

Analysis of Leading Arm in Suspension System With a Horizontal Spring Damper Assembly



Engineering

KEYWORDS : Leading arm, horizontal spring damper assembly, analysis of the leading arm.a

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ABSTRACT

The passive suspension systems have been the designer's choice for the economy it offers. These systems have been in most of the passenger vehicles. The horizontal orientation of the shock absorbers helps the designers to accommodate other parts of the vehicles and lower its centers of gravity and hence the stability of the vehicle. The use of mathematical optimization techniques for the improvement of the engineering design process is rapidly gaining acceptance.

In this work attempt is made to analyze a leading arm in a horizontally oriented spring damper assembly and the geometric and space and force requirements are studied to improve road handling abilities. The leading arm has been incorporated which essentially transmits the road undulations to the suspension shock absorber with the help of an arm which is robustly built and designed. The model for suspension under consideration.

The suspension system of the front wheels has a steering system to accommodate. The system has to be so designed to run in harmony with the vehicle steering system

1.Introduction:

Suspension is the term given to the systems of springs, shock absorbers and linkages that connect a vehicle to its wheels and allows relative motion between the two.

Suspension systems serve dual purpose, contributing to the vehicle's road holding/handling and braking for good active safety and driving pleasure, and keeping vehicle occupants comfortable and reasonably well isolated from road noise, bumps and vibrations. It is important for the suspension to keep road wheel and the road surface into contact as much as possible.

The main objective of a suspension system to provide comfortable riding and reduce stresses and strains on the various components. Enhance the life of the vehicle's components and maintain the stability in the moving vehicle by absorbing road shocks. It also damps down the amplitude of vibratory oscillations caused due to the road undulations.

The suspension springs mounted between the vehicle's body and the road wheels serve to store the strain energy by deflecting themselves when the wheels come across any bump on the road. As soon as the wheels go off the bump, the springs rebound back owing to their inherent elastic action. By doing so, the strain energy is released, and the spring starts vibrating. The amplitude of such vibrations decrease gradually due to internal friction in the spring material and in various joints.

A system needs to be incorporated for sufficient and quick damping of the spring's vibrations. This is provided by a device called damper.

The device called leading arm holds the wheel on one side and on the other has a horizontal spring damper assembly which helps the suspension system and the whole suspension system is based on the leading arm transmitting forces from the vehicles bump and steers and the overall weight of the vehicle and rigidly support the vehicle.

2. LEADING ARM DESIGN AND ANALYSIS.

2.1 MODEL OF THE LEADING ARM:

A model of the leading arm was developed first by the calculation of the weight of the vehicle under consideration and the requirements of the suspension systems and the space and geometric considerations and the design considerations for the vehicle. This model was considered and then model design was done in design software PRO-e. The model was constructed to help in the analysis of the leading arm in consideration.

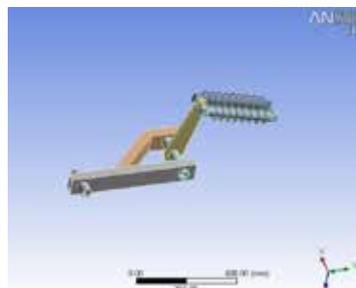


Fig 1.MODEL OF LEADING ARM IN HORIZONTAL SUSPENSION SYSTEM .

2.2 ANALYSIS OF THE SUPENSION:

An analysis of the leading arm was carried out with the help of a software ANSYS version 12. The model depicted certain characteristics under the analysis. The stress analysis and the failure analysis was carried out. The analysis of the arm with the forces acting upon the leading arm on the axis that acts on the direction of the wheel travel that is in the direction of the wheel travel. The model was analysed under different loading conditions and the leading arm tested in ANSYS for deformation and loading stresses in the different forces and direction of forces.

2.2.1 ANALYSIS OF THE LEADING ARM IN LOADING DIRECTION OF THE BUMP TRAVEL.

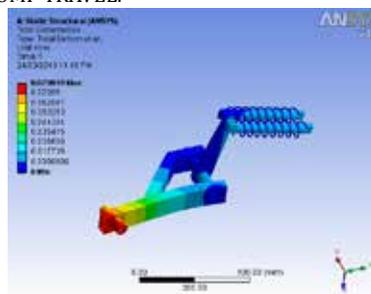


Fig 2.The leading arm under bump travel x-direction.

The load condition under bump travel in the x-direction has the maximum deformation of 4.3122mm. The load and the direction of load and the deformation has been considered.

2.2.2 ANALYSIS OF THE LEADING ARM UNDER EQUIVALENT (VON MISES) STRESS:

The analysis of the leading arm under the load in x-direction up-

wards and the analysis gave us the results that the max equivalent stress was 609.96 MPa.

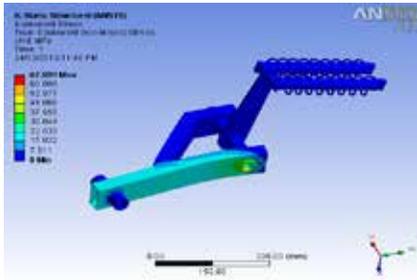


Fig 3.

2.2.3 ANALYSIS OF THE LEADING ARM UNDER MAX. PRINCIPAL STRESS:

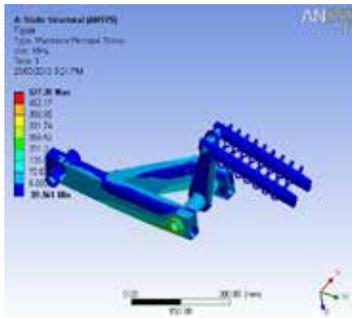


Fig 4.

2.3 BOUNDING AND MATERIAL AND PROPERTIES OF MODEL:

Nonlinear Effects	Yes				
Thermal Strain Effects	Yes				
Bounding Box					
Length X	212. mm	38. mm	120. mm	195.32 mm	270. mm
Length Y	538.45 mm	347.91 mm	18. mm	315.62 mm	44. mm
Length Z	80. mm	127.29 mm	18. mm	80. mm	44. mm
Properties					
Volume	5.6674e+005 mm ³	3.6799e+005 mm ³	16398 mm ³	3.1508e+005 mm ³	2.1971e+005 mm ³
Mass	4.4546 kg	2.8924 kg	0.12889 kg	2.4765 kg	1.7209 kg
Centroid X	50.148 mm	66. mm	102.99 mm	155.11 mm	105. mm
Centroid Y	-54.525 mm	432.7 mm	281.87 mm	84.907 mm	200. mm
Centroid Z	-1.0739e-006 mm	-206.37 mm	-248.84 mm	6.569e-009 mm	-6.8787e-015 mm
Moment of Inertia Ip1	1.2211e+005 kg mm ²	20905 kg mm ²	3.1487 kg mm ²	25933 kg mm ²	598.3 kg mm ²
Moment of Inertia Ip2	6728.5 kg mm ²	504.17 kg mm ²	194.82 kg mm ²	3392.6 kg mm ²	10670 kg mm ²
Moment of Inertia Ip3	1.2239e+005 kg mm ²	25912 kg mm ²	194.82 kg mm ²	25264 kg mm ²	10670 kg mm ²
Statistics					
Nodes	8158	2055	507	4572	2328
Elements	4038	1022	232	2188	324
Mesh Metric	None				

Fig 5.

3. CONCLUSION :

The leading arm was modeled under the software and an analysis carried out with the ANSYS software and the leading arm shows proper working under different loading conditions. The axial load and the load in the direction of the bump travel was considered and the leading arm shows proper structure design with the results shown.

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