CONTACT STRESS ANALYSIS IN DYNAMIC CONDITION OF SPUR GEAR BY USING ANSYS

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ABSTRACT:
To design the spur gear to study the weight reduction and stress distribution cast steel and composite materials. Gearing is one of the most critical components in a mechanical power transmission system, and in most industrial rotating machinery. It is possible that gears will predominate as the most effective means of transmitting power in future machines due to their high degree of reliability and compactness. To design the spur gear model using designs software. To study the impact analysis for cast steel, Aluminium and composite materials.

Keywords- Spur Gear, Catia, Ansys Workbench, Solid works, Cast steel, Aluminum Alloy, Epoxy E Glass UD, Composite material.

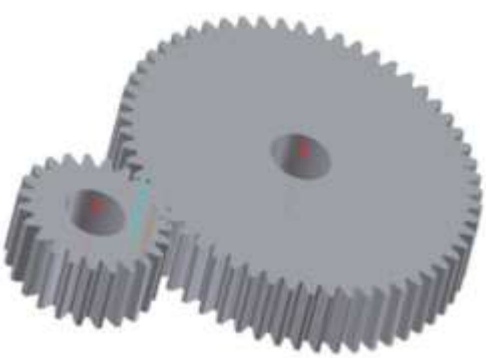
1. INTRODUCTION:

Gearing is one of the most critical components in a mechanical power transmission system, and in most industrial rotating machinery. Gears are toothed members which transmit power/ motion between two shafts by meshing without any slip. Hence, gear drives are also called positive drives. In any pair of gears, the smaller one is called pinion and the larger one is called gear immaterial of which is driving the other.

A gearbox as usually used in the transmission system is also called a speed reducer, gear head, gear reducer etc., which consists of a set of gears, shafts and bearings that are factory mounted in an enclosed lubricated housing. Speed reducers are available in a broad range of sizes, capacities and speed ratios. In this, analysis of the characteristics of spur gear was studied..

1.1 SPUR GEAR

The spur gear is simplest type of gear manufactured and is generally used for transmission of rotary motion between parallel shafts. The spur gear is the first choice option for gears except when high speeds, loads, and ratios direct towards other options. Other gear types may also be preferred to provide more silent low-vibration operation. A single spur gear is generally selected to have a ratio range of between 1:1 and 1:6 with a pitch line velocity up to 25 m/s. The spur gear has an operating efficiency of 98-99%. The pinion is made from a harder material than the wheel.



(FIG-1:SPUR GEAR)

2. LITERATURE SURVEY:

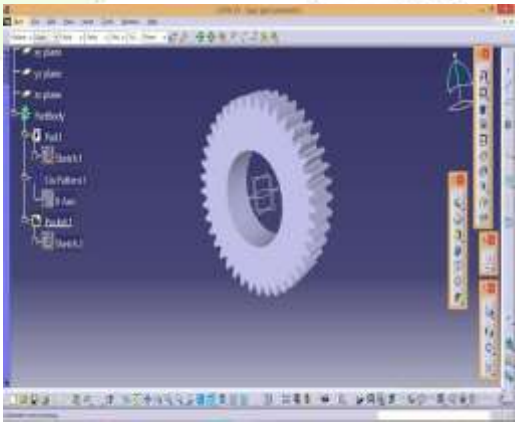
The gear stress analysis, the transmission errors, and the prediction of gear dynamic loads, gear noise, and the optimal design for gear sets are always major concerns in gear design. The polymer gear wear rate will be increased, when the load reaches a critical value for a specific geometry. The gear surface will wear slowly with a low specific wear rate if the gear is loaded below the critical one. The possible reason of the sudden increase in wear rate is due to the gear operating temperature reaching the material melting point under the critical load condition. Actual gear performance was found to be entirely dependent on load. A sudden transition to high wear rates was noted as the transmitted torque was increased to a critical value. This is to be associated with the gear surface temperature of the material reaching its melting point. That is for a given geometry of actual gear, a critical torque can be decided from its surface temperature calculation. [K. Mao, 2006]

3. MATERIALS PROPERTIES USED FOR SPUR GEAR:

TABLE 1

S.no	Material	Youngs modulus (gpa)	Density Kg/m^3	Poisson's Ratio
1	Cast steel	200	7870	0.29
2	Aluminum alloy	71	2770	0.33
3	E Glass epoxy	100	2000	0.4
4	Composite	450	1800	0.30
5	Structural steel	200	7850	0.3

4. DESIGN IN CATIA



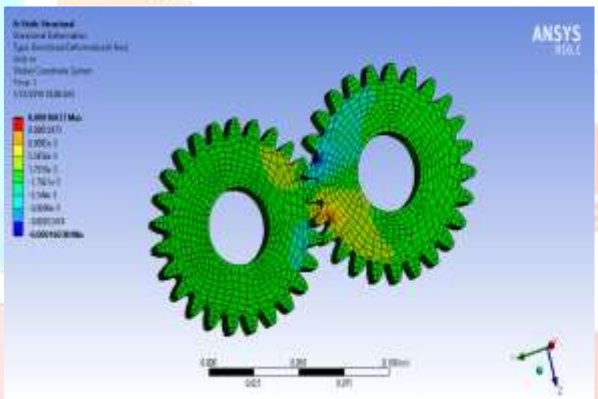
(Fig-1: CATIA Model in spur gear)

5. ASSEMBLY IN CATIA:

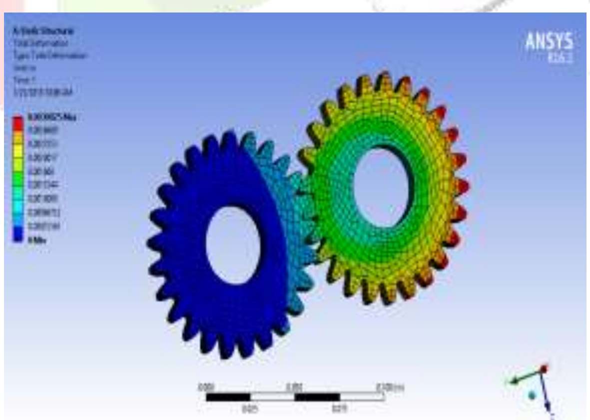
(Fig-2: ASSEMBLY OF SPUR GEAR)

ANALYSIS

5.1 STATIC ANALYSIS
ALUMINIUM ALLOY



(Fig-3: DIRECTIONAL DEFORMATION)



(Fig-4: TOTAL DEFORMATION)

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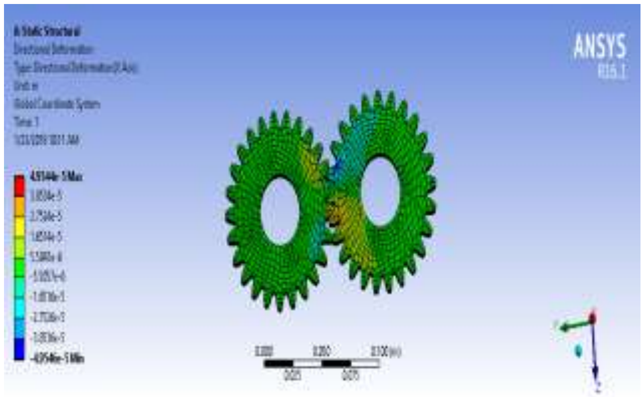
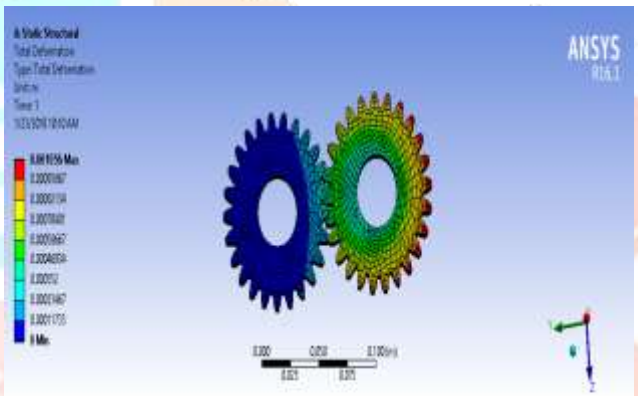
CAST STEEL

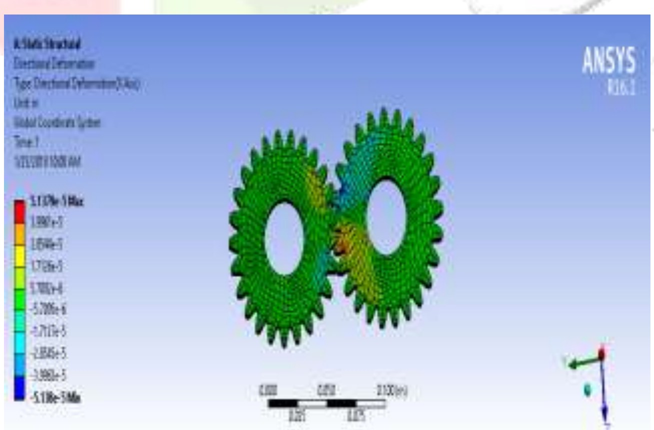


(Fig-5:Directional Deformation)

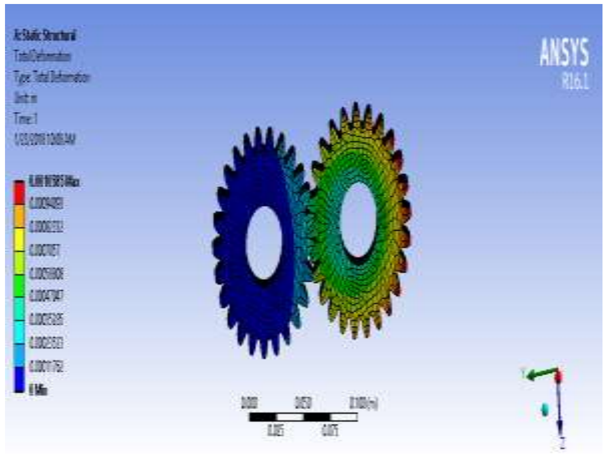


(Fig-6: TOTAL Deformation)

STRUCTURAL STEEL



(Fig-7: DIRECTIONALDEFORMATION)

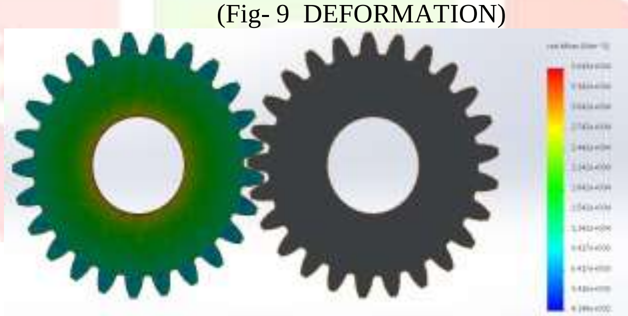


(Fig-8:TOTAL DEFORMATION)

5.2 DYNAMIC ANALYSIS

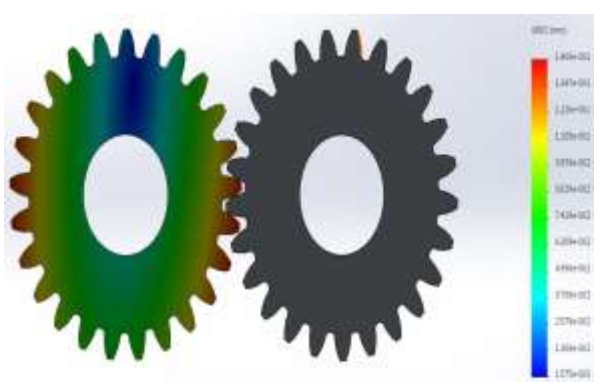
ALUMINIUM

(Fig- 9 DEFORMATION)

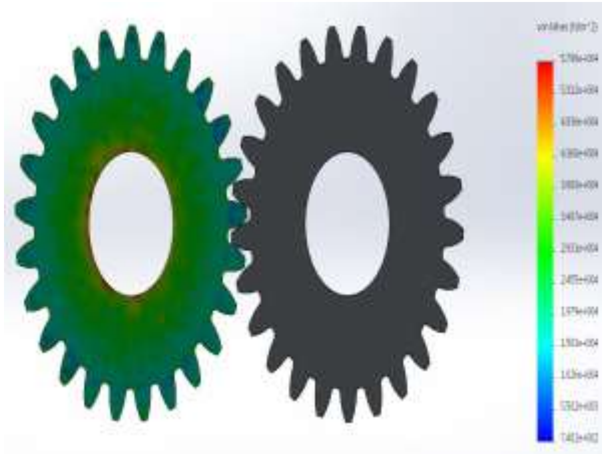


(Fig- 10 STRESS)

CAST STEEL

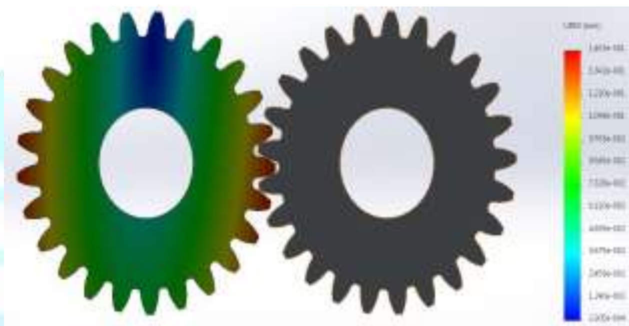


(Fig-11: DEFORMATION)

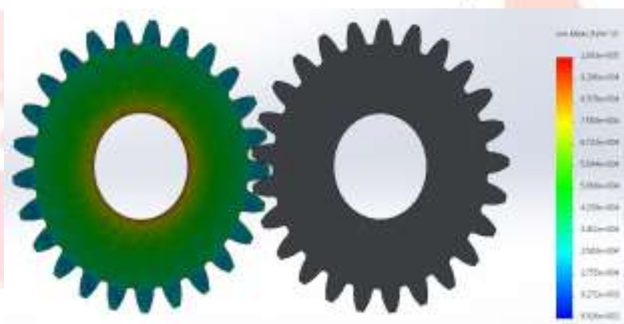


(Fig-12:STRESS)

COMPOSITES

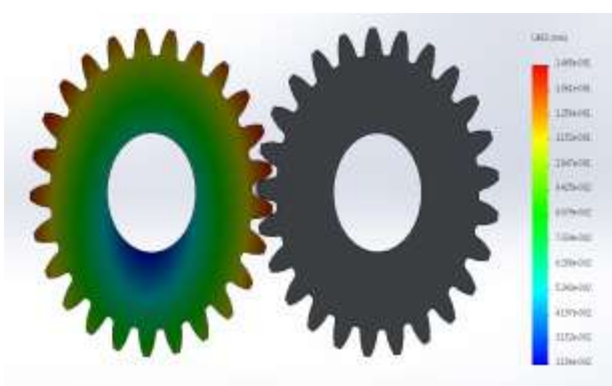


(Fig-13:DEFORMATION)

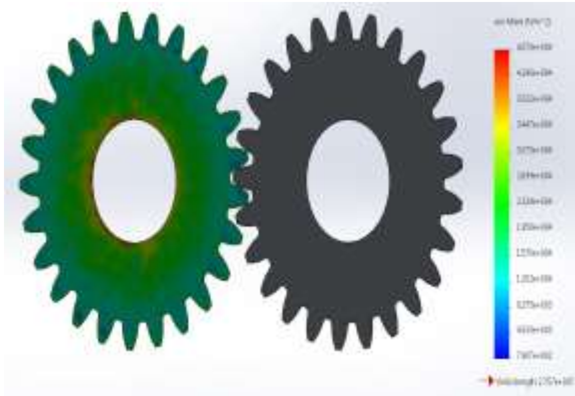


(Fig-14:STRESS)

EPOXY E GLASS



(FIG-15:DEFORMATION)



(Fig-16: STRESS)

COMPARISON TABLE

Materials	Deformation		Stress	
	Max	**Min**	**Max**	**Min**
Cast steel	$1.46e-^{1}$	$1.57e-^{3}$	$5.78e+^{4}$	$7.4e+^{2}$
A1 1060	$1.45e-^{1}$	$1.6e-^{2}$	$3.6e+^{4}$	$4.1e+^{2}$
E Glass epoxy	$1.45e-^{1}$	$2.1e-^{2}$	$4.5e+^{4}$	$7.9e+^{2}$
Composite	$1.46e-^{1}$	$2.3e-^{2}$	$1.0e+^{4}$	$9.9e+^{2}$

6. CONCLUSION:

In this project, spur gear is modeled in 3D software using Catia v5, ANSYS Workbench 16.0 and solid works 2015 package 3. In this project, used materials are cast steel, Epoxy e glass, A1 1060, and composite material. Spur gear has been analyzed in static and dynamic to find the total deformation and stress. By comparing the results it is clear that A1 1060 has less deformation and stress than other materials. So using the materials is safe. By comparing the results between materials, A1 1060 is more advantageous than other materials due to its less weight and cheap weight.

7. REFERENCES:

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