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COMPUTER AIDED ENGINEERING FOR FOUR WHEELER ACCELERATOR PEDAL

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Abstract

In this work re-engineering approach has been used to determine the design concept of an acceleration pedal and structural steel material had been used at this stage for analysis purpose. Various designs had been tried to reduce deformation in this acceleration pedal. In this particular design Catia software is used at the design stage and for analysis, Ansys 17.2 had been used.The Same metal had been selected for both the pedals in order to compare the results between them. Deformation results are achieved on Ansys. The result reveals that remodeled design has better results than the existing pedal. The pedal deformation is reduced comparatively up to 12%.

***Keywords*:**CAE, CATIA, ANSYS, Four wheeler accelerator peddal.

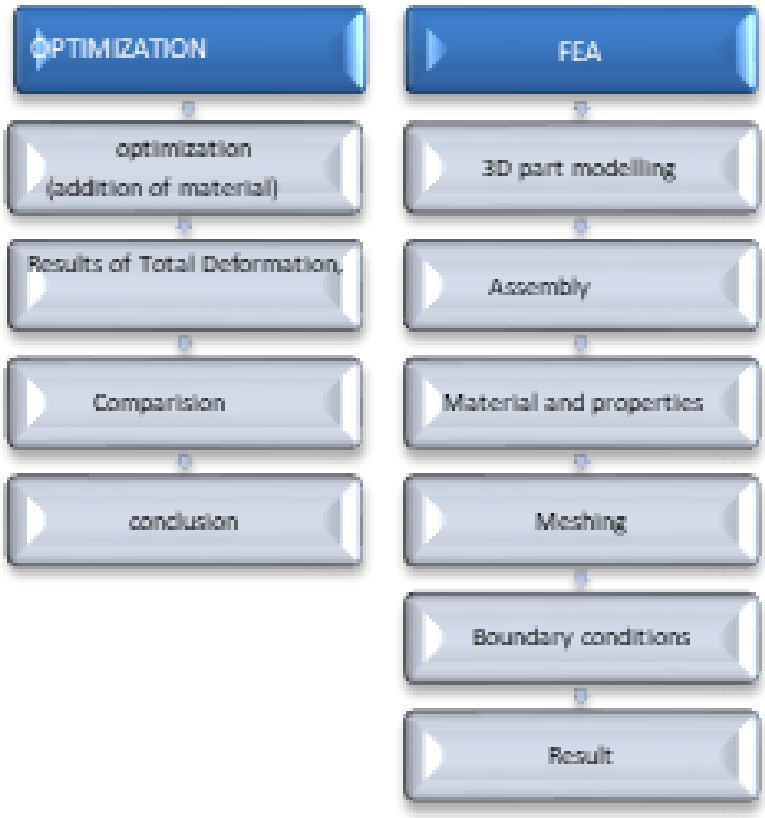
1 INTRODUCTION

Acceleration pedal is the main component of every automobile vehicles. This throttle pedal mainly controls the fuel and air supply to the engine. This acceleration pedal Is usually at the right-hand side of the vehicle. This pedal usually controls the speed of the vehicle. This acceleration mainly consists of a spring, Pedal plate, pedal bracket, pedal arm, pivot shaft. pedal. It has a safe design spring returns to the idle position when the driver removes the force on an acceleration pedal. As acceleration and brake pedals are to the right- hand side there are accidents occurring due to the acceleration of the breaks. Latest developments are made to design combined acceleration and brake pedals which leads to the reduction of accidents. The design is based on a requirement of the customer. After the design process is completed then modeling is done. This modeling can be done in various modeling software such as CATIA, solid works, pro-e, etc. [1] [2] [3].In this approach, CATIA software is used to model the component. Catia is a core for cad i.e .computer aided design collaborative application.This software is the proficient and highly popular cad software. It was developed by Dassault Systems of France.This software was marketed by IBM till 2010.As this software is highly important in industries this certification has high value and this is the most prominent software. Catia is used in almost in every industrial sector.This software is mostly used by the designer team [4] [5] [6].The designer team main objective is to create the model of an object which has to be manufactured.This modeling can be created with much ease with the help of CATIA software. After the modeling process is completed this modeled component is analyzed with the help of ansys software.Ansys is the tool which is used with for various applications.This software was founded by Dr.John.A Swanson in 1970.Its purpose was to develop FEM software.Sasi systems were the founded company for this software.this company developed its business by parallel growth in [7] [8] [9]computer technology and engineering needs.It was sold to TA Associates in the year 1994.The new owner took this to the new heights by making this as leading software called as ANSYS.It is a brilliant software used in the crucial analysis which is playing a vital role in this

engineering world. The objective of this research work is to develop a pedal which reduces deformation and stress.

2 METHODOLOGY

The below figure shows the analysis and optimization procedure for the concept design.



In order to start FEA analysis[10] [11] we need to consider any existing pedal as shown in Fig.1 as our Existing component. We took our Existing component as Ashok layland dost acceleration pedal.To take measurements for that particular pedal we followed

a techniques called as reverse engineering ,work measurement technique. With the help of this measured measurements we had designed the component, and process is continued.

3 FEA FOR EXISITNG PEDAL

3.1 Modeling of Basic Structure

In order to do an analysis of any component first procedure is to do Modeling. The component Acceleration pedal is modeled in Catia software as shown in fig.2.This modeling is done by taking all the parameters from the existing pedal(Ashok Layland dost acceleration pedal).All the measurements were taken by drafting procedure.After these procedure material properties were applied to the existing one.

Figure 1: Existing acceleration pedal

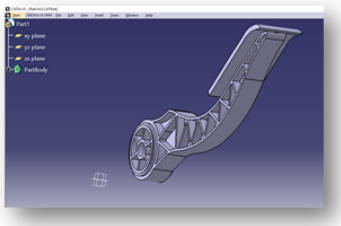


Figure 2: Existing acceleration pedal in catia

3.2 Analysis of basic structures

The values of Acceleration pedal where taken from the material library as shown in Tab.1

Table 1: MATERIAL PROPERTIES

property	Unit
Material	Structural Steel
Force	300N
Youngs Modulus	200 GPa
Poisons Ratio	0.3
Density	7850 kg/m3

3.3 Meshing, Boundary Conditions, Deformation, Vonmises stresses, Equivalent strain

After defining material properties this, meshing is done on ansys workbench as shown in fig.3 with nodes,elements as 14435,7678 respectively.

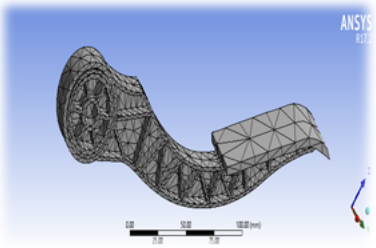


Figure 3: Existing acceleration pedal meshing

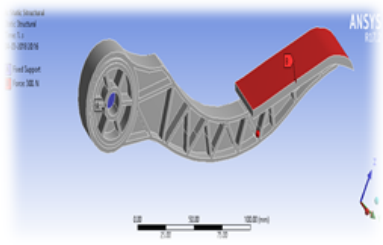


Figure 4: Boundary condition for the Existing acceleration pedal

These boundary conditions consists of loads and constrains .In order to get accurate results proper boundary conditions are to be applied as shown in fig.4.
For this acceleration pedal is fixed at point A. The force of 300N is applied at point B Fig 5,fig.6,fig.7 depicts Deformation , stress strain for the existing component. Maximum deformation found in the given model is 0.34229 mm and that of the minimum is 0.038033 mm.
The maximum and minimum Stress developed is 79.015, 0.0739.

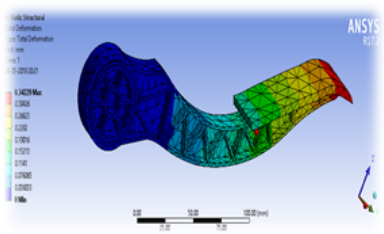


Figure 5: Deformation for the Existing acceleration pedal

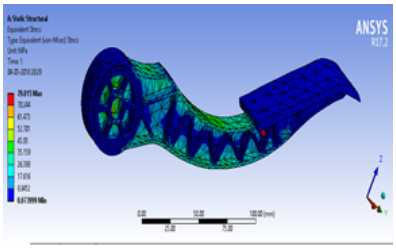


Figure 6: Stress for Existing acceleration pedal

The maximum Strain developed is 0.0050942.

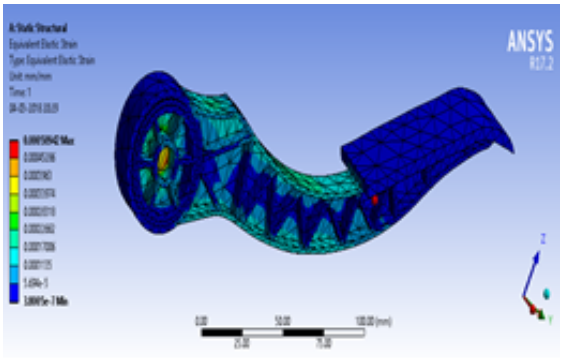


Figure 7: Strain for Existing acceleration pedal

4 TOPOLOGICAL CHANGES OF MODIFIED COMPONENT

Topology optimization contracts with the scientific method that enhances material layout for a given set of loads and boundary conditions within a given design space. The design modification

by addition of material at slopes is illustrated in fig.8.The boundary conditions are assumed to that of existing component as shown in fig.9 For this acceleration pedal is fixed at point A.The force of 300N is applied at point B Fig10,Fig11,Fig12 stimulates deformation,strain stress for the modified component in ANSYS. Maximum deformation found in the given model is 0.27583 mm and that of the minimum is 0.03064 mm The maximum Strain developed is 0.0003418 The maximum Stress developed is 52.254.

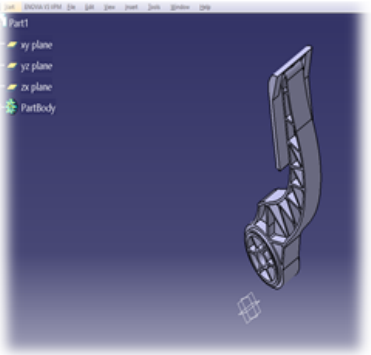


Figure 8: Modified acceleration pedal

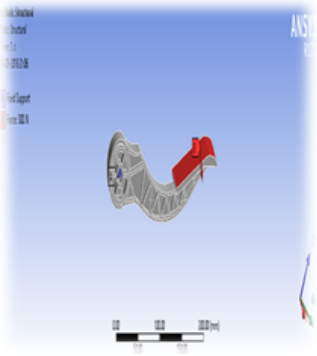


Figure 9: Boundary conditions for Modified acceleration pedal

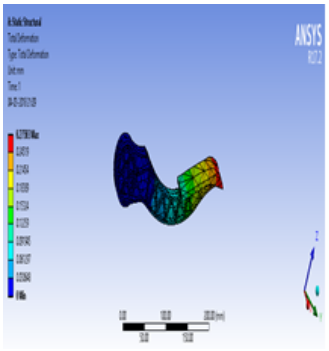


Figure 10: Deformation for the Modified acceleration pedal

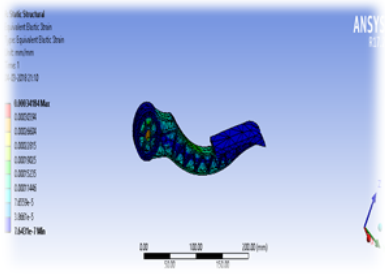


Figure 11: Strain for Modified acceleration pedal

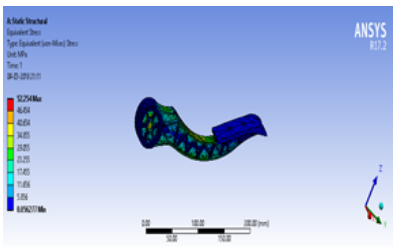


Figure 12: Stress for Modified acceleration pedal

5 FEA FOR EXISITNG PEDAL RESULTS AND DISCUSSIONS

From the above Tab.2 it is concluded that ,the results of the modified pedal has better than the Existing pedal. The Results for existing and modified components in terms of deformation is 0.34229mm & 0.27583mm respectively, also the strains are 0.0050942,0 0003418,and stress are 79.015,52.254 respectively.

Table 2: COMPARISION OF RESULTS

	Exisitng pedal	**Modified pedal**
Deformation	0.34229 mm	0.27583 mm
Strain	0.0050942	0.0003418
Stress	79.015	52.254

6 CONCLUSIONS

From outcomes of finite element analysis it is noted that the maximum stress value is within the safety limit. There is a great potential to enhance, this safety limit which can be done by adding material at high stressed region thus optimizing its deformation without affecting its structural behaviour. The maximum displacement value is also very less. The total deformation reduced up to 12% in modified model.

7 RESULTS

This work is extended in future by manufacturing the modeled component with the help metal 3d printer.The quality of the component can be improved with the help of the modern manufacturing procedures and techniques.

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