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Analysis of stiffness about the torsion beam rear suspension based on Hyper Mesh

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Abstract: A finite element model of a torsion beam rear suspension is built, and then reverse vertical load is applied based on Hyper Mesh software in this paper. At last, the result in conditions of torsional stiffness and strength is got, and the results were analyzed.

Key words: the torsion beam rear; stiffness; strength

I. INTRODUCTION

Torsion beam suspension has the characteristics of simple structure, small non suspension quality, easy assembly and dis-assembly. Compared with other suspension systems, the cost is lower. It connects the body (or frame) with the wheel (or axle), and the structure is shown in Figure 1.

A torsion beam rear suspension is between the wheels and the frame (or body) to transfer all the forces and torques, ease due to uneven pavement to the impact load of the frame (or body), so a torsion beam rear suspension must have appropriate stiffness and strength. When just spent hours, the car will be tilted in the role of lateral force, so that it will seriously affect the vehicle handling stability. When a large, the side of the wheel to be inspired, so the impact on the body is too large, the impact of the vehicle ride comfort. In order to ensure that the vehicle has good handling and stability, and the design and development of the torsion beam rear suspension, it is required to consider the stiffness characteristics of the rear suspension.

Fig. 1 The Structure of Torsion Beam Suspension

II. LOAD ANALYSIS OF TORSION BEAM SUSPENSION

Torsion beam rear suspension load is divided into static load and dynamic load. Static load is defined as the gravity of the vehicle body when the vehicle is stationary. Dynamic load can be divided into two kinds, a kind is automobile in very flat on the road at high speed when driving, because the car from both the left and the right parts configuration is basically the same, and by vertical load in the same direction; when four wheel vehicle not in the same horizontal plane, resulting in a torsion beam suspension frame together with the twisted

and the dynamic load is another.

Through to several torsion beam suspension load comparative analysis, we can concluded that dynamic load caused by the torsion beam rear axle torsion deformation and torsion stress is large. Therefore, we can use the Mesh Hyper software to analyze the torsional condition under dynamic load, so that we can get the torsional rigidity value.

III. FINITE ELEMENT MODEL OF TORSION BEAM SUSPENSION

The torsion beam part is the main part of a torsion beam type suspension, including longitudinal swing arm, crossbeams is major part of such suspension design analysis and is the core part of the torsion beam suspension performances. The finite element model of the torsion beam of the suspension was established by using the HyperMesh.

When finite element modeling is carried out, it is not only to reflect the mechanical properties of the structure, but also to adopt the appropriate unit configuration and the number of elements as few as possible. Before dividing the mesh, we should divide the plate parts of different thickness into different parts, which can be divided into the beam, the longitudinal swing arm, the torsion bar, the frame and so on.

Fig. 2 The finite element model of twist beam

When we build the finite element model, we first convert the three-dimensional model of the torsion beam into IGS format into HyperMesh. Then we divide the mesh, and the mesh size is 4 mm. The finite element model contains 26380 nodes and 25755 shell elements, which contain 25655 quadrilateral elements and 1000 triangular elements, which account for 3.8% of the total units. We set up an independent node with the center of the spring tray, bushing, brake and install the bottom plate, and set up the rigid connection with the node. We establish the RBE2 unit, and set the material elastic modulus 210MPa, Poisson's ratio is 0.288, the material density is 7.8Kg/m^2. The finite element model of mesh generation is shown in Figure 2.

IV. TORSIONAL STIFFNESS CALCULATION OF TORSION BEAM SUSPENSION

We have established the finite element model to add the corresponding load boundary conditions, using Optistruct to carry on the static analysis of the torsion beam suspension. By means of analysis we can get the stress distribution and displacement of the suspension, and calculate the stiffness of the suspension.

When the car turn occurred, the outside of the curve of the suspension compression and medial suspension diastolic, on both sides of the suspension is moving in the opposite direction, at this time of the torsion beam with elastic stiffness, damping spiral spring and a torsion beam while providing support, at this time of the torsion beam produced a reverse direction of the elastic, thereby overcoming body roll, reduced to roll. The stiffness of the torsion beam has a great influence on the vehicle handling and stability.

Next, we carry out the static analysis of torsion beam suspension under the condition of torsion. First,

the corresponding load boundary conditions are applied to it in Figure 3, the size of the force is 330N. Then, we obtained the stress nephogram of the torsion beam in Figure 4, by using Optistruct to carry on the static calculation of the torsion beam suspension. According to the results of finite element analysis, we get the torsional stiffness of the torsion beam suspension, and the torsional stiffness of the suspension is calculated to be 45.67 Nm/deg.

Fig. 3 Loading and restraint of force

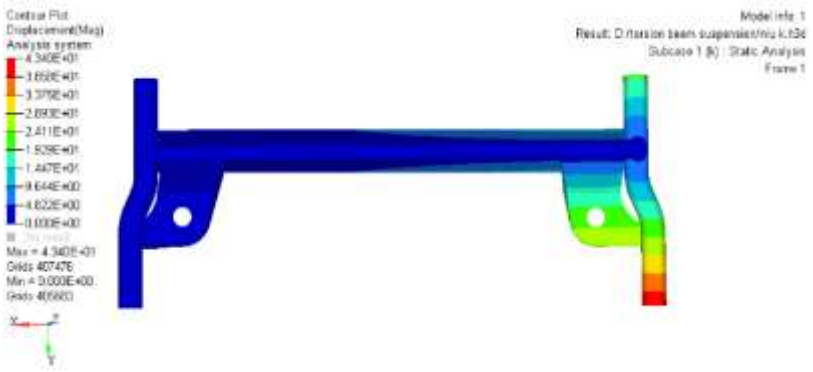

Fig. 4 The stress nephogram of the torsion beam

V. SUMMARIZE

We according to the factory provided for a passenger car torsion beam suspension frame of CATIA 3D model, in the finite element software HyperMesh established finite element model of the suspension torsion beam part, and on it were reversed load stress analysis, the torsional rigidity of the suspension. The finite element software is used to calculate the suspension stiffness, which not only shortens the period of the torsion beam suspension, but also saves the cost and improves the design efficiency of the suspension.

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