SCM ENGINEERING SERVICES

Technical Report on

FEA ANALYSIS OF ENGINE MOUNTING

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INTRODUCTION

An automotive engine mounting system is typically subjected to unbalanced engine forces, uneven firing forces especially at the idling speeds, dynamic excitations from gearboxes and accessories through the coupling between these parts with the engine, and road excitation. Since design trends have been towards compact and efficient automobiles, engine-to-frame weight ratio and engine force densities have increased. Consequently, recent research and development efforts have been focused on improving engine mounting technology to achieve better vibration isolation, smooth vehicle movement, and noise reduction. In the present study, non-linear static modeling issues for engine mountings involving the contact analysis have been done for a **leading American client by SCM Engineering Services**

This project was accomplished in 80 working hours.

The first case examines the radial calibration and performance of elastomer engine mounts. In second case study, the engine pre-load condition on the mounting is taken into consideration. The third case study comprises of three sub-cases and is the extension of second case. In the third case multi-step loading on the mountings are taken into consideration, in which, along with the engine pre-load - radial, torsional and conical displacement of the core is taken into account

METHODOLOGY

In this study, the Mooney-Rivlin model has been used along with 3D, SOLID185, Mooney-Rivlin Hyperelastic elements. The 2 parameter Mooney-Rivlin option has been chosen with the strain of about 100% in tension and 30% in compression i.e no inflection points (single curvature).

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c_{10}, c_{01} = material constants characterizing the deviatoric deformation of the material

d = material incompressibility parameter

and, $d = (1 - 2*\nu) / (C_{10} + C_{01}) = 0.00185e\text{-}6$

in all three cases static non-linear analysis was set with the reasonable number of steps and sub-steps along with automatic program chosen by ANSYS is used to capture the reasonable accurate results.

OBJECTIVES

The first case is to examine the radial calibration and performance of elastomer engine mounts.

In second case study, the engine pre-load condition on the mounting is taken into consideration.

The third case study comprises of three sub-cases and is the extension of second case. In the third case multi-step loading on the mountings are taken into consideration in which, along with the engine pre-load - radial, torsional and conical displacement are taken into account.

HARDWARE AND SOFTWARE

HARDWARE

The hardware used for mesh generation, pre processing, analysis and post processing was Intel based windows platform having P4 processor, with 1 GB RAM and 40 GB hard disk.

SOFTWARE

The analysis activity consists of Mesh generation, Pre–processing, Non-linear analysis and Post-processing. Mesh generation was done using HYPERMESH. The pre & post processing for setting problem and analyzing results was done in ANSYS 9. The real constants were defined in ANSYS for the contact elements.

A hex mesh was used in this analysis and all the quality criteria were by the standards of **SCM Engineering Services**

RESULTS AND DISCUSSIONS

In all three cases static non-linear analysis was set with the reasonable number of steps and sub-steps along with automatic program chosen by ANSYS is used to capture the reasonable accurate results.

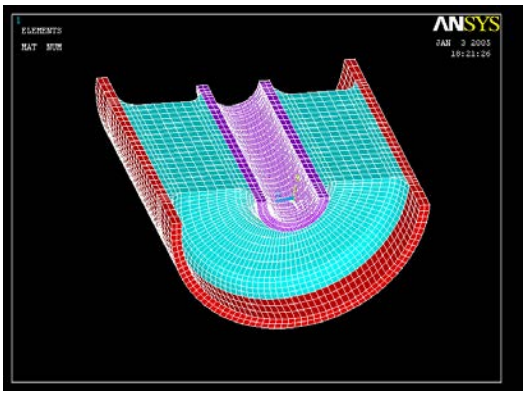

Fig.1 Half symmetry model mesh

CONCLUSIONS

Non-linear static analyses of engine mountings involving the contact analysis are illustrated via three case studies. FEA analysis is now an integral part of the engineering design process in the automotive industry. Various computational tools including finite and boundary element codes are employed to analyze and optimize components and sub-assemblies. The case studies presented in this article demonstrate on **SCM's** strength on some of the challenges that designers and analysts face.

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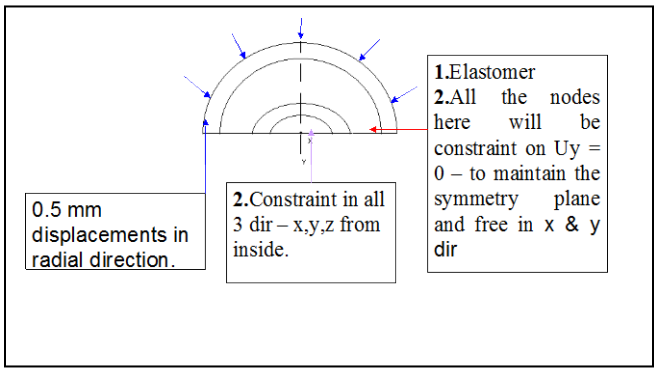

Fig.2 Boundary conditions for case-1

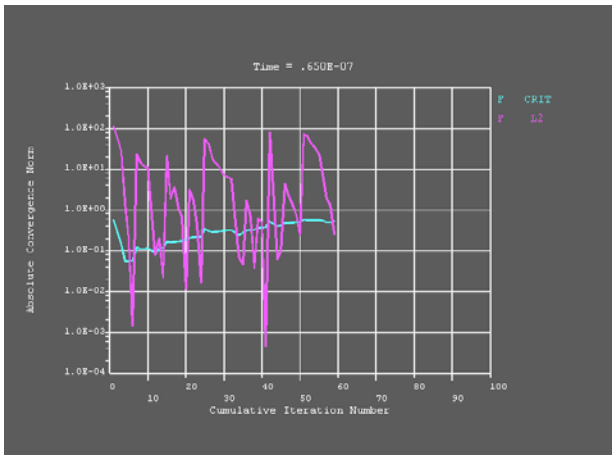

Fig.3 Convergence plot trend for all cases

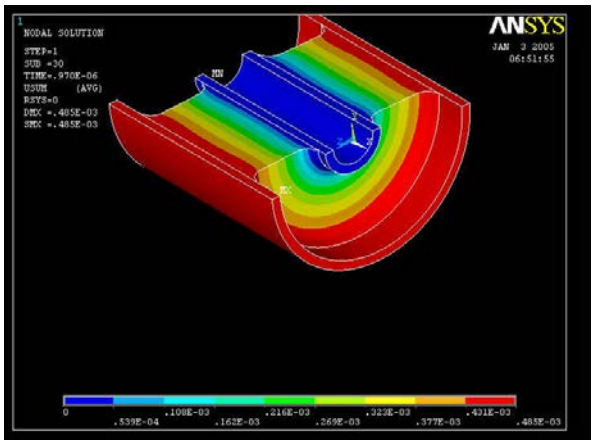

Fig.1 Deflection plot for one of the cases

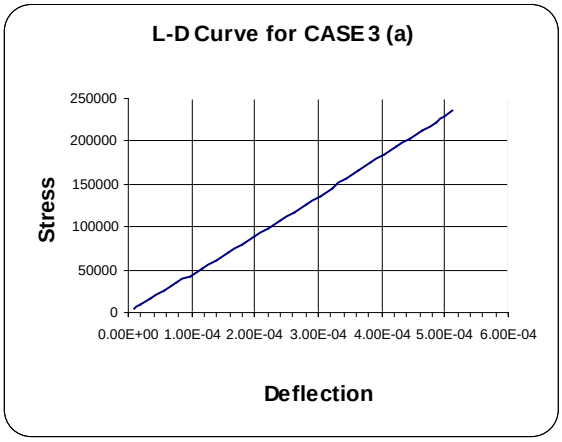

Fig.6 Load deflection curve for one of the cases

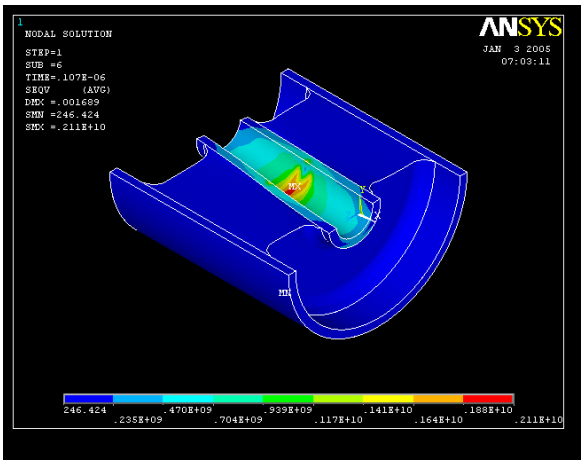

Fig.2 Von mises stress for one of the cases.

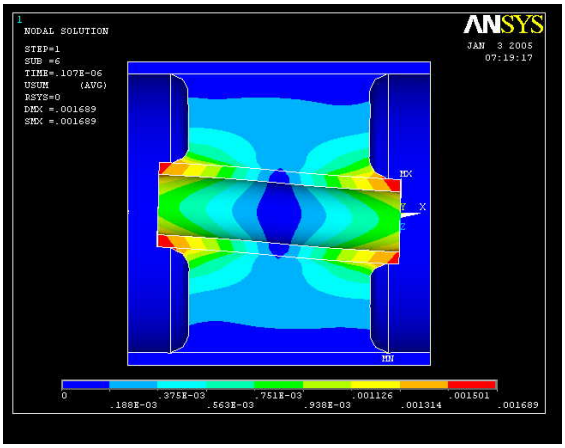

Fig.6 Top view of displacement sum for one of the cases

REFERENCES

ANSYS INC theory and reference