

Design of a Lighter and Lower Cost Engine Oil Pan for an Indian Car



Aniket Bag

anineemabag@gmail.com
Ph. No: 0 99001 07774

Student's Name **Aniket Bag** **APD (PT-2008)**

Academic Supervisor(s) S. Srikari and Vinod K. Banthia

Industrial Supervisor(s)

Keywords: Engine Oil Pan, Plastic, NVH, Stone Impact Analysis

Abstract:

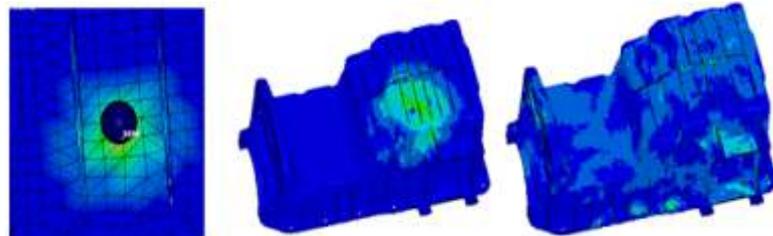
Today car manufacturing industries are facing new global challenges: the competition in market, increasing fuel cost, reduce fuel consumption, reduce CO₂ emissions and government regulatory requirements. Therefore, lightweight materials play a key role to overcome these challenges. Most of the car engine oil pans are made of steel and aluminum material and its weight and cost are high. This project is aimed at development of car engine oil pan made of low density reinforced plastic instead of aluminum with similar performance but with lower cost.

In this project existing Ford 1.3L Endura E petrol engine aluminum oil pan has been taken for investigation. A 3D model was created in CATIA. Finite element (FE) analysis was used to determine static and dynamic properties of the oil pan structure. FE modeling of pan was carried out in Hypermesh. Fixed modal analysis and harmonic frequency response function (FRF) analysis were performed in ANSYS. G static load analysis was carried out in Ansys to find out high stress and displacement area under gravity load. Low velocity stone impact analysis was performed to obtain structure's behavior under impact load. Same methods have been followed to design and analysis of new plastic oil pan. Design parameters were different as material and manufacturing process are different. Part cost estimation was done for both aluminum and plastic oil pan. Finally comparison study of weight, performance and the cost between aluminum and plastic oil pan was carried out.

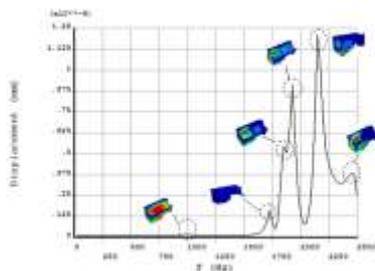
It can be concluded that plastic oil pan can be designed which has easy manufacturability. It has been observed from modal analysis that resonance has not been occurring because of 1st modal frequency of plastic oil pan is far away from engine operating frequency. It has been found that there was no damage to the plastic oil pan structure under stone impact loading. For plastic oil pan weight reduction has been observed to be around 55% and cost reduction was around 60% compared to that of aluminum oil pan.



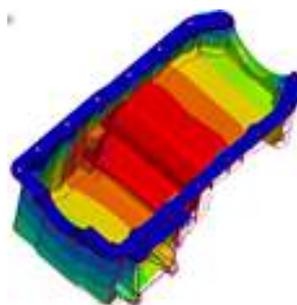
Aluminum engine oil pan



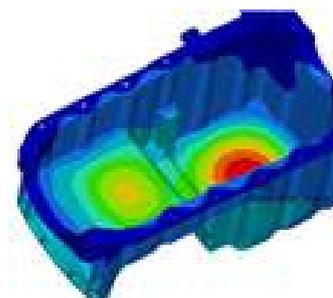
Stone impact analysis stress results



FRF analysis results in X direction



1st Modal shape - Bending



G load displacement result