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A Review on Study of Analysis of Chassis

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Abstract: *In this paper an effort is made to review the investigations that have been made on the different analysis techniques of automobile frames. That analysis may be fatigue analysis, static analysis or dynamic analysis. A number of analytical and experimental techniques are available for the analysis of the automobile frames. Determination of the different analysis around different condition in an automobile frames has been reported in literature.*

Keywords: *Fatigue life prediction, Automotive Vehicles, static analysis, dynamic analysis*

I. Introduction

Truck chassis is a major component in a vehicle system. This work involves static and dynamics analysis to determine the key characteristics of a chassis. The static characteristics include identifying location of high stress area and determining the torsion stiffness of the chassis. The dynamic characteristics of chassis such as the natural frequency and mode shape were determined by using finite element (FE) method; Experimental modal analysis was carried out to validate the FE models. Modal updating of the chassis model was done by adjusting the selective properties such as mass density and Poisson's ratio. And other properties also the modification of the updated FE truck chassis model was proposed to reduce the vibration improve the strength and optimize the weight of the chassis. Chassis has a considerable affected to the performance of the vehicle. Also known as the "back bone" of the vehicle, it will be subjected to mechanical shocks, and vibrations and the result were the failures some component and resonant was the worst problem can be happened. Therefore, the prediction of the dynamic properties of the chassis is great significance to determine the natural frequencies of the structure to make sure working frequency are lower than natural frequency of the chassis to avoid resonant and determine the stress distribution on the chassis when receive the load. The finite element modeling issues regarding the experimental analysis of vehicle chassis is addressed for the natural frequency analysis (modal) by using different analysis software such as Ansys, Algor, Ls-Dyna

II. Fatigue, static & Dynamic Analysis

Fatigue damage concepts:

Stress-Life Diagram (S-N Diagram): The basis of the Stress-Life method is the Wohler S-N diagram, shown schematically for two materials in Figure 2.The S-N diagram plots nominal stress amplitude S versus cycles to

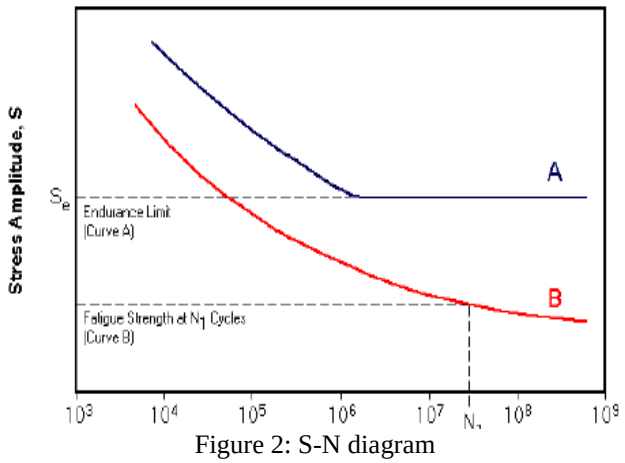

Figure 2: S-N diagram

Failure N. There are numerous testing procedures to generate the required data for a proper S-N diagram. S-N test data are usually displayed on a log-log plot, with the actual S-N line representing the mean of the data from several tests.

Roslan Abd Rahman, Mohd Nasir Tamin did the stress analysis of heavy duty truck chassis. The stress analysis is important in fatigue study and life prediction of components to determine the critical point which has the highes t stress which is shown in fig 4. The analysis was done for a truck model by utilizing a commercial finite element packaged Abaqus.

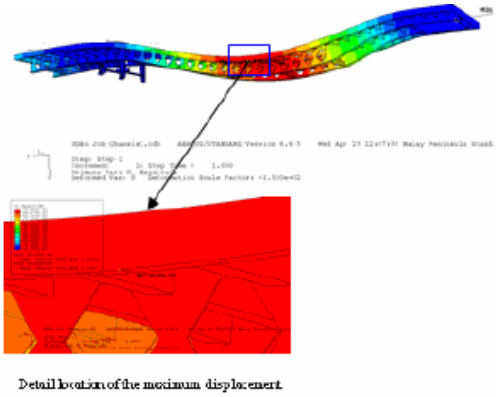

Fig 4: Displacement distribution of truck frame

Cicek Karao glu and N. Sefa Kuralay did the finite element analysis of a truck chassis. The analysis showed that increasing the side member thickness can reduce stresses on the joint areas, but it is important to realize that the overall weight of the chassis frame increases. Using local plates only in the joint area can also increase side member thickness. Therefore, excessive weight of the chassis frame is prevented.

In November 2008 Mohamad Tarmizi Bin Arbain Mechanical Engineering department Universiti Malaysia Pahang he use 3D model for finite element analysis issues regarding the experimental analysis of car chassis is addressed. The modeling approach is investigated extensively using both of computational and compared it to experimental modal analysis. A comparison of the modal parameters from both experiment and simulation shows the validity of the proposed approach. Then perform the computational stress analysis with linear material type analysis to find the stress concentration point in the car chassis.

Karaoglu and Kuralay investigated stress analysis of a truck chassis with riveted joints using Fem. Numerical results showed that stresses on the side member can be reduced by increasing the side member thickness locally. Fermer et al investigated the fatigue life of Volvo S80 Bi-Fuel using MSC/Fatigue Conle and Chu did research about fatigue analysis and the local stress –strain approach in complex vehicular structures. Structural optimization of automotive components applied to durability problems has been investigated by Ferreira et al

Filho Et. *al.* have investigated and optimized a chassis design for an off road vehicle with the appropriate dynamic and structural behavior.In1837, Wilhelm Albert publishes the first article on fatigue. He devised a test machine for conveyor chains used in

In July 2011 Kutay Yilmazçoban*, Yaşar Kahraman, Sakarya University, Mech. Eng. Dept., 54187 Serdivan-Sakarya, Turkey put some works on the chassis optimization by using the finite analysis, his main focus was on the redused the wight of the chassis for that he used three thickness 4 mm,5 mm & 6 mm and after analysis he conclude that the 4 mm thickness is better because the stress and the displacement in that is better than other two thickness.

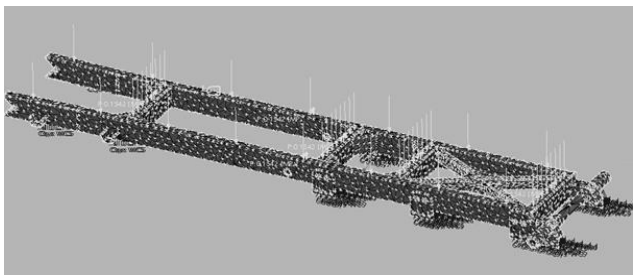

Figure: Truck chassis Finite Element Model

Teo Han Fui, Roslan Abd. Rahman, Faculty of Mechanical Engineering, Universiti Teknologi Malaysia, in December 2007, works on the Statics and Dynamics Structural Analysis of a 4.5 Ton Truck Chassis, he determined the dynamic characteristic, of the truck chassis, investigating the mounting locations of components on the truck chassis and observing the response of the truck chassis under static loading conditions. The local bending vibration occurs at the top hat cross member where the gearbox is mounted on it. And hence, the mounting location of the engine and transmission system is along the symmetrical axis of the chassis's first torsion mode where the effect of the first mode is less. However, the mounting of the suspension system on the truck chassis is slightly away from the nodal point of the first vertical bending mode. This might due to the configuration of the static loading on the truck chassis. For the linear static analysis, the stress distribution and deformation profile of the truck chassis subjected to two loading conditions: truck components loading and asymmetrical loading had been determined. Maximum stress occurred at the mounting brackets of the suspension system while the maximum translation occurred at the location where the symmetry and asymmetry load is acting. The maximum stress of the truck chassis is 490 MPa while the maximum translation is 33.6 mm. These values are acceptable as compared to the yield strength of the chassis material and the tolerance allowed for the chassis.

No.	Components	Weight (kg)	Load (N)	Position from origin (mm)
1	Cab	125	1226	4183
2	Engine	50	490	3875
3	Engine	100	981	3523
4	Cab	125	1226	3216
5	Gear box	50	490	2873
6	Pay load	417	4088	2873
7	Fuel tank	40	392	2433
8	Pay load	417	4088	2150
9	Chassis weight	200	1962	2150
10	Fuel tank	40	392	2023
11	Exhaust	20	196	1805
12	Pay load	417	4088	1710
13	Pay load	417	4088	1080
14	Pay load	417	4088	450
15	Pay load	417	4088	0

Table: Weights and forces of components and positions along the chassis

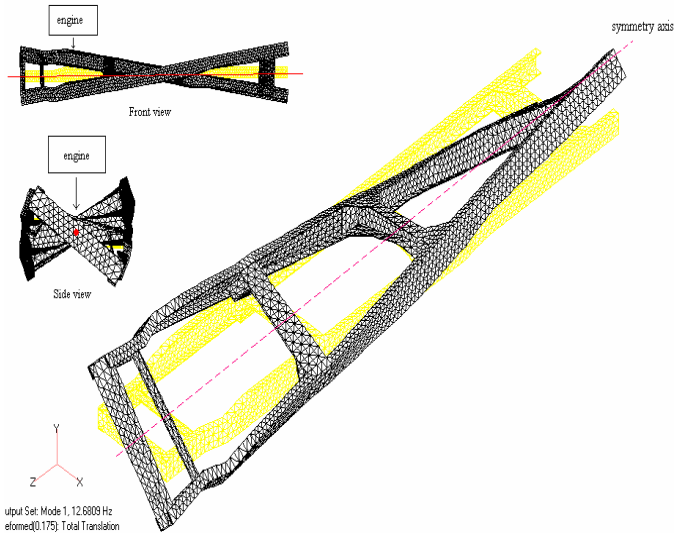

Figure: Mounting location of engine and transmission on the chassis

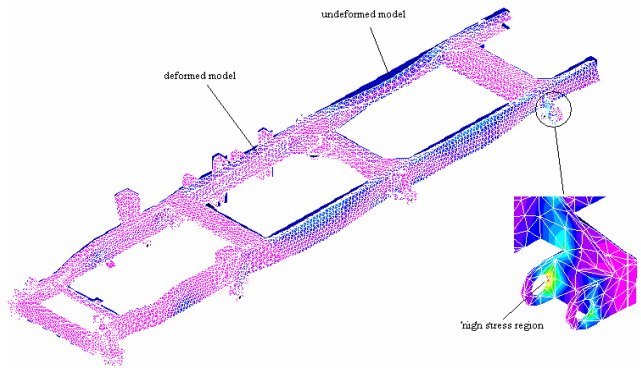

Figure: Stress contour and deformation pattern of the chassis under truck components loading.

O Kurdi, R Abd- Rahman, M N Tamin, Faculty of Mechanical Engineering Universiti Teknologi Malaysia 81310 Utm Skudai, Johor, works on the, Stress Analysis Of Heavy Duty Truck Chassis Using Finite Element Method, he mainly focus on the important steps in development of a new truck chassis is the prediction of fatigue life span and durability loading of the chassis frame. Fatigue study and life prediction on the chassis is necessary in order to verify the safety of this chassis during its operation. Stress analysis using Finite Element Method (FEM) can be used to locate the critical point which has the highest stress. This critical point is one of the factors that may cause the fatigue failure.

In June 2012 Haval Kamal Asker1, Thaker Salih Dawood1 and Arkan Fawzi, put some works on the Stress Analysis of Standard Truck Chassis during Ramping on Block Using Finite Element Method and he focused on the intensity and the strength of the frame play a big role in the truck's design. A frame of 6 wheels, standard dump truck has been studied and analyzed using Ansys package software. The static intensity of the frame has been analyzed when exposed to pure

bending and torsion stress, within two cases. First case is when the rear wheels zigzag gets over block (only one side of the chassis steps the block), and the second case is when both wheels gets over the block. The results show important differences between the two case studies, especially in the torsion and deformations results obtained from the chassis model. Also, vibration modes have been analyzed during the loading conditions. The more damping ratio Used, the more stabilizing of the stresses with respect to time

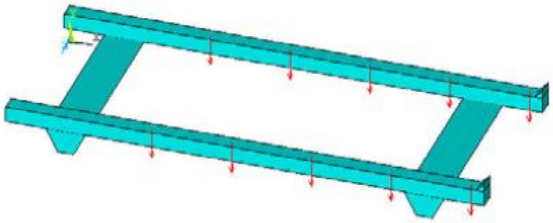

fig: model of chassis

III. Conclusion

In this paper an effort is made to review the investigations that have been made on the analysis of various automobile frames. An attempt has been made in the article to present an overview of various techniques developed for the analysis of automobile frames and results of that analysis due to which further study on the chassis will become easy An information of assessment of a suspension arm, vehicle suspension components, analysis of truck chassis, for the fatigue analysis of a truck chassis with riveted joints are considered.

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[10] JUNE 2012 Haval Kamal Asker1, Thaker Salih Dawood1 And Arkan Fawzi Stress Analysis Of Standard Truck Chassis During Ramping On Block Using Finite Element Method