Vibration&Stress Analysis of Differential GearBox

[1]Ashish Kumar , [2]Shahnawaz Alam

[1]Mechanical Engineer, [2]Assistant Professor
[1]Mechanical Department,
[1]SRM University, NCR Campus, India

Abstract : The primary point of this paper is to concentrate on the mechanical plan and investigation on get together of riggings in apparatus box when they transmit control at various paces. Examination is likewise directed by changing the materials for apparatuses, Cast Iron, Cast Steels and Aluminum Alloy and so on., by and by utilized materials for riggings and rigging shafts is solid metal, cast steel. In this paper to supplant the materials with Aluminum material for diminishing load of the item. Stress, removal is broke down by considering weight decrease in the rigging box at higher speed. The examination is done in ANSYS programming. It's a result of Solid works. In the present work every one of the pieces of differential are planned under static condition and demonstrated. The required information is taken from diary paper. Demonstrating and get together is done in Pro Engineer. The itemized illustrations of all parts are to be outfitted.

***IndexTerms* - Gearbox, Differential, Structural analysis, Ansys.**

I. INTRODUCTION

A differential is a gadget, ordinarily however not really utilizing riggings, fit for transmitting torque and turn through three shafts, quite often utilized in one of two different ways: in one way, it gets one information and gives two yields this is found in many vehicles and in the other manner, it consolidates two contributions to make a yield that is the aggregate, contrast, or normal, of the data sources. In autos and other wheeled vehicles, the differential permits every one of the driving street wheels to pivot at various velocities, while for most vehicles providing equivalent torque to every one of them. A vehicle's wheels pivot at various paces, chiefly when turning corners. The differential is intended to drive a couple of wheels with equivalent torque while enabling them to pivot at various paces. In vehicles without a differential, for example, karts, both driving wheels are compelled to pivot at a similar speed, generally on a typical hub driven by a basic chain drive instrument. While cornering, the internal wheel needs to travel a shorter separation than the external wheel, so with no differential, the outcome is the inward wheel turning as well as the external wheel hauling, and this outcomes in troublesome and flighty dealing with, harm to tires and streets, and strain on (or conceivable disappointment of) the whole drive train.

II. FUNCTIONAL DESCRIPTION

The accompanying portrayal of a differential applies to a "customary" back wheel-drive vehicle or truck with an "open" or constrained slip differential: Torque is provided from the motor, through the transmission, to a drive shaft. It originates from British term: 'propeller shaft', normally and casually curtailed to 'prop-shaft', which races to the last drive unit that contains the differential. A winding angle pinion gear takes its drive from the finish of the propeller shaft, and is encased inside the lodging of the last drive unit. These lattices with the huge winding angle ring gear, known as the crown wheel. The crown haggle may work in hypoid introduction, not appeared. The crown wheel gear is appended to the differential bearer or confine, which contains the 'sun' and 'planet' wheels or riggings, which are a group of four restricted incline outfits in opposite plane, so each slope gear networks with two neighbors, and turns counter to the third, that it faces and does not work with. The two sun wheel gears are adjusted on a similar pivot as the crown wheel rigging, and drive the pivot half shafts associated with the vehicle's driven wheels. The other two planet gears are adjusted on an opposite hub which changes introduction with the ring rigging's revolution. In the two figures appeared, just a single planet gear (green) is represented, be that as it may, most car applications contain two restricting planet gears. Other differential structures utilize distinctive quantities of planet gears, contingent upon strength necessities. As the differential bearer pivots, the changing hub introduction of the planet gears grants the movement of the ring apparatus to the movement of the sun outfits by pushing on them instead of betraying them, for example similar teeth remain in a similar work or contact position), but since the planet gears are not confined from betraying one another, inside that movement, the sun apparatuses can counter-pivot with respect to the ring gear and to one another under a similar power in which case similar teeth don't remain in contact.

III. ANYSIS

Ansys is useful programming for structure examination in mechanical structure. That is an introduction for you who should need to get comfortable with Ansys. Ansys is a structure examination robotization application totally fused with ProEngineer. This item uses the Finite Element Method (FEM) to reproduce the working conditions of your structures and predict their direct. FEM requires the course of action of significant structures of conditions. Constrained by snappy solvers, Ansys makes it serviceable for organizers to quickly check the dependability of their structures and search for the perfect course of action.

A thing improvement cycle regularly fuses the going with advances:

- Build your model in the ProEngineer system.
- Prototype the arrangement.
- Test the model in the field.
- Evaluate the delayed consequences of the field tests.
- Modify the arrangement subject to the field test results

IV. PROPERTIES OF MATERIALS

4.1 Nickel Chrome Steel

Table -1 Properties of Nickel Chrome Steel

Name	Nickel Chrome Steel
Model type	Linear Elastic Isotropic
Default Failure Criterion	Max von Mises Stress
Yield Strength	1.72339e+0.008 N/m^2
Tensile Strength	4.13613e+0.008 N/m^2
Elastic Modulus	2e+011 N/m^2
Poisson's Ratio	0.28
Mass Density	7800 kg/m^3
Shear Modulus	7.7e+010 N/m^2

4.2 Aluminium Alloy

Table -2 Properties of Aluminium Alloy

Name	al_alloy7475-1761
Model type	Linear Elastic Isotropic
Default Failure Criterion	Max von Mises Stress
Yield Strength	1.65e+0.008 N/m^2
Tensile Strength	3.0e+0.008 N/m^2
Elastic Modulus	7e+011 N/m^2
Poisson's Ratio	0.33
Mass Density	2600 kg/m^3
Shear Modulus	3.189e+010 N/m^2

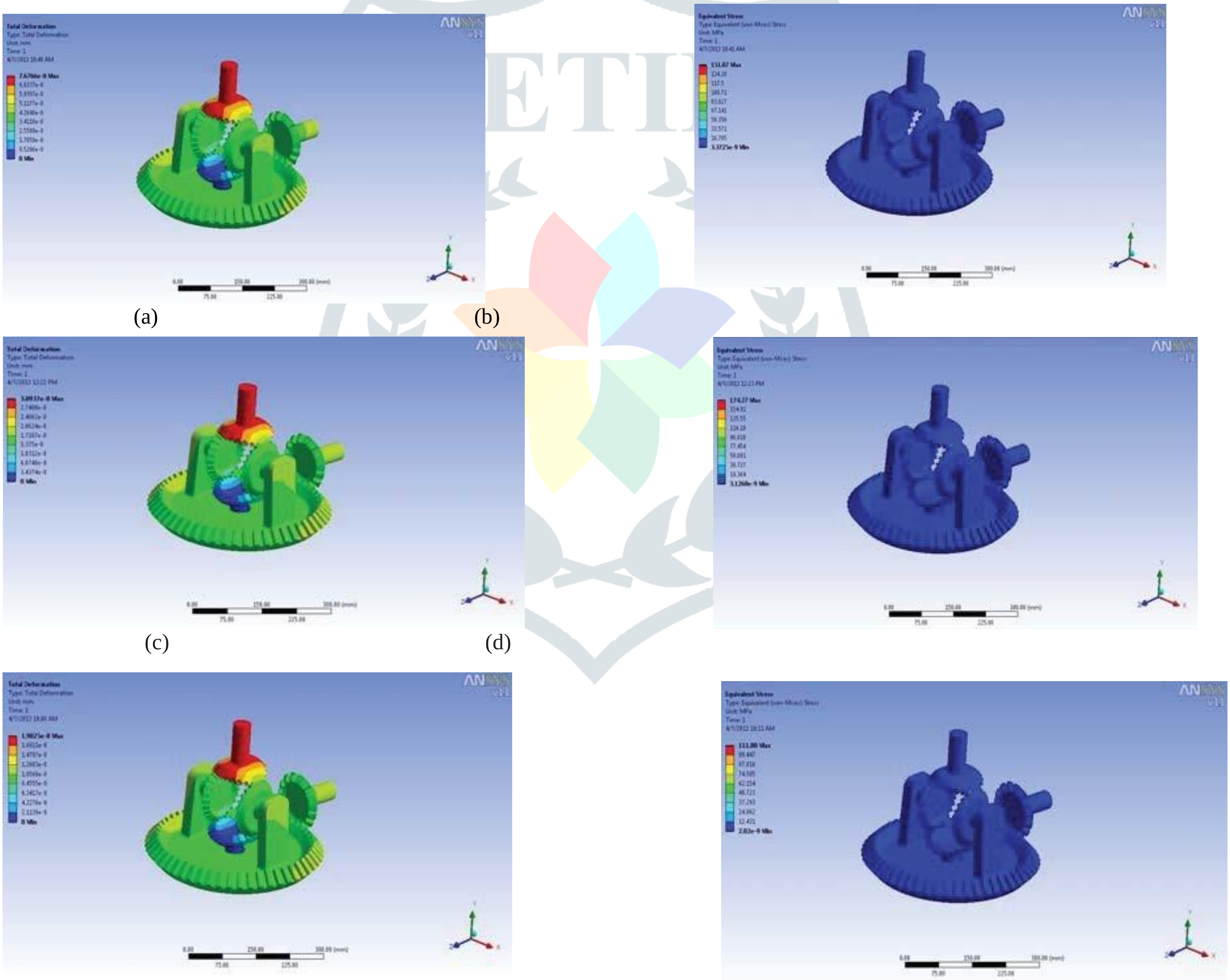
4.3 Cast Iron

Table -3 Properties of Cast Iron

Name	Malleable Cast Iron
Model type	Linear Elastic Isotropic
Default Failure Criterion	Max von Mises Stress
Yield Strength	2.75742e+0.008 N/m^2
Tensile Strength	4.13613e+0.008 N/m^2
Elastic Modulus	1.9e+011 N/m^2
Poisson's Ratio	0.27
Mass Density	7300 kg/m^3
Shear Modulus	8.6e+010 N/m^2

V. EXPERIMENT TOTAL DEFORMATION AND EQUIVALENT STRESS

4.4 AT 2000 RPM



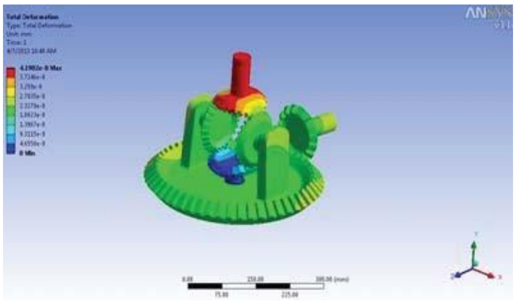
(a) (b)

(c) (d)

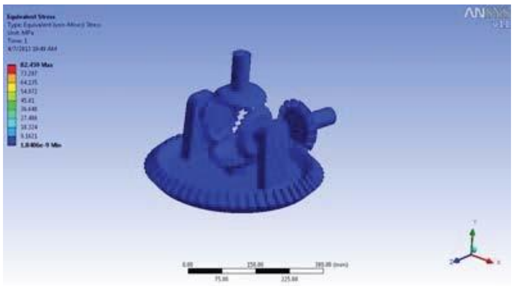
(e) (f)

Figure 1 (a) Total Deformation Aluminium Alloy (b) Equivalent Stress Aluminium Alloy (c) Total Deformation Cast Iron (d)Equivalent Stress Cast Iron (e) Total Deformation Structural Steel (f) Equivalent Stress Structural Steel

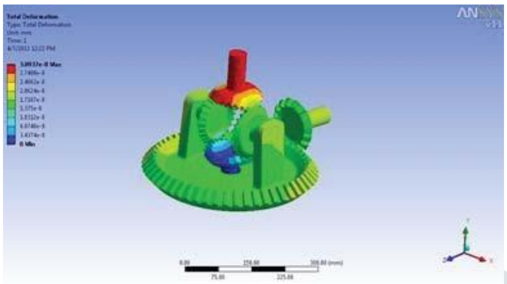
4.5 AT 4500 RPM



(a)

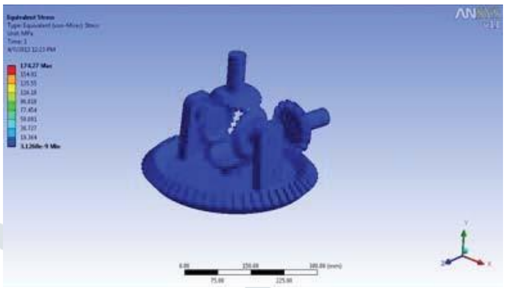


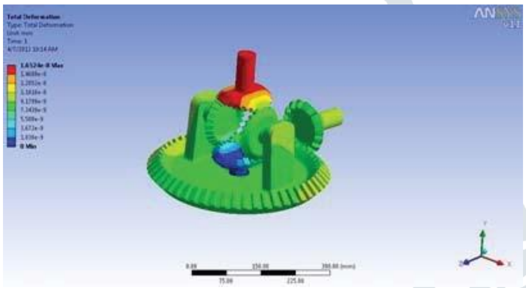
(b)



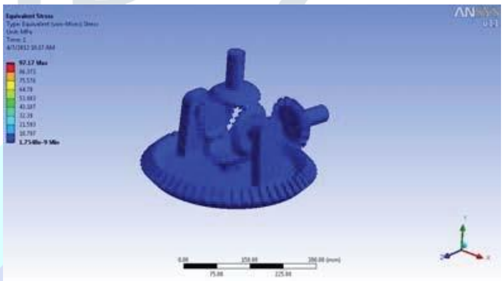
(c)

(d)





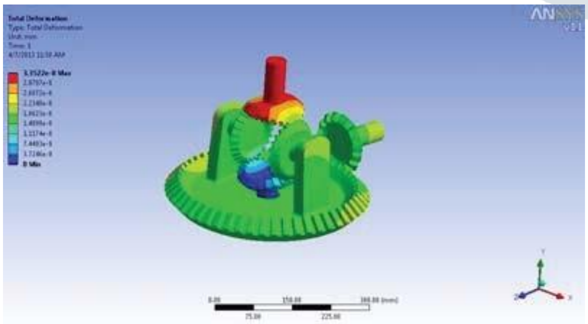
(e)



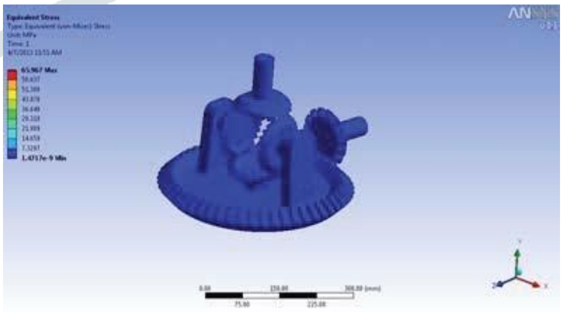
(f)

Figure 2. (a) Total Deformation Aluminium Alloy (b) Equivalent Stress Aluminium Alloy (c) Total Deformation Cast Iron (d)Equivalent Stress Cast Iron (e) Total Deformation Structural Steel (f) Equivalent Stress Structural Steel

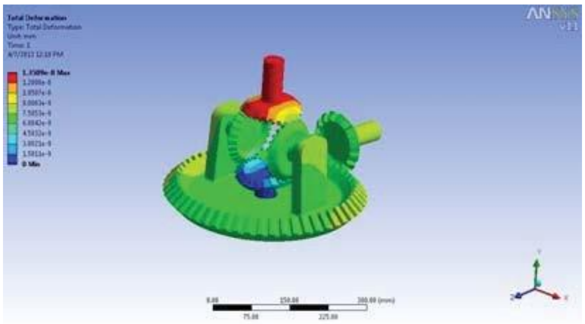
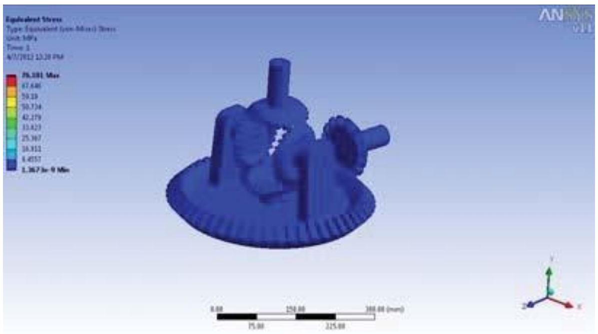
4.6 AT 6000 RPM



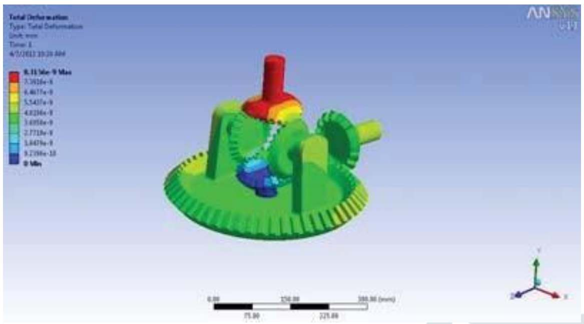
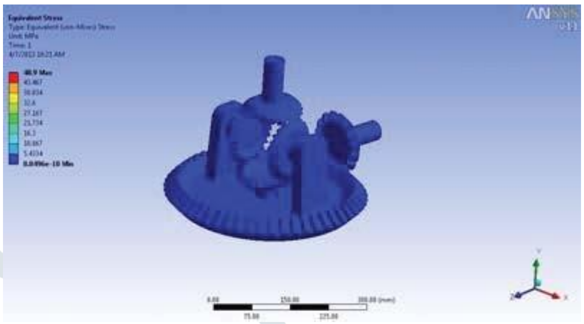
(a)



(b)

(c) (d)

(e) (f)

Figure 3. (a) Total Deformation Aluminium Alloy (b) Equivalent Stress Aluminium Alloy (c) Total Deformation Cast Iron (d)Equivalent Stress Cast Iron (e) Total Deformation Structural Steel (f) Equivalent Stress Structural Steel

VI. CONCLUSION

By viewing the fundamental examination results using Aluminum blend the weight regards are inside the allowable weight regard. So using Aluminum Alloy is okay for differential apparatus. When taking a gander at the weight estimations of the three materials for all speeds 2000rpm, 4500rpm and 6000 rpm, the characteristics are less for Aluminum composite than Alloy Steel and Cast Iron. By viewing the repeat examination, the vibrations are less for Aluminum Alloy than other two materials since its ordinary repeat is less. What's more, besides weight of the Aluminum amalgam decreases pretty much on numerous occasions when differentiated and Alloy Steel and Cast Iron since its thickness is outstandingly less. In this manner mechanical capability will be extended. By watching examination results, Aluminum Alloy is best material for Differential.

REFERENCES

[1] J.O.Nordiana, S.O.Ogbeide, N.N.Ehigiamusoe and F.I.Anyasi., 2007,"Computer aided design of a spur gear, "Journal of Engineering and Applied Sciences 2 (12); pp 1743 1747.

[2] Zeping Wei., 2004"Stresses and Deformations in Involute spur gears by Finite Element method," M.S, Thesis, College of Graduate Studies and research, University of Saskatchewan.

[3] Maitra, G.M, 2004, Hand Book of Gear Design, TataMcGrawHill, New Delhi.

[4] S.Md.Jalaluddin., 2006, "Machine Design, "Anuradha publications, Chennai.

[5]S.Mahalingam, R.E.D Bishop, 1974, "Dynamic loading of Gear tooth", Journal of sound and vibration, 36(2), pp179189 9. S.H.Choi, J.Glienicke, D.C.Han, K.Urlichs, April 1999, "Dynamic Gear Loads due to coupled lateral, Torsional and Axial Vibrations in a helical Geared System" , Journal of vibration and acoustics, Vol 121

[6]Thirupathi Chandrupatla, Ashok D.Belegundu, "Introduction to finite element in Engineering" ,2003.

[7] PSG, 2008."Design data," Kalaikathir Achchagam publishers, Coimbatore, India.