DESIGN OPTIMIZATION OF CAR WHEEL RIM USING FEA TECHNIQUE

Dr B RAVI[1], K NAGENDRA BABU[2], V ANUSHA[3], P SUDHEER KUMAR[4]
[1]Associate Professor, Department of Mechanical Engineering, AnuBose Institute of Technology for Women's, KSP Road, New Paloncha, Bhadradri Kothagudem District, Telangana (TS), 507115
[2,3,4,]Assistant Professor, Department of Mechanical Engineering, AnuBose Institute of Technology for Women's, KSP Road, New Paloncha, Bhadradri Kothagudem District, Telangana (TS), 507115

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ABSTRACT
Archaeologies and understudies of history of today consider the to be of the wheel as the genuine beginning of any old civilisation. The wheel is conceivably the most fundamental disclosure of past occasions. The wheel has produced using just a curiously gigantic bearing to an absolutely key piece of any modem transportation vehicle. The moved vehicle is besides observed today an arrangement thing to upgrade individuals' individual necessities. Engine vehicles are made by astoundingly genuine principles to guarantee the thriving of the pioneers. Each part is along these lines sorted out by the criticality of the segment. Wheels are doled out a security basic part and overall cods and criteria are utilized or structure a wheel.
The motivation driving the vehicle wheel edge gives a firm base on which to fit the tire. Its estimations, shape ought to be reasonable to enough suit the specific tire required for the vehicle. As of now comprehend expended on vehicle wheel edge having a spot with the plate wheel gathering is considered. Plan in a basic present day action which impacts the possibility of the thing.
3D appearing of the Volkswagen wheel which is specific state of edge (y-shape and u-shape)done in parametric programming CREO. Static, weariness and estimated appraisal is done ANSYS.
In static evaluation forms the weight and removal by utilizing two astounding materials to be unequivocal aluminum composite and conveyed steel. Specifically assessment, to pick the shirkings and frequencies.

I. INTRODUCTION

Vehicle wheels have advanced at some point or another of the various years from early talked plans of wooden and metal, scraps from wagon and motorbike improvement, to sort out metallic plates finally to the wandered metallic blueprints and contemporary solid and standard aluminum composites edges of the present current automobiles. All things considered, stunning structures seemed following quite a while of understanding and enormous subject taking a gander at. Since the 1970's couple of shrewd techniques for assessing very an unfathomable game plan helped with exploratory strain estimations have been started. As of past due, the procedure were progressed by an assortment of primer and intentional approachs for fundamental test (stress degree and obliged part techniques).Within the previous 10 years, life length explore (exhaustion lifestyles predication) and consistency systems for managing the sorts normal in building structure were applied to the auto wheel.

Archaeologies and history authorities of nowadays consider the to be of the wheel as the authentic start of any vintage civilisation. The wheel is maybe the most essential revelation of previous occasions. The wheel has produced using truely a greater than conventional bearing to a critical piece of any modem transportation vehicle. The bleeding edge vehicle is what's more chosen today a plan point of view to upgrade people's particular stipulations. Engine vehicles are familiar by using requesting rules with guarantee the wellbeing of the explorers. Every region is along these lines dependent through the criticality of the portion. Wheels are assigned a success chief section and standard cods and rules are utilized or structure a wheel.

Materials to cause those wheels to have end up has marvelous as a game plan and substances can run from metallic to nonferrous blends like magnesium and aluminum. Vehicle wheels have common for the length of the decades from early talked systems of wooden and metallic. Connect's from wagon and bike headway, to degree steel drifts finally to the wandered steel blueprints and front line made and built aluminum mixes edges of the present ebb and flow automobiles overall profitable structures avowed up following very some period of acknowledge and huge request taking a gander at. Since the 1970's couple of innovative techniques for assessing very tons reinforced with take a gander at pressure estimations were started.

Alloy Wheel

Objectives of the study

1. To have a look at the impacts of tire pneumatic strain, spiral burden associated with the radial burden at the stress and removal in rims underneath static circumstance, via restrained aspect research.
2. Optimization of wheel rim to reduce Weight with considering the hundreds following up on a wheel thru restricted component examination.
3. Determination of recurrence and mode states of wheel rim thru modular research using constrained element exam.
4. Life Prediction utilizing confined component research considering Stress-lifestyles technique Prefer the pleasant cloth among 3 lighter combos, for example, aluminum 7475, produced metal and Kevlar composite wheel rim considering static primary and modular examination

II. LITERATURE REVIEW

S Chaitanya et.al learned about lessening the rim weight and expressed that efficiency and execution will be improved as the general wright and inertial burdens are decreased by limiting the unsprung mass. The investigation demonstrated that burdens created are underneath yield worry after advancement.

Xin Wang et.al learned about the mechanical properties of graphene in fire hindered epoxy gum and expressed that the mechanical properties had diminished because of consideration of combustible retardants and because of less interfacial associations of added substance.

III. INTRODUCTION TO CAD and ANSYS

Computer aided drafting (CAD) is the utilization of PC systems (or workstations) to help inside the appearance, change, test, or streamlining of an arrangement. PC supported plan writing computer programs is used to construct the productivity of the modeler, improve the character of design, upgrade correspondences through documentation, and to make a database for amassing. PC supported design yield is every now and again as computerized documents for print, machining, or other gathering commitments. The term CADD (for Computer Aided Design and Drafting) is similarly used.

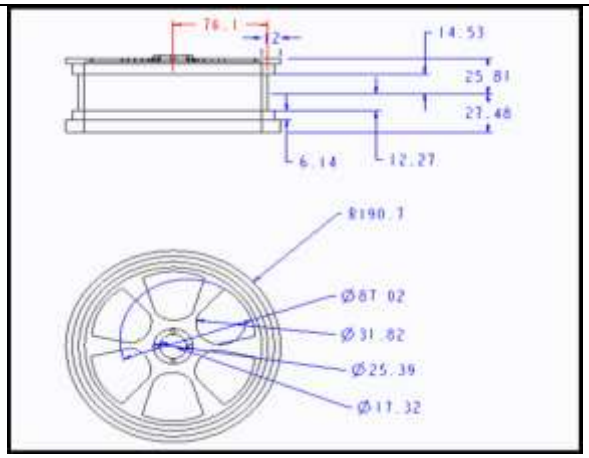
Its use in organizing computerized systems is known as advanced arrangement automation, or EDA. In mechanical arrangement it is called mechanical structure computerization (MDA) or PC helped drafting (CAD), which remembers the way for the bearing of making a particular drawing with the usage of use.

Introduction to Ansys

ANSYS Autodyn is pc reenactment gadget for reproducing the response of materials to snappy period unbalanced loadings from sway, extreme pressure or blasts. ANSYS Mechanical ANSYS Mechanical is a limited detail assessment instrument for basic appraisal, together with straight, nonlinear and dynamic investigations. This PC reenactment item offers limited components to form conduct, and permits texture styles and condition solvers for a major style of mechanical structure issues. ANSYS Mechanical likewise incorporates warm assessment and combined material science abilities concerning acoustics, piezoelectric, warm auxiliary and thermo-electric fueled assessment.

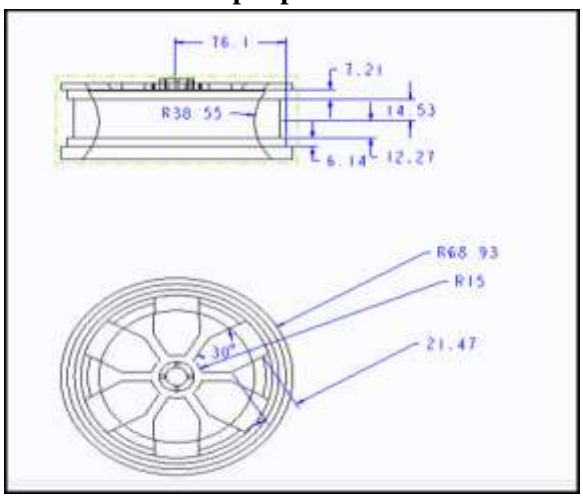
3d model of U-shape spoke wheel

2d model of U-shape spoke wheel



model of Y-shape spoke wheel

2D model of Y-shape spoke wheel



LOAD ANALYSIS FOR WHEEL RIM

Examination under Tire Air Pressure

Be that as it may, 35 psi is the standard swelling pressure setting. Hence

35 Psi = 35x0.4535x9.81/(25.4) ² = 0.241 Mpa

Investigation under Radial Load

They chose model Volkswagen polo 1.Zero TSI weight is

Around - 1500kg

Seating confine of the vehicle - 5 individuals

Assessed weight of every individual - 80Kg

Overages secured - 100Kg.

The hard and fast weight on wheels =2000Kg.

Which is passed on more prominent than 4 tires, on this way 500 Kg in step with tire.

Nevertheless, we regular for most negative circumstance condition considering

Braking, Cornering, etc as 700kg of mass

Subsequently the Maximum vertical weight is

F= 700x9.81=6867 N

The extended weight is chosen through the verbalization

$F_r = k. F$

Where F is the most significant weight passed on with the guide of the wheel, and

okay= 2.2 [5] with conformance from SAE, which is

Known as an accelerating check segment. In our examination,

We thought about F=6867N,

Therefore

F_r =15107. 4N = 15.1KN

IV RESULTS AND ANALYSIS

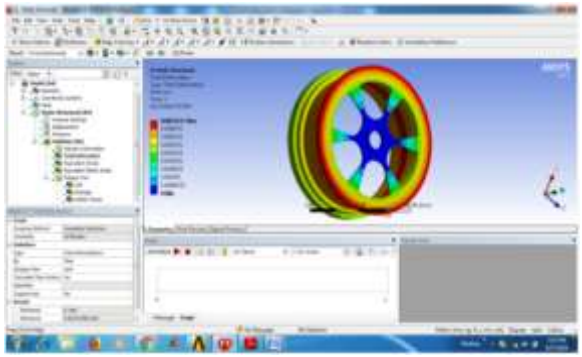
Casw 1 U Shape spokes Material: steel

Total deformation

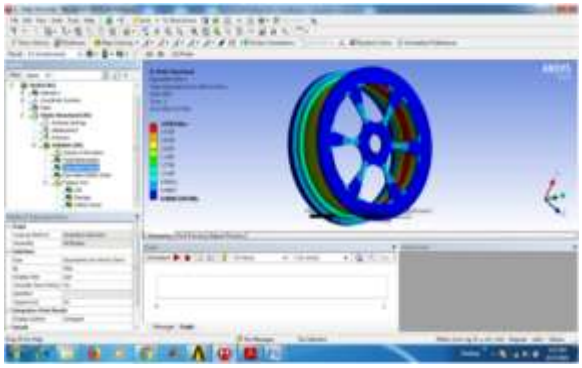
Von-mises stress

VON-MISES STRAIN

Material –Aluminum Alloy 7475
TOTAL DEFORMATION



VON-MISES STRESS



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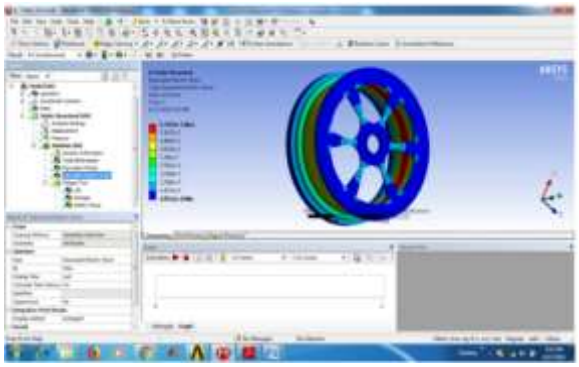
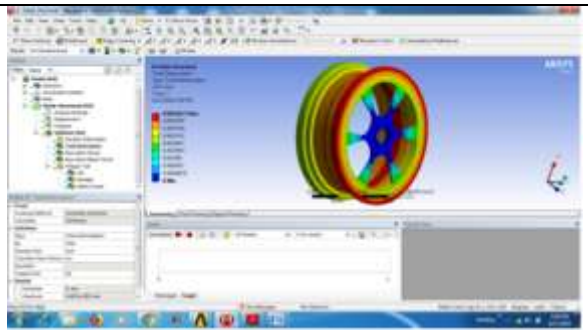
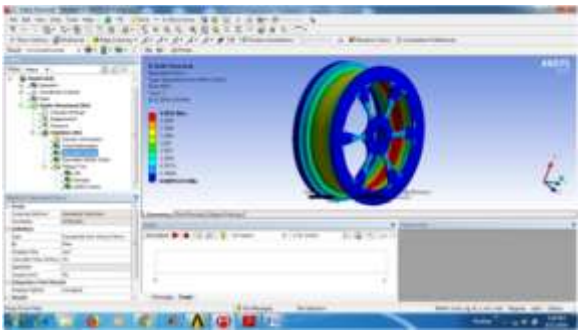


Material: kevalr
TOTAL DEFORMATION



VON-MISES STRESS

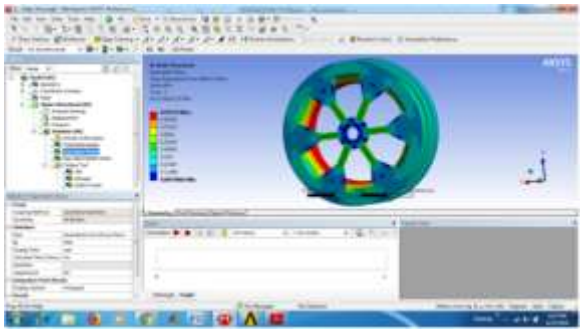


VON-MISES STRAIN

Case: 2 Y-shape spokes Material: steel

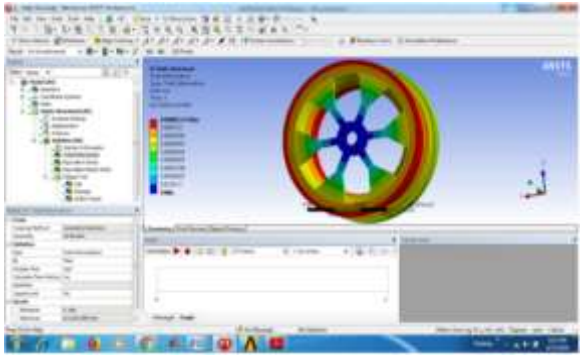
TOTAL DEFORMATION

VON-MISES STRESS



VON-MISES STRAIN

Material: aluminum alloy 7475
TOTAL DEFORMATION



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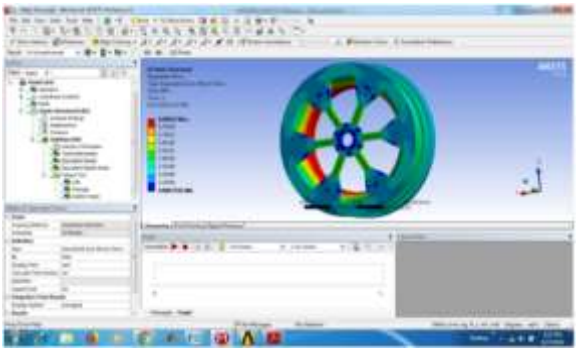

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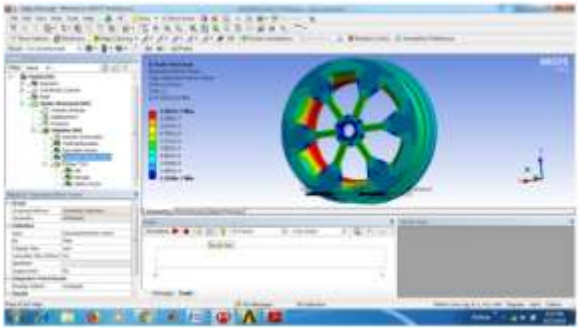
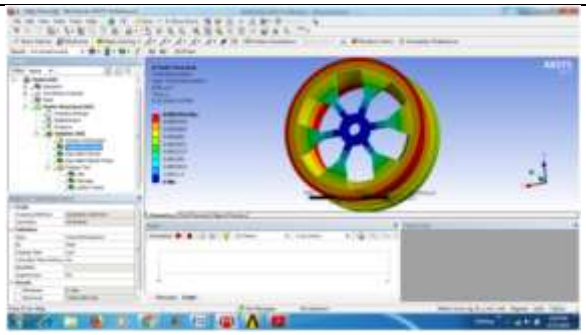


Material: Kevlar
TOTAL DEFORMATION



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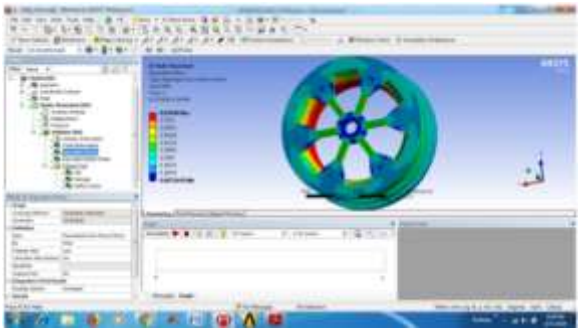
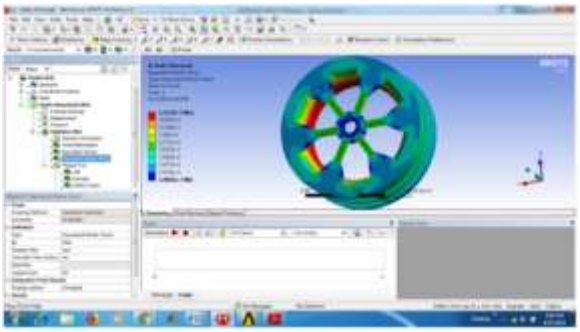


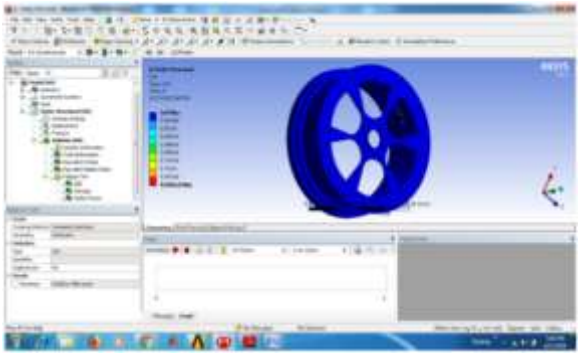
VON-MISES STRAIN



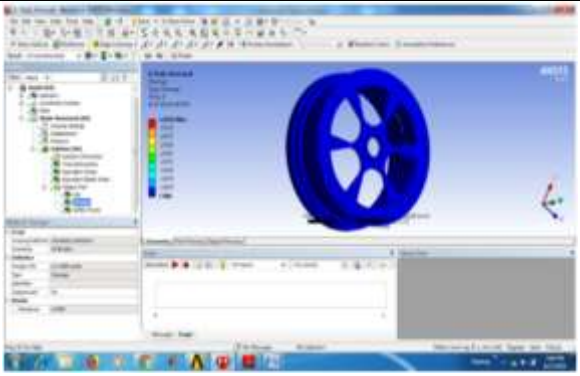
FATIGUE ANALYSIS OF CAR WHEEL RIM

Case: 1 U-shape spokes Material: steel

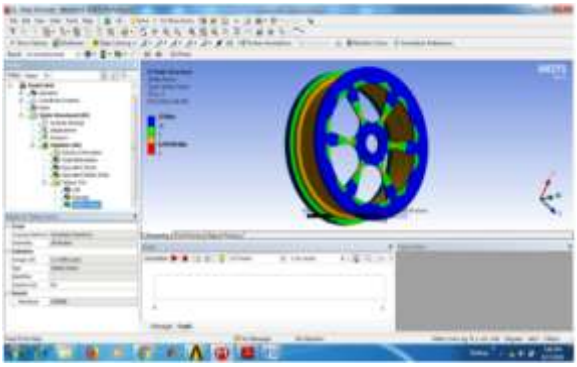
Life



Damage

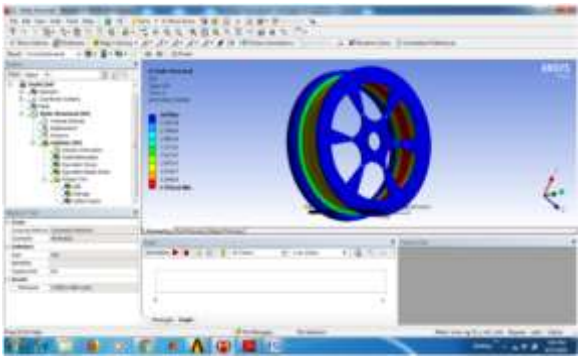


Safety factor

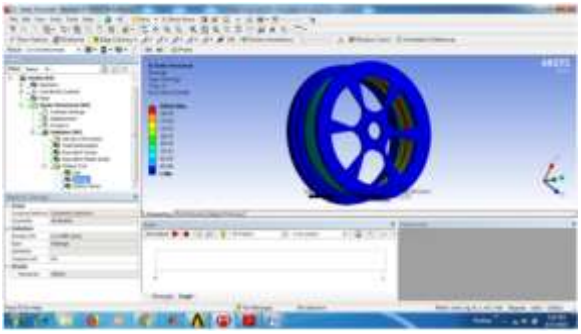


Material: Aluminum alloy 7475

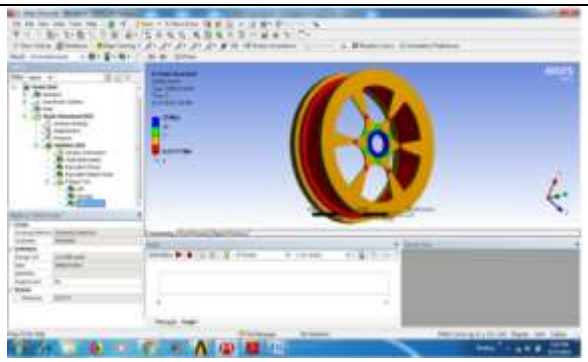
Life



Damage

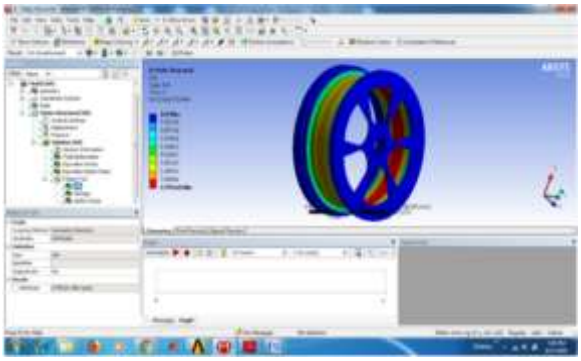


Safety factor

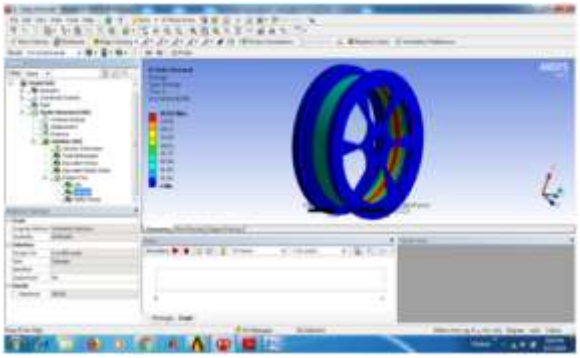


Material: kelvar

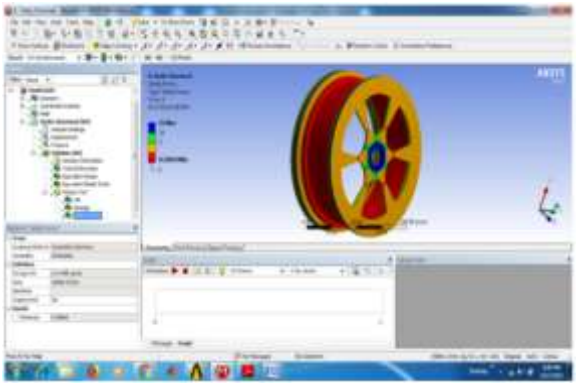
Life



Damage



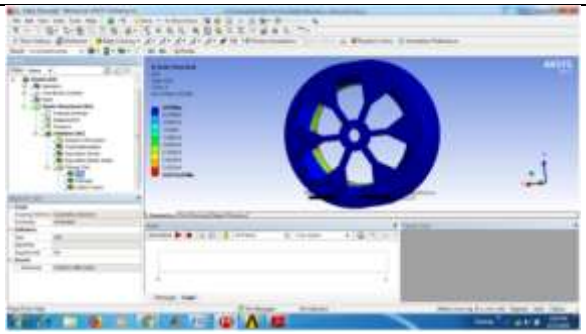
Safety factor



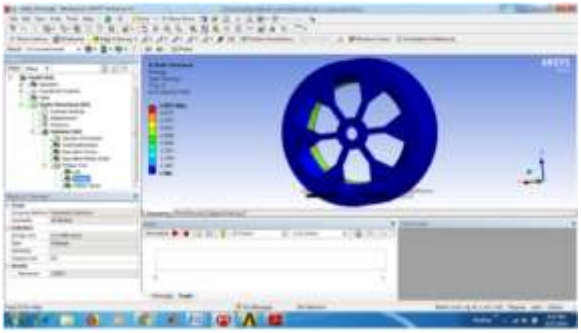
Case: 2 Y-shape spokes

Material: steel

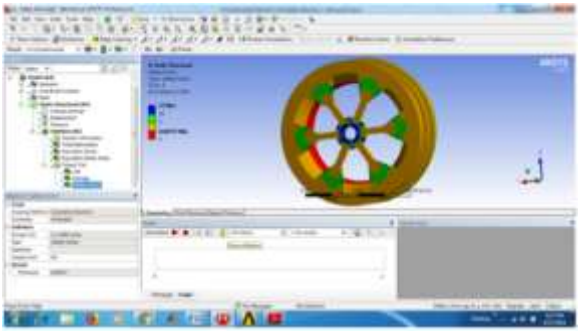
Life



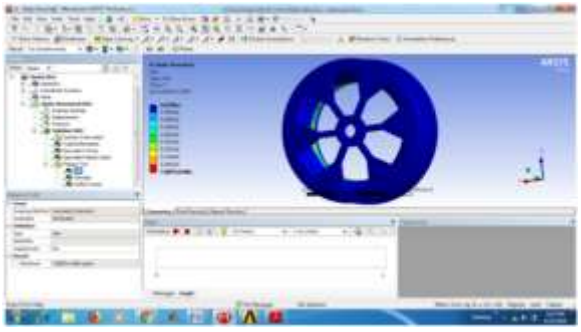
Damage



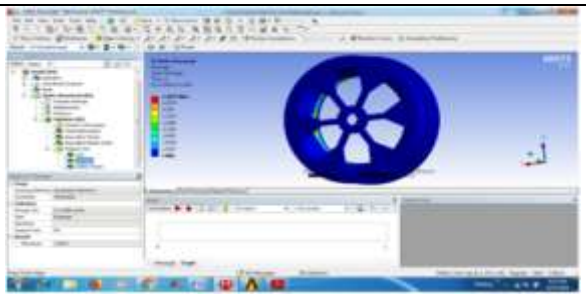
Safety factor



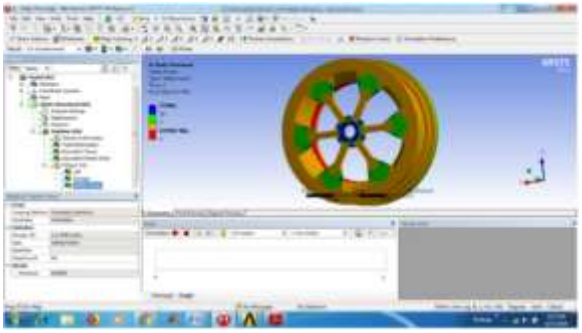
Material: aluminum alloy 7475
Life



Damage

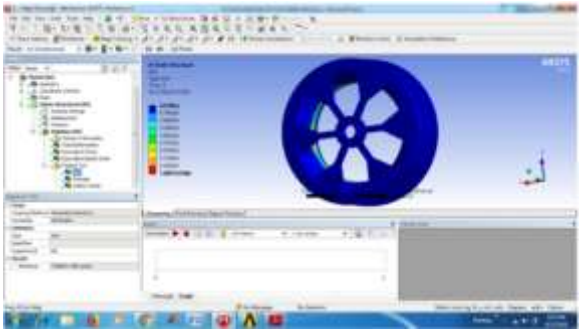


Safety factor

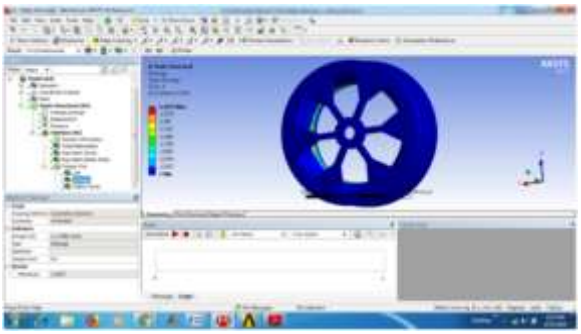


Material: Kevlar

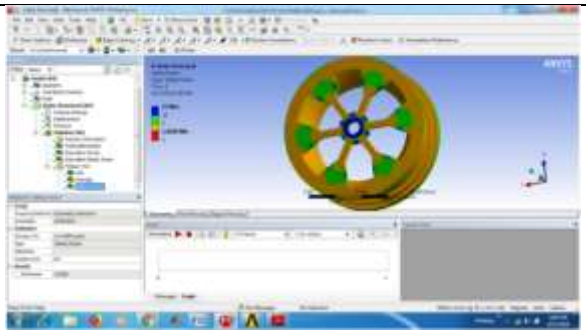
Life



Damage



Safety factor



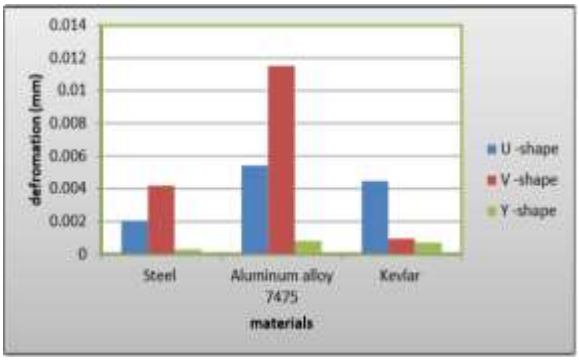
Results table

Static analysis results

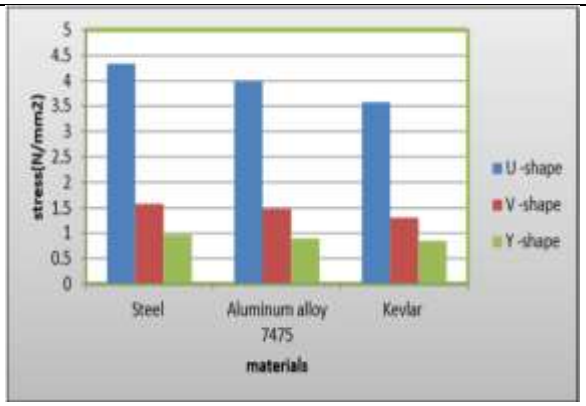
Spoke shape	Materials	Total deformation(mm)	Stress (N/mm^2)	Strain
U -shape	Steel	0.0020464	4.3361	2.168e-5
	Aluminum alloy 7475	0.0054271	3.9871	5.788e-5
	Kevlar	0.0044671	3.581	4.7175e-5
V -shape	Steel	0.0041876	1.5741	8.0867e-5
	Aluminum alloy 7475	0.011506	1.4793	2.169e-5
	Kevlar	0.00093764	1.3095	1.8147e-5
Y -shape	Steel	0.00029764	0.97119	4.7376e-6
	Aluminum alloy 7475	0.00081123	0.89823	1.3037e-5
	Kevlar	0.0007026	0.84598	1.1131e-5

Fatigue analysis results

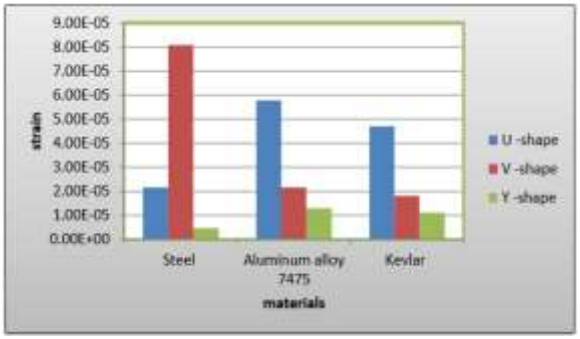
Spoke shape	Materials	Life	Damage	Safety factor	
				Min	Max
U -shape	Steel	1e9	1.0354	0.9938	15
	Aluminum alloy 7475	1e9	358.02	0.2214	15
	Kevlar	1e9	263.63	0.24044	15
V -shape	Steel	1e9	16.206	0.54761	15
	Aluminum alloy 7475	1e9	11.086	0.60733	15
	Kevlar	1e9	8.2668	0.65828	15
Y -shape	Steel	1e9	1.9872	0.887511	15
	Aluminum alloy 7475	1e9	1.2675	0.959671	15
	Kevlar	1e9	1.011	1.0189	15



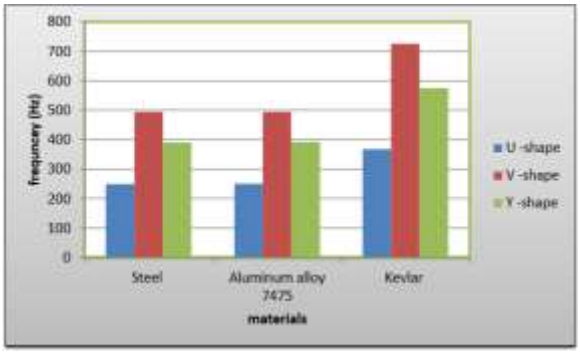
Materials and spoke shapes Vs deformation



Materials and spoke shapes Vs stress



Materials and spoke shapes Vs strain



Materials and spoke shapes Vs frequency

V. CONCLUSIONS

The inspiration driving the vehicle wheel edge gives a firm base on which to fit the tire. Its estimations, shape should be sensible to enough suit the particular tire required for the vehicle. At the present time feel tired of vehicle wheel edge having a spot with the plate wheel class is considered. Plan in a critical current activity which impacts the idea of the thing.

3D exhibiting of the vehicle edge done by parametric programming CREO. Static and particular examination done by ANSYS. The weight of the edge is upgraded by decreasing the greatness of 7%, and the headway technique relies upon the described burdens act by the wheel edge. Since the most extraordinary weight made at inboard dot seat and spine zone are not actually the yield quality, subsequently setup is okay for all the three materials.

If we consider just Deflection and Fatigue life into account the steel can be preferred. As we presumably am mindful the benefits of execution and eco-kind disposition from low weight wheels, in this manner

pondering the solidarity to weight extent and dynamic lead, Kevlar Composite material is considered as progressively conceivable to be used in wheel edge than various materials.

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