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Design and Fea Analysis of Worm and Worm Wheelfor Automation in Hand Brake of Lmv

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ABSTRACT: Hand brake is perhaps the main parts in vehicles. Overall the hand brake is worked manually. In this project we are developing Ignition Switch Operated Automatic Parking Brake System for safety purpose. The hand brake engagement and disengagement is done with the help of contact type limit switches operates the motor.

Key point:
Hand brake, ANSYS, Worm gear box

I. INTRODUCTION

In cars, the parking brake, additionally known as emergency brake, hand brake, or e-brake, is a latching brake sometimes used to keep the vehicle stationary. It's generally additionally accustomed prevent a vehicle from rolling once the operator desires each feet to work the clutch and throttle pedals. Automobile hand brakes sometimes contain a cable directly connected to the brake mechanism on one finish and to a lever or pedal at the driver's position. The mechanism is usually a non-automatic lever (hence the emergency brake name), on the ground on either aspect of the motive force, or a pull handle situated below and close to the wheel column, or a (foot-operated) pedal situated way with the exception of the opposite pedals.

Although generally called a hand brake, using it in any emergency wherever the footbrake continues to be operational is probably going to badly upset the brake balance of the automotive and immensely increase the probability of loss of management of the vehicle, for instance by initiating a rear-wheel skid. To boot, the stopping force provided by using the handbrake is tiny and wouldn't considerably aid in stopping the vehicle. The hand brake operates totally on the rear wheels that have reduced traction whereas braking however in some cases, hand brake operates on front wheel, as wiped out most Citroens manufactured since the tip of World War II. The emergency brake is instead supposed to be used just in case of mechanical failure wherever the regular footbrake is inoperable or compromised. Trendy brake systems square measure usually terribly reliable and equipped with dual circuit hydraulics and low-brake-fluid sensing element systems, which means the handbrake is never accustomed stop a moving vehicle.

Conventional hand brake feat involves the human interference. While not pull or pushing the lever, the hand brake won't work. Also, generally as a result of negligence or in emergency conditions, we have a tendency to humans usually forget to use parking brakes. This could result in rolling of auto just in case of slopes and collision with different vehicles in park. Constant enhancements in active safety and enhancements with relation to the dependableness and luxury of operation mean that mechanical handbrakes are progressively being replaced by mechanical device systems.

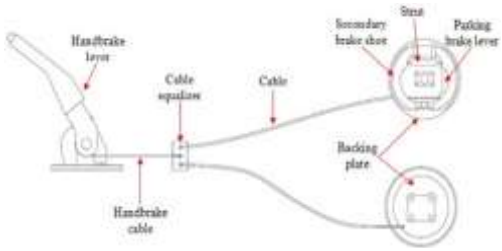

Fig. 1 Show Basic Layout of Parking Brake

II. PROBLEM STATEMENTS

1. Insufficient of force applied by the driver against parking brake system.
2. Occupies more space and size in Front side of the drivers driving seat that is not ergonomically in nature.
3. Driver has not remembered many times to

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apply and release a break.

4. In lock condition if vehicle is running its cause in break drum heat and broken due to overheat.
5. Same case happen in Electrical vehicle then causes of overheating of wiring of vehicle or motor will be bust due to over loading.

III. OBJECTIVES

1. To reduce the effort of the driver that leads in conventional one.
2. To increase the comfort and safety for the driver by using modified parking brake system named as automatic handbrake for engagement and release system.
3.In this to developed a Worm and Worm wheel gear for self-locking of system
4. As when the ignition switch turned ON, handbrake must disengage and vice versa when ignition switch is OFF, handbrake must engage.
5. System may work electro mechanically using motor, sensor and gear box.

IV. METHODOLOGY

1. Calculating force and displacement requirements for breaking of hand break.
2. Design of basic layout for hand breaking.
3. Selection of motor and calculating of gear box requirements
4. Design of Gear box and 3D Modeling of gear box
5. Analysis and optimization of gear box
6. Development of model and testing on real vehicle

V. PROPOSED MODEL

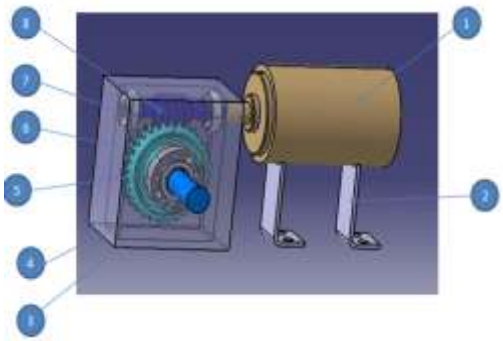

Fig. 2 Proposed 3D model of Automatic break

VI. DESIGN

Selection of proper motor by using given data from the industryHand Brake should be applied in 0.5 sec & in this the cable wire travel distance should not Exceed 60 mm Consider output shaft dia =10mm

$= 2\pi r$

$= 2x\pi x5$

$= 31.4$

So we required = 240 rpm

Selection of Motor

Motor Model:- 95 to 135 cc		
1	Rated Voltage	12 v
2	Rated Power	0.35 kw
3	Assured Performance @ 10v	80A Max. 7000rpm
4	Lock Torque @ 6v	250A max
5	Application	Starter Motor

Considers Out shaft diameter of Motor is 10 mm

Input (12v motor)	Output
Motor Power = 0.35 kw	Speed of out Shaft = 240 r.p.m
Speed of Motor = 7000 r.p.m	

Speed reduction gear box calculation
Therefore now we have Input speed & output speed.
Input speed = 7000 R.P.M
Output speed = 240 R.P.M
Speed Ratio = Input speed / Output speed
= 7000 / 240
= 29.16
1:30 Gear Ratio for this speed reduction is required Hence, we require Worm and Worm wheel gear box for large speed reduction as well as self-locking mechanism.

VII. FINITE ELEMENT ANALYSIS

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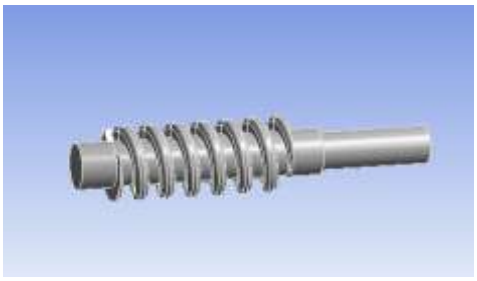

Fig.3 Geometry imported in ANSYS of Worm

Fig.4 Geometry imported in ANSYS of Worm wheel

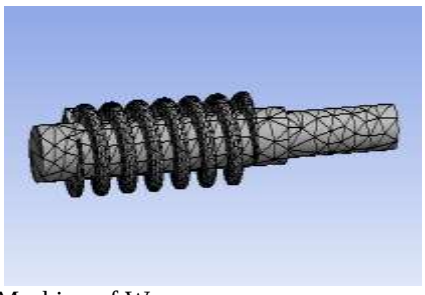

Fig.5 Meshing of Worm

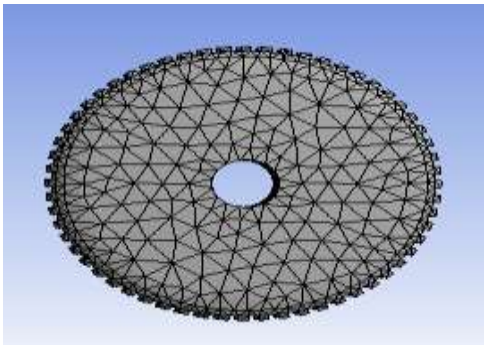

Fig.6 Meshing of Worm wheel

VIII. ANSYS RESULTS

Boundary condition

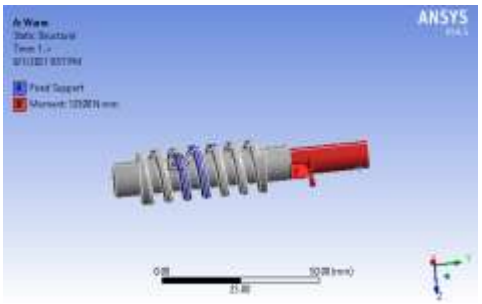

Fig.9 Show a boundary condition of applied 12500 N-mm Moment at one end of the shaft and Outer Dia. is fix in Worm

stress

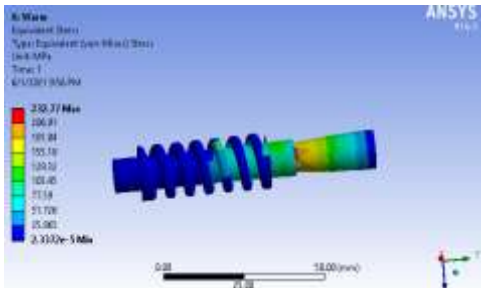

Fig.10 Show a stress in shaft after applied 12500 N-mm Moment at one end of the shaft and Outer Dia. is fix in Worm

Deformation

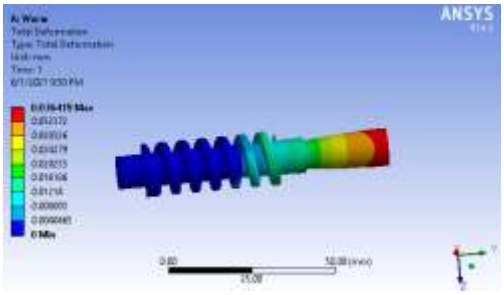

Fig.11 Show a Deformation in shaft after applied 12500 N-mm Moment at one end of the shaft and Outer Dia. is fix in Worm

Boundary condition

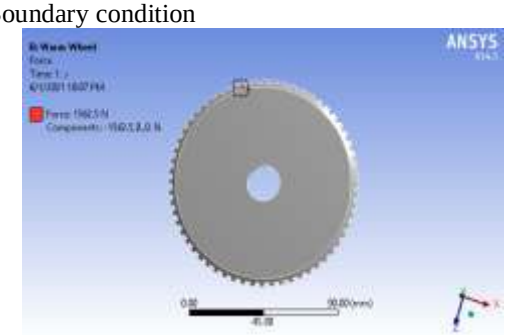

Fig.12 Show a boundary condition of applied 1562.5 N forces at one tooth and center of Worm wheel is fixed

Stress

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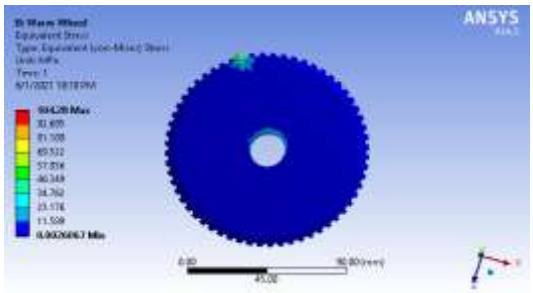

Fig.13 Show a Stress of applied 1562.5 N forces at one tooth and center of Worm wheel is fixed

Deformation

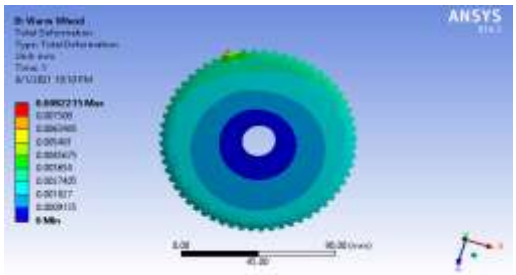

Fig.14 Show a Deformation of applied 1562.5 N force at one tooth and center of Worm wheel is fixed.

IX. RESULT TABLE

Sr. No.	Boundary Condition	Worm		Worm Wheel	
		Deformation (mm)	Stress (MPa)	Deformation (mm)	Stress (MPa)
1	1562.5 N force	NA	NA	0.00822	104.28
2	12500 N-mm Moment	0.036	232.77	NA	NA

Table3. Results of applied moment for both gear

X. CONCLUSION

From the results obtained it is concluded thatStress occurred in the both parts are not more than allowable stress, hence both are safe.Stress occurred in Worm wheel is too less than allowable stress, hence we can go for optimization in same.

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