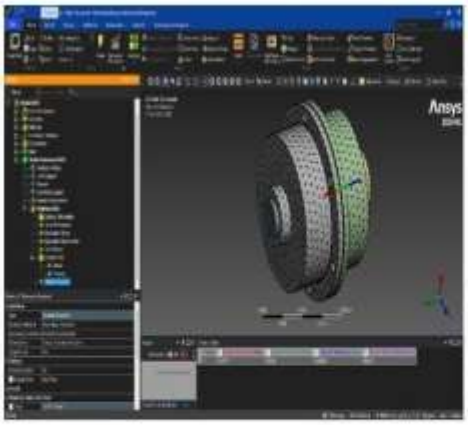


Fig. 6.3.10 Output Torque

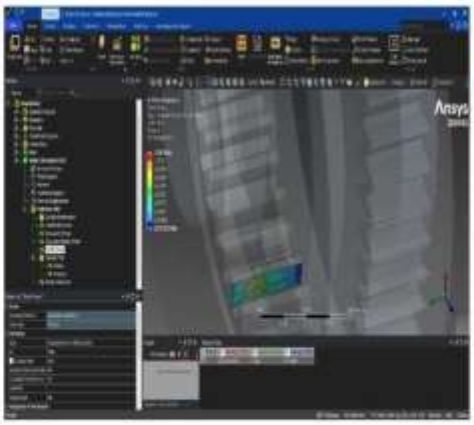


Fig. 6.3.11 Teeth Stress

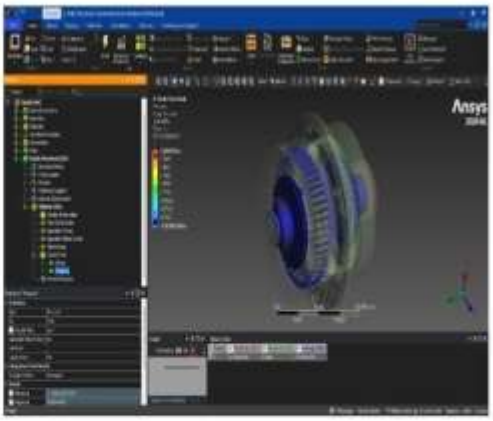


Fig. 6.3.12 Contact Pressure

0 Crowning 1.5º Misalignment: 100 Nm Torque.



Fig. 6.3.13 Output Torque

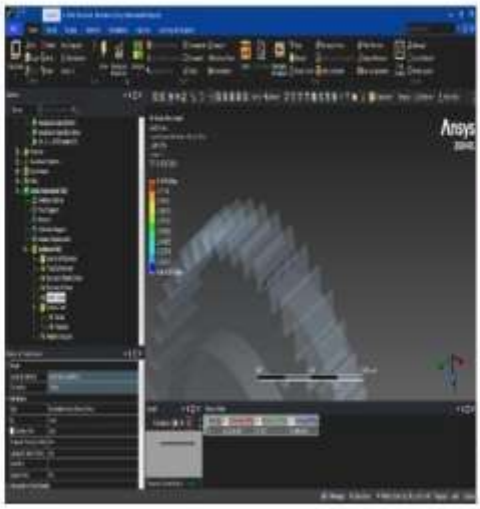


Fig. 6.3.14 Teeth Stress

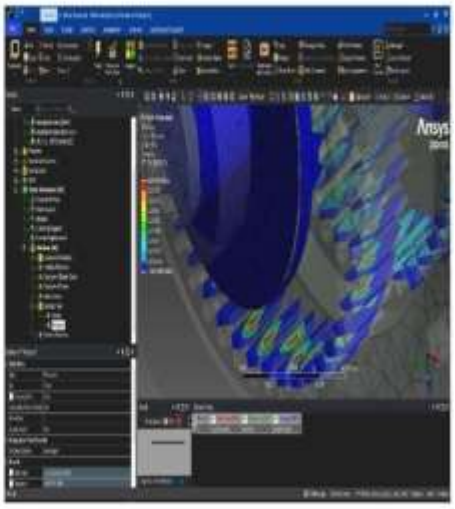
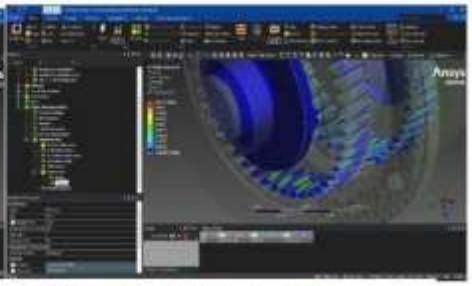


Fig. 6.3.15 Contact Pressure

0 Crowning 1.5º Misalignment: 200 Nm Torque.

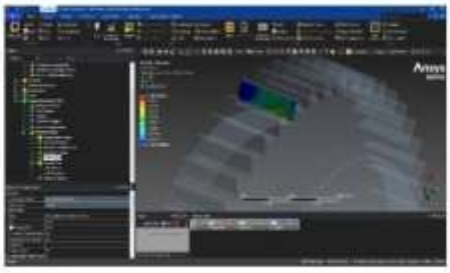

Fig. 6.3.16 Output Torque

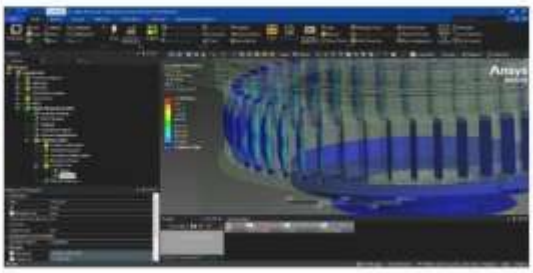

Fig. 6.3.17 Teeth Stress


Fig. 6.3.18 Contact Pressure

0 Crowning 1.5º Misalignment: 300 Nm Torque.


Fig. 6.3.19 Output Torque

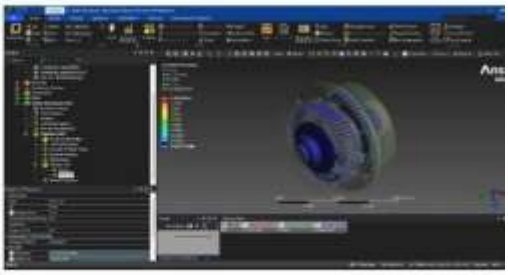

Fig. 6.3.20 Teeth Stress


Fig. 6.3.21 Contact Pressure

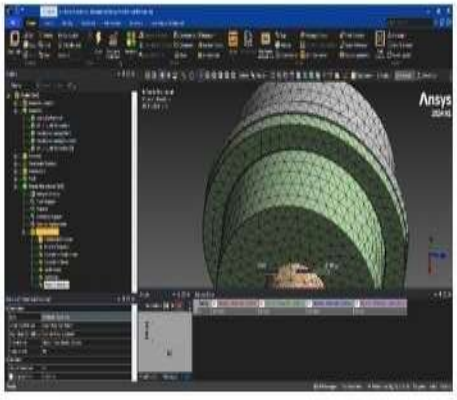
0 Crowning 1.5º Misalignment: 400 Nm Torque.


Fig. 6.3.22 Output Torque


Fig. 6.3.23 Teeth Stress


Fig. 6.3.24 Contact Pressure

0.06 Crowning 0.5 Misalignment:100 Nm Torque


Fig. 6.4.1 Output Torque

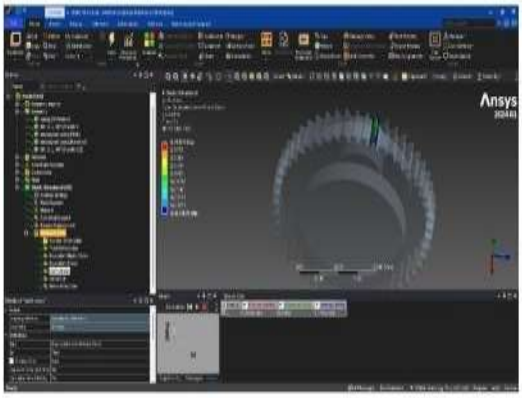

Fig. 6.4.2 Teeth Stress


Fig. 6.4.3 Contact Pressure

0.06 Crowning 0.5 Misalignment:200 Nm Torque

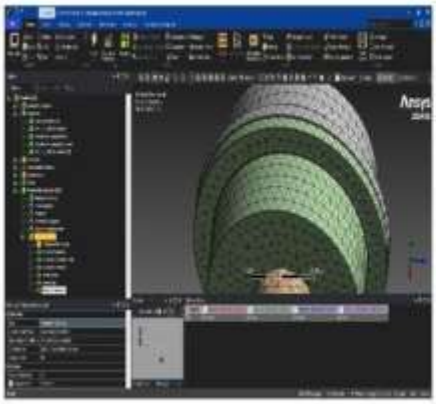


Fig. 6.4.4 Output Torque



Fig. 6.4.5 Teeth Stress



Fig. 6.4.6 Contact Pressure

0.06 Crowning 0.5 Misalignment: 300Nm



Fig. 6.4.7 Output Torque

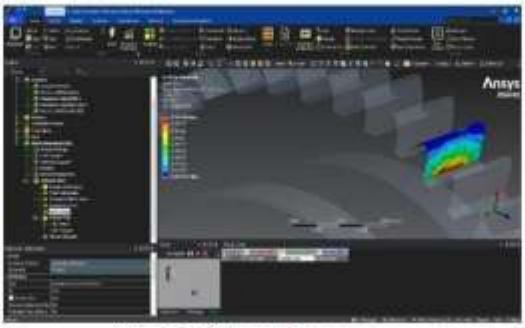


Fig. 6.4.8 Teeth Stress

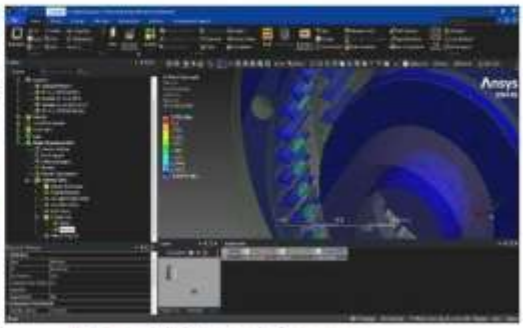


Fig. 6.4.9 Contact Pressure

0.06 Crowning 0.5 Misalignment: 400Nm

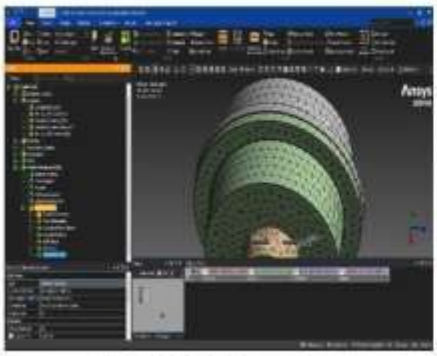


Fig. 6.4.10 Output Torque

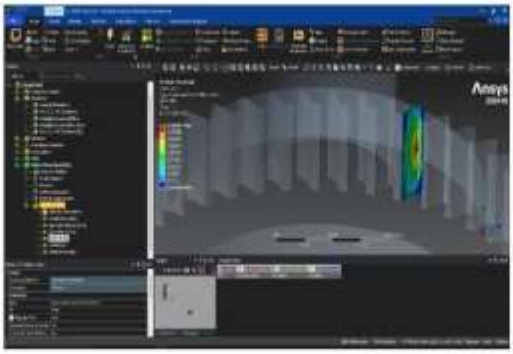


Fig. 6.4.11 Teeth Stress



Fig. 6.4.12 Contact Pressure

0.06 Crowning 1.5 Misalignment: 100Nm

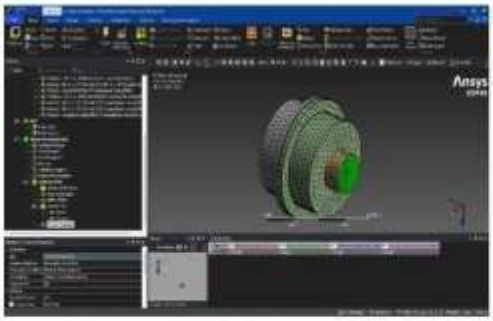


Fig. 6.4.13 Output Torque



Fig. 6.4.14 Teeth Stress

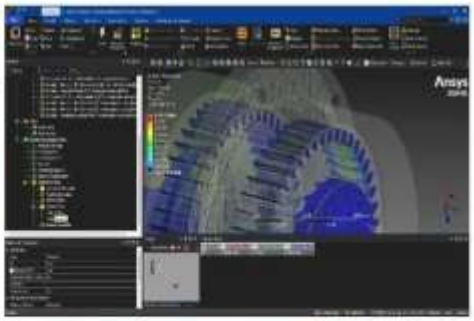


Fig. 6.4.15 Contact Pressure

0.06 Crowning 1.5 Misalignment:200Nm



Fig. 6.4.16 Output Torque



Fig. 6.4.17 Teeth Stress

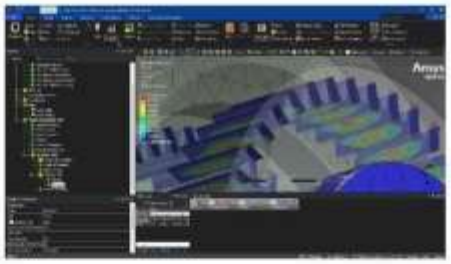


Fig. 6.4.18 Contact Pressure

0.06 Crowning 1.5 Misalignment:300Nm



Fig. 6.4.19 Output Torque

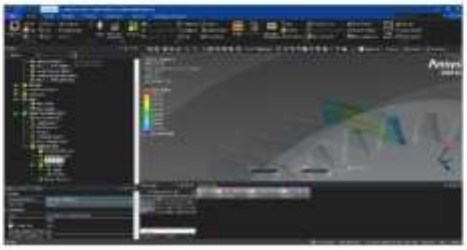


Fig. 6.4.20 Teeth Stress



Fig. 6.4.21 Contact Pressure

0.06 Crowning 1.5 Misalignment:400 Nm

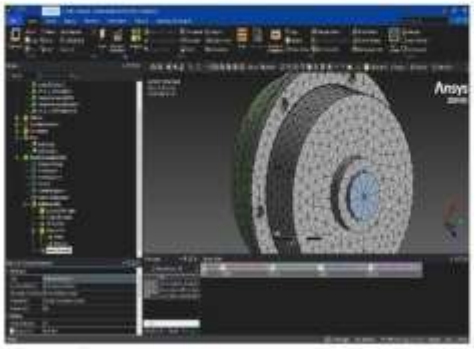


Fig. 6.4.22 Output Torque

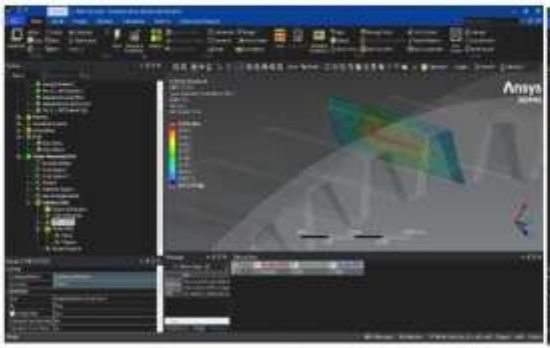


Fig. 6.4.23 Teeth Stress

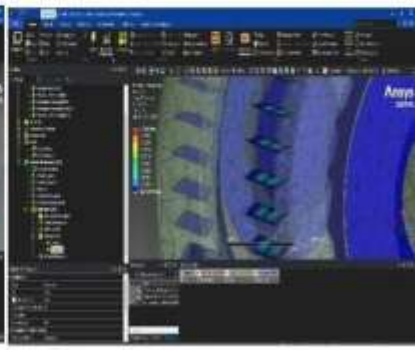


Fig. 6.4.24 Contact Pressure

0.08 Crowning 0.5 Misalignment:100Nm



Fig. 6.5.1 Output Torque

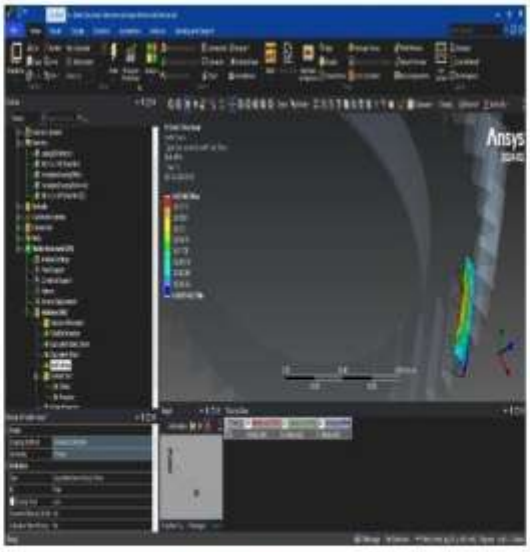


Fig. 6.5.2 Teeth Stress

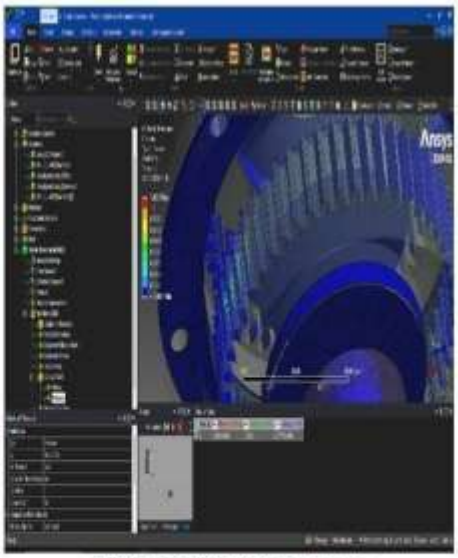


Fig.6.5.3 Contact Pressure

0.08 Crowning 0.5 Misalignment:200Nm



Fig. 6.5.4 Output Torque



Fig. 6.5.5 Teeth Stress



Fig. 6.5.6 Contact Pressure

0.08 Crowning 0.5 Misalignment:300Nm

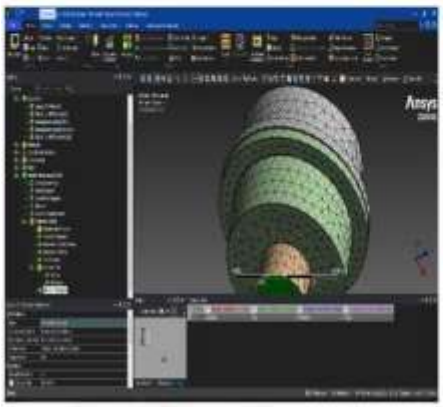


Fig. 6.5.7 Output Torque



Fig. 6.5.8 Teeth Stress

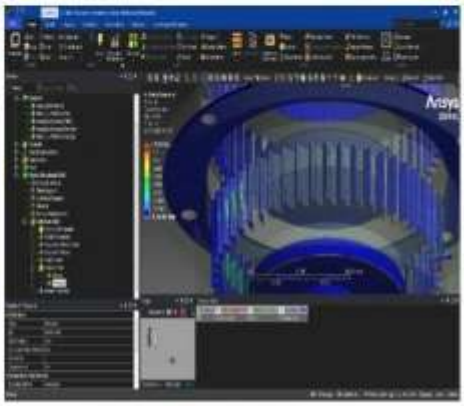
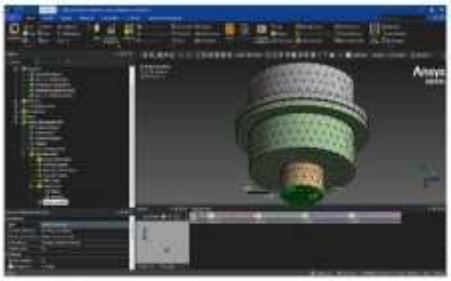
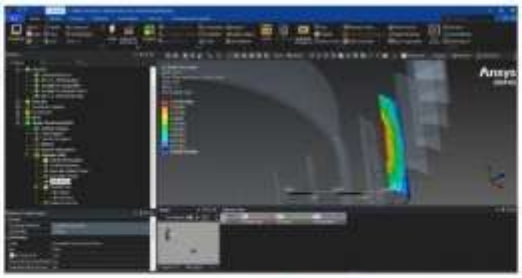
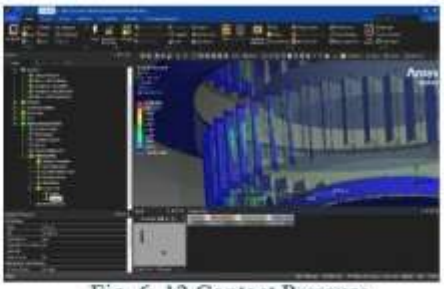


Fig. 6.5.9 Contact Pressure

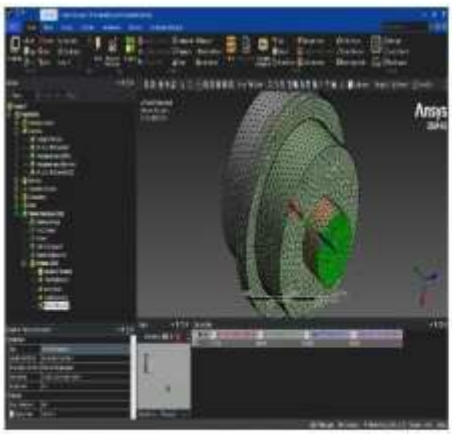
0.08 Crowning 0.5° Misalignment: 400 Nm Torque.

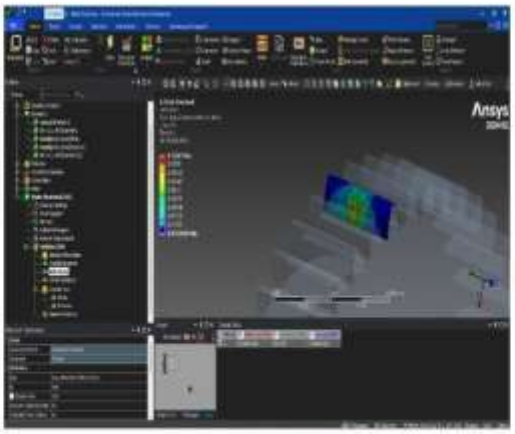

Fig. 6.5.10 Output Torque

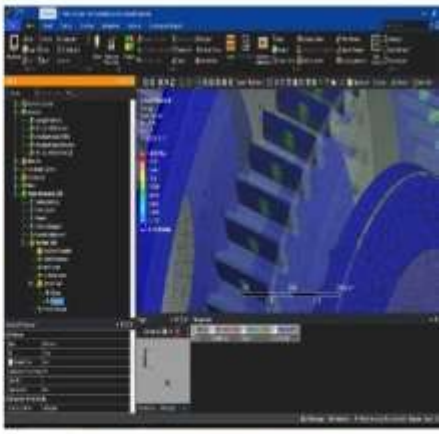

Fig. 6.5.11 Teeth Stress


Fig. 6..12 Contact Pressure

0.08 Crowning 1.5 Misalignment:100Nm


Fig. 6.5.13 Output Torque


Fig. 6.5.14 Teeth Stress


Fig. 6..15 Contact Pressure

0.08 Crowning 1.5 Misalignment:200Nm


Fig. 6.5.16 Output Torque

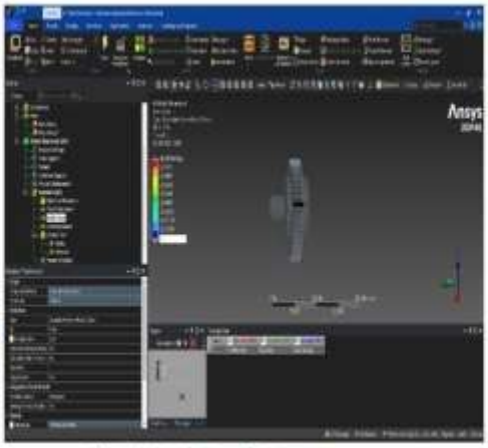

Fig.6.5.17 Teeth Stress


Fig. 6.5.18 Contact Pressure

0.08 Crowning 1.5 Misalignment:300Nm



Fig. 6.5.19 Output Torque

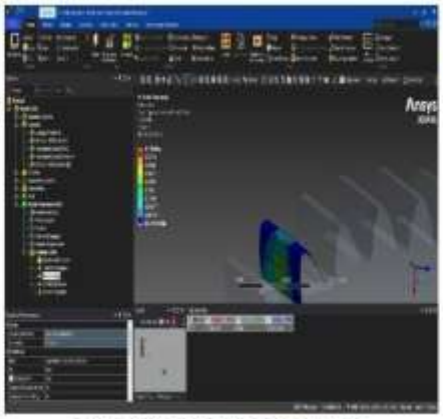


Fig. 6.5.20 Teeth Stress



Fig. 6.5.21 Contact Pressure

0.08 Crowning 1.5 Misalignment:400Nm

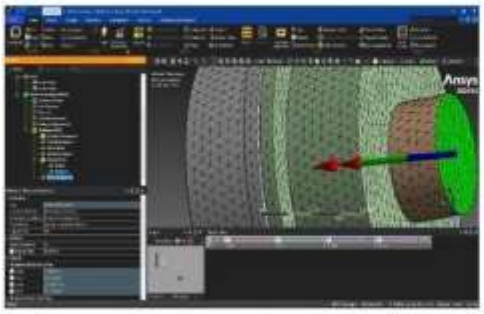


Fig. 6.5.22 Output Torque

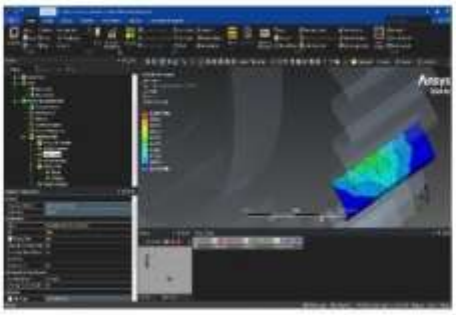


Fig. 6.5.23 Teeth Stress

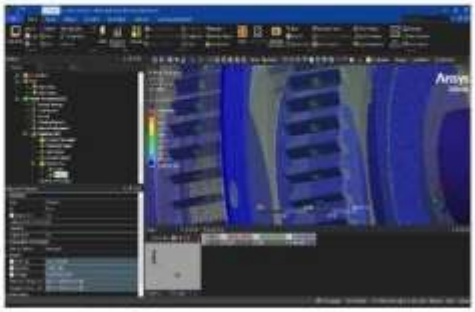


Fig. 6.5.24 Contact Pressure

0.1 Crowning 0.5 Misalignment:100nm

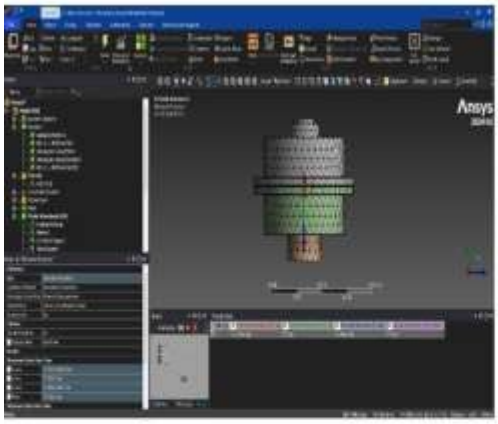


Fig. 6.6.1 Output Torque

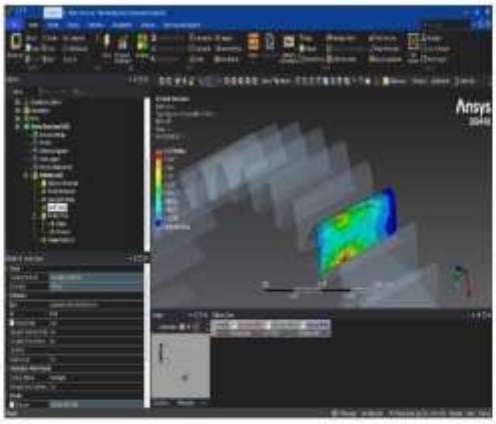


Fig. 6.6.2 Teeth Stress

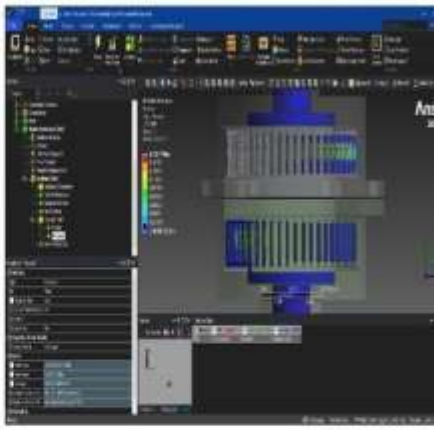


Fig. 6.6.3 Contact Pressure

0.1 Crowning 0.5 Misalignment:200nm

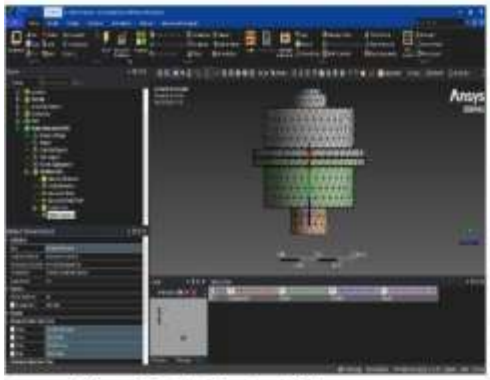


Fig. 6.6.4 Output Torque

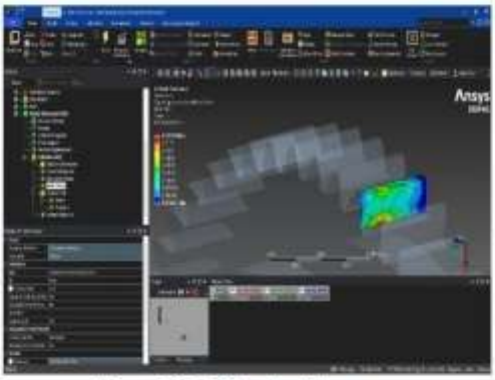


Fig. 6.6.5 Teeth Stress



Fig. 6.6.6 Contact Pressure

0.1 Crowning 0.5 Misalignment:300nm

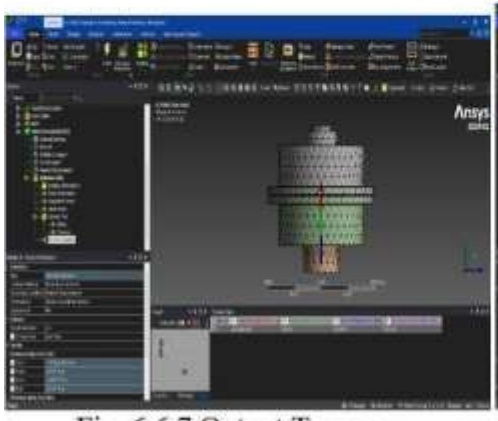


Fig. 6.6.7 Output Torque

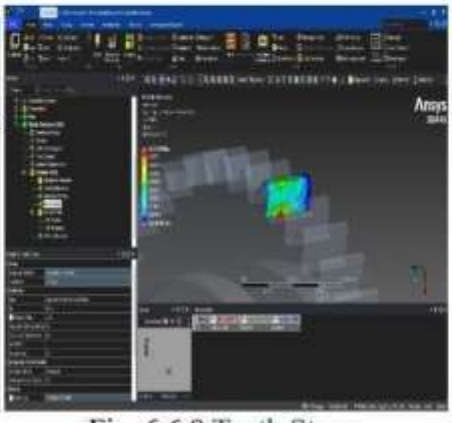


Fig. 6.6.8 Teeth Stress

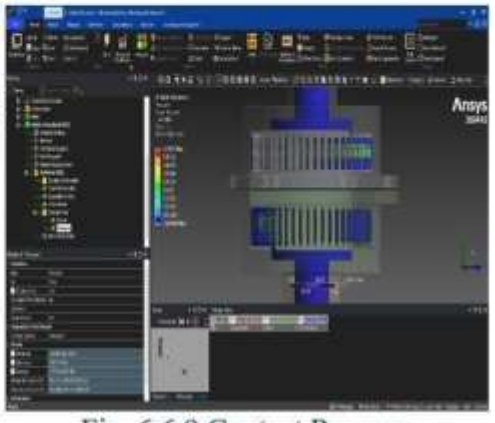
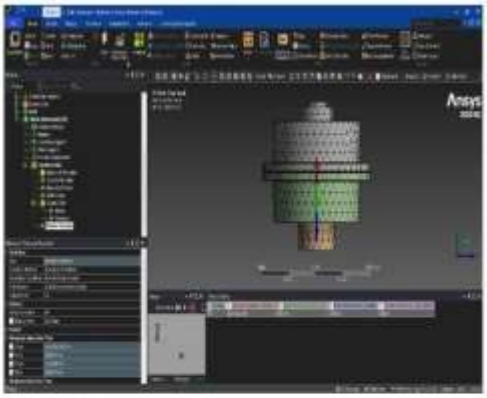
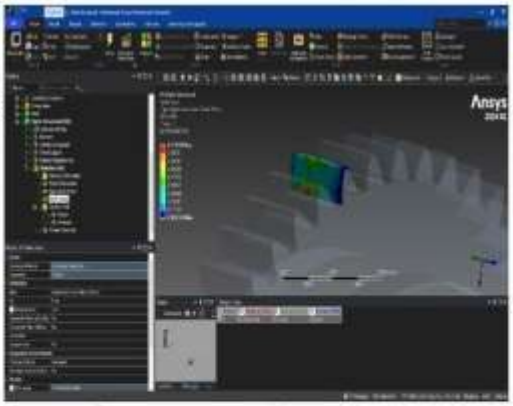
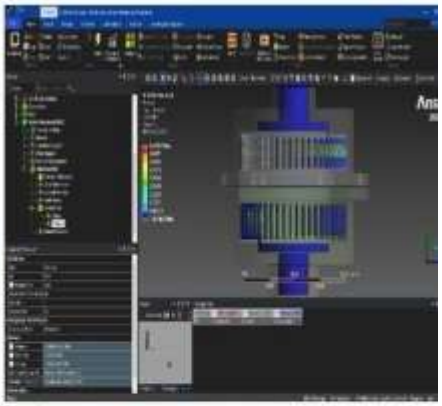


Fig. 6.6.9 Contact Pressure

0.1 Crowning 0.5 Misalignment:400nm

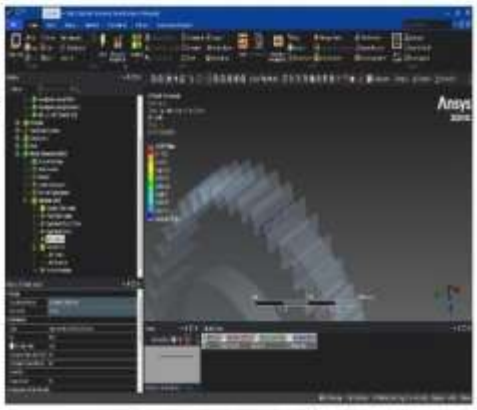

Fig.6.6.10 Output Torque

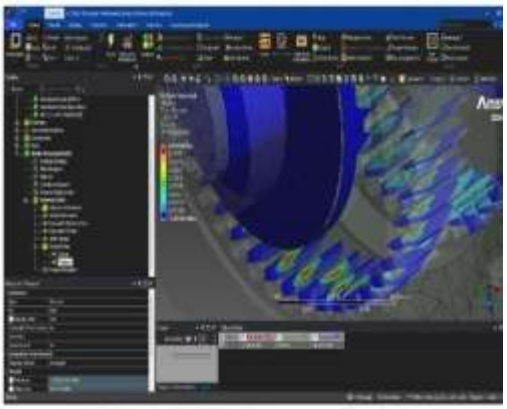

Fig. 6.6.11 Teeth Stress


Fig. 6.6.12 Contact Pressure

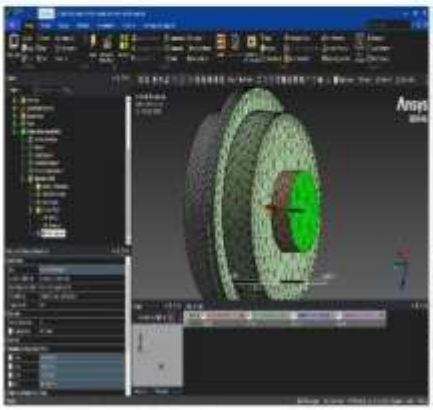
0.1 Crowning 1.5 Misalignment:100nm

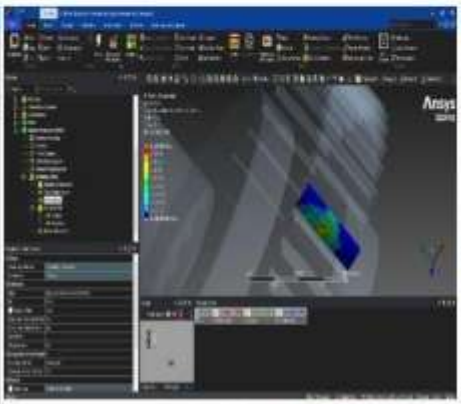

Fig. 6.6.13 Output Torque

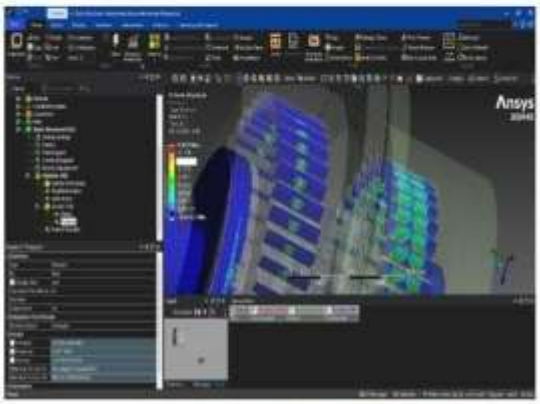

Fig. 6.6.14 Teeth Stress


Fig. 6.6.15 Contact Pressure

0.1 Crowning 1.5 Misalignment:200nm


Fig. 6.6.16 Output Torque


Fig. 6.6.17 Teeth Stress


Fig. 6.6.18 Contact Pressure

0.1 Crowning 1.5 Misalignment:300nm

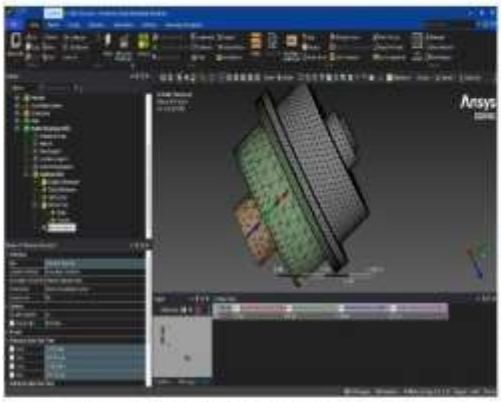


Fig. 6.6.19 Output Torque

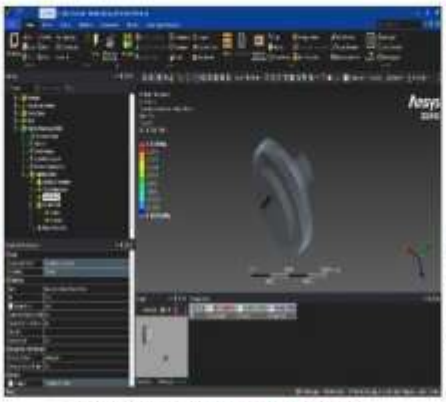


Fig. 6.6.20 Teeth Stress

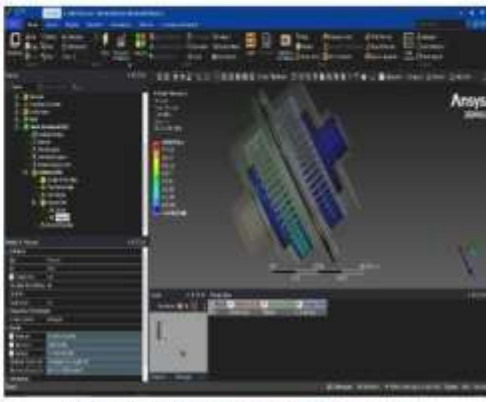


Fig. 6.6.21 Contact Pressure

0.1 Crowning 1.5 Misalignment:400nm

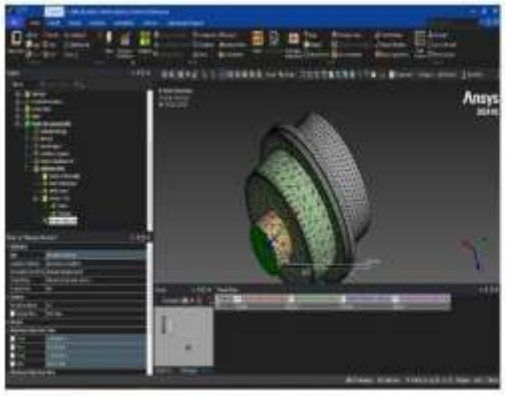


Fig. 6.6.22 Output Torque



Fig. 6.6.23 Teeth Stress

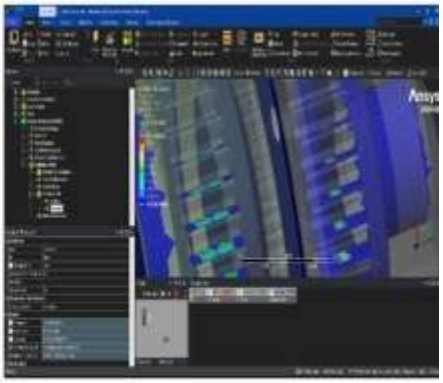


Fig. 6.6.24 Contact Pressure

Table 9. Overall result of crowning configurations

Input Torque	Crowning	Misalignment	Output Torque	Gear Teeth Stress	Contact Pressure
100	0	0.5	76.74	0.67	0.3
		1.5	76.52	0.43	0.12
200	0	0.5	153.49	1.34	0.6
		1.5	153.06	0.97	0.25
300	0	0.5	230.23	2.01	0.9
		1.5	229.58	1.71	0.38
400	0	0.5	306.98	2.68	1.2
		1.5	306.13	2.46	0.51
100	0.06	0.5	67.08	0.21	0.19
		1.5	79.43	0.19	0.15
200	0.06	0.5	134.18	0.43	0.39
		1.5	158.84	0.38	0.31
300	0.06	0.5	201.26	0.64	0.59
		1.5	238.31	0.57	0.47
400	0.06	0.5	268.35	0.86	0.79
		1.5	317.75	0.76	0.62
100	0.08	0.5	76	1.26	0.02
		1.5	68.32	1.62	0.12
200	0.08	0.5	152.01	2.52	0.05
		1.5	136.64	3.24	0.24
300	0.08	0.5	228.01	3.78	0.07
		1.5	204.96	4.84	0.36
400	0.08	0.5	304.02	5.05	0.1
		1.5	273.28	6.49	0.49
100	0.10	0.5	77.02	0.18	0.17
		1.5	70.58	0.29	0.11
200	0.10	0.5	154.05	0.36	0.35
		1.5	141.16	0.58	0.22
300	0.10	0.5	231.07	0.54	0.53
		1.5	211.74	0.88	0.33
400	0.10	0.5	308.09	0.72	0.71
		1.5	282.32	1.17	0.44

DISCUSSION: It has been observed that 0.10 mm crowning is the best-suited crowning value for the used coupling and it can improve its perfromence.

V. CONCLUSION

The present project investigated the effect of gear tooth crowning on the performance of a gear coupling using Finite Element Analysis. The test was carried out using SolidWorks for 3D modeling and ANSYS Workbench for numerical analysis.

Consideration of four crowning configurations of 0 mm, 0.06 mm, 0.08 mm and 0.10 mm. Evaluation of each configuration at input torques of 100 Nm, 200 Nm, 300 Nm and 400 Nm under angular misalignment of 0.5° and 1.5°. The recorded output parameters included the reaction torque, contact pressure and tooth stress.

The following conclusions can be drawn from the recorded results:

1. Effect of crowning: The results demonstrate the differences in the recorded output torque, contact pressure and tooth stress for the four crowning configurations. This indicates that the selected crowning value is an important parameter to investigate when evaluating gear coupling performance.
2. Performance at 0.5° misalignment: At an input torque of 400 Nm, the 0.10 mm configuration recorded an output torque of 308.09 Nm and a contact pressure of 0.72 MPa. These represent the highest reported output torque and the lowest reported contact pressure, respectively, among the four configurations for this condition.
3. Performance at 1.5° misalignment: At an input torque of 400 Nm, the 0.06 mm configuration recorded an output torque of 317.75 Nm and a contact pressure of 0.76 MPa. These correspond to the highest reported output torque and the lowest reported contact pressure, respectively, among the four configurations for this condition.
4. Comparison of tooth stress: At 400 Nm input torque and 0.5° misalignment, the lowest reported tooth stress was 0.10 MPa for the 0.08 mm configuration. At 1.5° misalignment, the lowest reported tooth stress was 0.44 MPa for the 0.10 mm configuration. Consequently, the configuration with the highest reported output torque is not necessarily the one with the lowest reported tooth stress.
5. Influence of misalignment: The comparison indicates the change in the ranking of the crowning configurations with angular misalignment. The results therefore suggest evaluating crowning under more than one operating condition rather than selecting a design from a single case.
6. Selection of a suitable crowning value: Based on the current data, the 0.10 mm configuration is a promising candidate for the 0.5° misalignment condition, whereas the 0.06 mm configuration is promising for the 1.5° condition when output torque and contact pressure are considered together.

Overall, the study presents a comparative numerical assessment of different gear tooth crowning values. However, the verification of the reaction torque extraction method and stress results must be completed before a final design recommendation can be made. In particular, some reported output torque values exceed the applied input torque, so the reaction location, constraints and sign convention should be checked. The precise ANSYS stress output used in the comparison should also be confirmed.

Consequently, the present results do not determine one universally optimum crowning value but instead indicate that the preferred configuration depends upon the misalignment condition and the performance criteria being considered.

REFERENCES

1] Guo, Y., Wallen, R., Lambert, S., Keller, J., & Errichello, R., "Theoretical, and experimental study on gear-coupling contact, and loads considering misalignment, torque, and friction influences", Mechanism, and Machine Theory, *98*, 242–262, 2016.

2] Vondra R., Rehak K., Prokop A., "Stress Strain Analysis of Gear Coupling", 26 th International Conference ENGINEERING MECHANICS, Brno, Czech Republic, November 24 – 25, 2020.

3] Yabin Guan , Zongde Fang , Xiaohui Yang and Guoding Chen, "Effects of misalignment and crowning on contact characteristics of crown gear coupling", Journal of Mechanical Engineering Science, 1-21,2018.

4] Yabin Guan, Zongde Fang, Xiaohui Yang, Guoding Chen, "Tooth Contact Analysis of Crown Gear Coupling with misalignment", Mechanism and Machine Theory, 295–311, 126, 2018.

5] Ankit V Prajapati 1 Prof. Amit R Patel 2 Prof. Dhaval P. Patel, "Design Approaches for Employing Enhanced Transmission Efficiency in Over Head Cranes", International Journal for Scientific Research & Development, Vol. 3, Issue 03, 2015.

6] Yabin Guan, Xiaohui Yang, Zongde Fang, Guoding Chen, " Comparative analysis of three geometric models for crown gear coupling", Mechanism and Machine Theory, 269–283, 136, 2019.

7] Ping WANG, Zhijun ZHENG, June ZHANG, "Design and Finite Element Analysis on Crown Gear Coupling of High Torque Considering Radial Restriction", Key Engineering Materials, Vols 474-476 pp 1750-1753,Trans Tech Publications, Switzerland, 2011.

8] M.A. Alfares , A.H. Falah, A.H. Elkholy, "Clearance distribution of misaligned gear coupling teeth considering crowning and geometry variations, Mechanism and Machine Theory, 1258–1272, 41, 2006.

9] Aurea Iñurritegui, Jon Larrañaga, Aitor Arana, and Ibai Ulacia, " Geometry optimisation of highly crowned gear couplings working in high misalignment applications to reduce tooth root stresses", MATEC Web of Conferences 387, 01004, Power Transmissions, 2023.

10] Guan, Y., Wang, J., Ning, K., & Li, H., "Theoretical, and experimental investigation of contact wear of three crowned teeth with angular misalignment", Tribology International, 195, 2024.