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OPTIMIZATION OF THE SUSPENSION SYSTEM AND ITS STRESS ANALYSIS 1 Mohammed Parvez Ali, 2 Shaik Gulam Abdul Hasan 1 Persuing M.tech, Vidya jyothi institute of technology, Hyderabad, India. 2Assistance Professor at Vidya jyothi institute of technology, Hyderabad, India. 1Department of Mechnical Engineering, Vidya jyothi institute of technology, Hyderabad, india. aliparvez0928@gmail.com ABSTRACT Suspension frameworks dealing with and braking for good dynamic security and driving, and keeping vehicle tenants agreeable and a ride quality sensibly all around confined from street commotion, knocks, vibrations, and so forth.

The suspension additionally ensures the vehicle itself and any load or gear from harm and wear. The plan of front and back suspension of an auto might be unique. In this thesis the study of front suspension system was design in catia software. In design software finite example of existing model suspension system will be consider. By using the ansys software the shape Optimization will be done by observing the deformation, stress cause by the specified boundary condition of the body.

In this thesis the suspension of the 4 wheeler are made by wish bone and shock absorbers. In first all the under go to the analysis independently, later the full suspension system will be analyzed. The main objective of this thesis is to determine the finite shape of the suspension system for the vehicle by optimization the shape and stress valve of the suspension system. Key Points: Suspension System, Vehicle, Catia, Shape Optimization, Ansys, Analysis, Re Modification.

--- 1. Introduction _ Suspension is combination of tires, rim, springs, wishbones and linkages that partners a vehicle to its deals with vibration of the vehicle.

Suspension systems fill a twofold need — added to vehicle's road holding/managing and braking for good powerful security and driving satisfaction, and keeping vehicle inhabitants pleasing and a ride quality sensibly all around limited from road bustle, thumps, vibrations, et cetera. Fig 1 Car Front Suspension 1.1.

Suspension Geometry: Suspension structures can be completely requested into two subgroups: penniless and free. These terms suggest the limit of reverse wheels to move openly of each other. Right when the camber of one wheel changes, the camber of the reverse wheel changes comparatively (by custom on one side this is a positive change in camber and on the contrary side this a negative change). De Dion suspensions are also in this class as they inflexibly interface the wheels together. 2. Literature Review 2.1.

Introduction: Basic essential examinations, human solace studies, methods and characterizations for suspension frameworks. Theoretical examinations and displaying plans. Investigation and improvement of activation strategies for dynamic suspension. Experimental investigation and displaying with reenactment of the suspension technique.

Optimization investigation and control law flexibility, attainability and ongoing applications. 2.2. Review Of Fundamental Studies Wotton et al. [1] showed an auto suspension intertwining a lotus actuator and a tvr suspension/wheel unit is thought about both likely and indicatively. A highlight is put on water driven showing using a movement of trade limits associating the weight driven and suspension parts.

This is basically upheld by the usage of a moog 2000 programmable servo controller (psc) to try and out the widening and pulling back low grabs of the servo-valve in the lotus actuator control circle, legitimizing the use of combined extending and pulling back transient data for parameter conspicuous confirmation. Eric little et al. [2] have shown the most all around recognized ride comfort appear, the nasa show.

They investigated that, with a repeatable testing approach, this model can give a strong foundation to close examination and convincing headway of a vehicles ride lead. They analyzed that in blend with a four channel road test framework, decisions can be capably augmented. D. A. Corolla [3], in his review paper overviews the duties of vehicle components theory to helpful vehicle design.

He has charmingly highlighted the effect of the suspension on upgrading the vehicle execution and security. The practical confinements which are keeping the business progression of obliged information exchange limit dynamic suspension structures have been determined. Senior part carhop [4] depicts the speculative hindrances in unique suspensions.

He shows up, using clear direct two level of-chance suspension system, show that despite using complete state contribution, there still are containments to suspension execution, in the totally powerful case. The logical model of vehicle and suspension is shown in detail. 3. Catia V5 Catia V5 is a 3d solid displaying bundle which enables clients to grow full solid models in a reenacted situation for both outline and examination.

In solid works; you draw thoughts and try different things with various outlines to make 3d models. _ Fig 2 Assembly 4. Data For The Load Application 4.1. Mathematics Of The Spring Rate: Spring rate is a proportion used to quantify how safe a spring is to being compacted or extended amid the spring's redirection. The spring power increments as redirection increments as per Hooke's Law. Quickly, this can expressed as F=-kx where k is the spring rate.

F is the force x is the deflection of the spring The spring rate of a loop spring might be ascertained by a basic logarithmic condition or it might be estimated in a spring testing machine. The spring consistent k can be ascertained as takes after: k= d4*G/ 8ND3. where d is the wire diameter, G is the spring's shear modulus , N is the number of wraps and D is the coil diameter.

As from designing of the half of the suspension system itself having 432 kg means the average weight of the car will be around 450*4+ 5 persons*100 + chassis(100) = 450*4+500+100 will be around 2400 kg. The load acting on the vehicle will be 2400*9.81(gravity) = 23544 N. As per the designing diameter of the wire d is 20 mm, diameter of the spring will be 120 mm in general, number of wraps 5 turns. _ Table 1 Deflection Of Spring 5.

Ansys Workbench 5.1. Starting Ansys Workbench 18: The workbench windows help streamline an entire project to be carried out in ansys workbench 16.0 . In this window. The workbench windows mainly consist of the menu bar, standard toolbar, the toolbar windows, project schematic windows, and the status bar. __ Fig 3 The Component Of The Workbench Windows Analysis And Definitions 5.2.

Transient Structural Analysis: The transient structural analysis is one of the important analyses in ansys workbench. It is available as transient structural analysis system in toolbox, this system analyses the structural components for displacements (deformation), stress to first analysis, strains, and forces under different loading conditions. The loads in this analysis system are assumed not to have damping characteristics (time dependent).

Steady loading and damping conditions are assumed in this type of analysis system. __ Fig 4 The Transient Structural Analysis and Modal As discussed in previous chapters, analysis can be carried out in three major steps: geometry, boundary conditions and loads. The tools required to carry out these steps are discussed next. 5.3.

Specifying The Boundary Conditions __ Fig 5 Connection And Force and Fixed Supported _ Fig 6 Deflection Applied 5.4. Solving The Fe Model And Analyzing The Results: After the boundary and load conditions are speci?ed for the model, you need to solve the analysis. After solving, you will get the total and directional deformations due to the given condition.

Also, you will get equivalent stress, maximum principal, and minimum principal stress to first analysis. The equivalent or von-misses stress is the criteria by which the effect of all the directional stress to first analysis acting at a point is considered his helps in ?nding out whether the model will fail or bear the stress at that particular point.

A Attempt No 1: __ Fig 7 The Values Of Total Deformation And The Values Of Equivalent Stress. The assembly of the suspension has been design in one of the designing software know as catia later the file as been transfer to ansys software for analysis. In ansys software the material as been consider as carbon steel alloy because it’s having higher compressive tensile strength as compared to other general material of alloy. Later the components are imported in to ansys software, and by using connection I here assemble the components and made for simulation or analysis process.

Now the modal and connection are made. The meshing and boundary condition are made from the hooks law as preferred above. Transient structural- equivalent stress individual of upper wise bone, lower wise bone and spring and its lower mono suspension system. As we see the ultimate compression yield stress of the carbon steel is having 460 mpa.

The equivalent stress of the upper wise bone, lower wise bone, spring and lower mono suspension having 458.6 mpa. 6. Results And Optimization B Attempt No 2: __ Fig 8 Re Modification Of The Modal and Equivalent Stress Transient structural- equivalent stress over the upper wise bone, lower wise bone and spring and its lower mono suspension system. As we see the ultimate compression yield stress of the carbon steel is having 460 mpa.

The equivalent stress of the upper wise bone, lower wise bone, spring and lower mono suspension having 441.95 mpa. C Attempt No 3: Equivalent Stress at wise bone upper, lower and spring are considered to optimization process such a way to reduce the equivalent stress should be decreased. In above condition and geometry we got 441.95 mpa as stress.

To optimized model I here added 10 mm bar to the lower wise bone in between the gap as shown Fig . __ Fig 9 Re Modification Of The Modal and Equivalent Stress As we see the ultimate compression yield stress of the carbon steel is having 460 mpa. The equivalent stress of the upper wise bone, lower wise bone, spring and lower mono suspension having 438.95 mpa.

D Attempt No 4: Equivalent Stress at wise bone upper, lower and spring are considered to optimization process such a way to reduce the equivalent stress should be decreased. In above condition and geometry we got 458.95 mpa as stress. To optimized model I here added 5 mm thickness to the spring as shown Fig . __ Fig 10 Re Modification Of The Modal and Equivalent Stress As we see the ultimate compression yield stress of the carbon steel is having 460 mpa.

The equivalent stress of the upper wise bone, lower wise bone, spring and lower mono suspension having 402.05 mpa. 7. Results As per attempts from above the change made in body of suspension system over upper wise bone, lower wise bone and spring effects the body stresses of suspensions are tabled below.

Above change based on percentages, _ _ Table 2 Change Of Stress Due To Modification On Suspension 8 Conclusion For carbon steel alloy material as been selected to optimized design and application of automotive suspension system are developed in catia and ansys software. In this project we used the used a simple suspension of jeep the material are chose for steel carbon for all component .

In this project we redesign the suspension system is design in catia V5 individually in part module. Later the part component is imported in ansys software to find out deformation and stress etc. In ansys software we used transient structural analysis system to find deformations and Stress.

In transient structural analysis the study of total deformation and stress are made to optimized such way that the equivalent stress should decrease by add extra supports. In first analysis the body weight is 432.48 kg (100 %) made an effect of 458.83 mpa (100 %) stress. At deformation 26 mm from hooks law. In second analysis the body weight is 437.44 kg (101 %) made an effect of 441.95 mpa (96 %) stress to first analysis due to changes made in upper wise bone At deformation 26 mm from hooks law. In third analysis the body weight is 439.58 kg (101 %) made an effect of 438.9 mpa (95 %) stress to first analysis due to changes made in lower wise bone At deformation 26 mm from hooks law.

In fourth analysis the body weight is 451.87 kg (104 %) made an effect of 402.05 mpa (87 %) stress to first analysis due to changes made in spring At deformation 26 mm from hooks law. In fifth analysis the body weight is 442.54 kg (102 %) made an effect of 388.47 mpa (84 %) stresses to first analysis due to changes made in spring and upper wise bone At deformation 26 mm from hooks law.

In sixth analysis the body weight is 452.87 kg (104 %) made an effect of 383.55 mpa (83 %) stress to first analysis due to changes made in lower wise bone and spring At deformation 26 mm from hooks law. In seventh analysis the body weight is 440.42 kg (101 %) made an effect of 418.48 mpa (91 %) stresses to first analysis due to changes made in upper and lower wise bone At deformation 26 mm from hooks law.

In eighth analysis the body weight is 453.82 kg (104 %) made an effect of 383.35 mpa (83.5 %) stresses to first analysis due to changes made in upper and lower wise bone At deformation 26 mm from hooks law. In over all the attempts, stress is reduce by 16.5 % due to change or adding extra support to components is increase its strength and decrease stress. 9.

Future scope: In this project we redesign the suspension system is design in catia V5 individually in part module. Later the part component is imported in ansys software to find out deformation and stress etc. In ansys software we used transient structural analysis system to find deformations and Stress.

After the analysis done I here specifically said that the redesign of lower wise bone arm, upper wise bone arm and spring will decrease stress. So the optimization process of redesign or add extra support are helpful in automobile industrials. 10. References Reza n. Jazar (2008). Vehicle dynamics: theory and applications. Spring. P. 455. Retrieved 2012-06-24. "suspension basics 1 - why we need it". Initial dave. Archived from the original on 2015-01-29.

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