Design & Optimization of Roll Cage

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Abstract -- *The Primary target of this paper is to optimize the plan of a recent roll cage structure for SAE standard based famous Atv vehicle. In this undertaking work , different factors, for example, Factor of safety ,distortion ,von-misses pressure , work estimate dependency of produced pressure and effect constrained are considered. A small portion vehicle is a small, rough terrain vehicle fuelled by a four stroke motor, along these lines large part of vehicle execution relies upon speeding up which is corresponding to the heaviness of the vehicle and consequently frame. To accomplish more noteworthy execution of the vehicle, a parity must be found among quality and weight of the roll cage to guarantee safety of the driver. So roll cage part of the case is the essential assurance for the driver. The structure improvement of roll cage which depends on position, area and direction of connection. Henceforth a multi-body dynamic examination is completed to think about execution of the roll cage. Demonstrating was done to convey the mass of the vehicle over its casing individuals to recreate this present reality issue for dynamic investigation. The learning intends to configuration, investigate and discover material for a roll cage of an ATV as per the rulebook of SAE BAJA 2018. SAE BAJA is an off-road vehicle rivalry which gives under alumni understudy a viable involvement in building engineering sciences. It manages displaying of roll cage of a car (SAE BAJA) and examining it to give an ideal plan. The roll cage must be built of steel tubing, with least dimensional and quality necessity managed by Society of Automotive Engineers (SAE).*

Keywords — *Roll cage, BAJA, ATV, solid work, ANSYS CFD*

I. INTRODUCTION

ATV implies All Terrain Vehicle which is extraordinarily intended for goes mud romping driving. ATV is intended for harsh territory, bounces, continuance. The plan procedure of this single-individual vehicle is iterative and dependent on a few building and figuring out procedures.

We are utilizing Ansys programming for investigation on the roll cage that we had structured and programming adaptation is ANSYS 18. Ansys Inc. is an American open organization situated in Canonsburg, Pennsylvania. It creates and markets designing reproduction software programming. Ansys programming is utilized to plan items and semi-conductors, just as to make recreations that test an item's solidness, temperature circulation, smooth motions, and electromagnetic properties.

Ansys was established in 1970 by John Swanson. Swanson offered his enthusiasm for the organization to investors in 1993. Ansys opened up to the world on NASDAQ in 1996.

II. Procedure Followed

1. Roll Cage Geometry Editing
2. Meshing
3. Structural analysis
4. Explicit analysis
5. Result generation
6. Report generation

III. Input Values

1. Velocity is taken maximum 2000m/s
2. Temperature at normal condition 22 c
3. Force is taken 100N
4. Directions as per need given
5. Mesh setting with 20 timelines
6. Analysis with .002 sec

The conditions of movement of a multi DOF framework is commonly naturally made by FEM programming that we are utilizing here, yet for expository purposes it tends to be determined utilizing the Lagrange's condition as demonstrated as follows

$$ddt(\partial T\partial qi)-\partial T\partial qi+\partial V\partial qi=Q$$

Θ = Angular deformation

Tan(θ)= D/(L/2)

Torsional Stiffness = (F x L) / θ

IV. Moment of inertia

I = (π/64)*(D^4O-D^4i)

=.0490625*(416231.4256-141646.8496)

= 13.471*e^3 mm^4

Yield strength Sy = 562.53 Mpa

Distance from the Neutral axis to extreme fibre

C = 12.7 mm

A. Bending strength

= ($Sy*I$)/C = (562.53∗13.471e^3)/12.70

= 596.680 N-m[1]

B. Bending Stiffness

= $E*I$ = (205∗13.471e^3)

= 2761.555 N-m

Torsional stiffness per unit degree

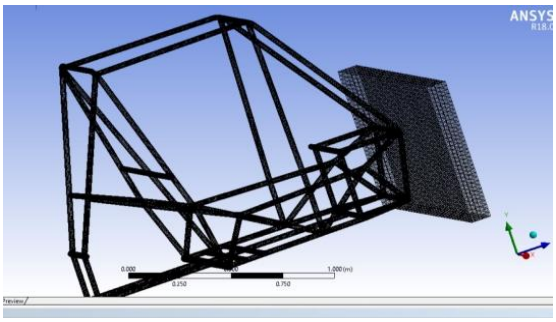
= (T/α) = (G*J)/L

= ((8.0*E^{10})*(2.6943 *E^{-8})/1

=2155.48 N-m/degree

V. Meshing of model

The precision and flawlessness in rollcage can discover by utilizing FEA model which incorporates all the little and components into an ideal shape. The limited component work is utilized to subdivide the CAD model into littler spaces called cells or components, over which a lot of conditions are illuminated and this gathering of cells is called Meshing.

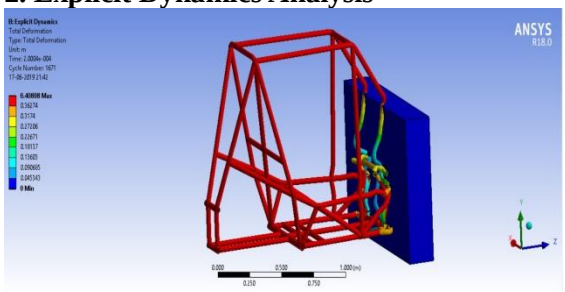


This paper investigates the methods for planning the move enclosure of an off-road vehicle and furthermore sheds on conceivable key focuses remembered for structuring. You can likewise discover analysis results in this paper alongside their individual outcomes and formulae utilized. During the static analysis of the roll cage the resultdefines security guarantees the sturdiness of the roll cage in the most extraordinary conditions and henceforth makes the roll cage safe as far as creation.

Two types of analysis that we had done on it are…

1. Structural analysis

2. Explicit Dynamics Analysis



Ansys structural analysis is done to know the exact pressure and forces and internal energy acting n material with defined design that we had given for analysis.

ANSYS Explicit Dynamics is a transient analysis elements Workbench application that can play out an assortment of designing reenactments, including the demonstrating of nonlinear powerful conduct of solids, liquids, gases and their collaboration.

Conclusion

This analysis shows the benefits of roll cage AISI 4130 over roll cage AISI 1018. This analysis shows that without use of any extra device, with some modification in existing roll cage, the stress developed inside the material of roll cage which is going to bear load of the engine and driver. With this analysis it is possible to increase the strength of existing roll cage with increase change in material or any other modification .The strength can be increased up to higher value with just a modification in design and in changing material. Torque can also be increase, with modification in design which can generate more torque compare to normal engine at particular rpm.

Referrences

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