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STUDY OF AUTOMATED LEAF SPRING BUILDING

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ABSTRACT

We know that the spring plays very essential part of every automobile for suspension point of view. Leaf spring is the main type of suspension system which is used in many light and heavy vehicles. Leaf spring used in many vehicles due to having some main characteristics which are shown below.

1) Uniformly load distribution

2) Lower cost

3) Rough used

4) Easier in Isolation and Tightly attached with working frame.

Today every automobile company has been working on increasing the efficiency with reducing the weight without having any load carrying capacity. In this paper we would like to review some previous research work performed on the leaf spring by previous researchers for increasing the working condition and capacity with load reduction. The paper based on material composition, experimental testing and load (Steady, Dynamic) study etc.

Keywords: Leaf Spring, Material Compositions, Mathematics, Experiments, ANSYS.

I. INTRODUCTION

A leaf spring is a simple form of spring commonly used for the suspension in wheeled vehicles. Originally called a laminated or carriage spring, and sometimes referred to as a semi-elliptical spring, elliptical spring, or cart spring, it is one of the oldest forms of springing, appearing on carriages in France in the mid-17th century in the form of the two-part elbow spring (as the illustrated example from Lisbon), and from there migrating to England and Germany.

Leaf springs are an integral part of your vehicle's suspension system. They are installed to help support the entire weight of your car or truck. Leaf springs also help to maintain the tyres grip on the road and regulate the wheelbase lengths when it is speeding up or slowing down. To control the height of the ride and axel damping leaf springs are very important.

These parts are susceptible to wear and tear which is why people would want to have them replaced. Either the leaf springs wear out and begin to sag, lowering the chassis of the vehicle or the leaf spring is cracked and broken. Oftentimes people also prefer to upgrade their leaf springs to one that is heavy duty to help increase the support and keep the vehicle safer. However, leaf spring replacement is not something anyone can do. It is always best to take your vehicle to a professional. Because of their benefits, leaf springs are in high demand. Casual transportation is just one way leaf springs have contributed to our transportation industry. These days, leaf springs are more popular with heavy commercial vehicles like trucks, SUVs and vans. Trucks need leaf springs for hauling trailers and other equipment. Leaf springs keep the load stable and the cargo grounded. Without them, the trailer would sway and bounce, lifting off the pavement after minor bumps. This issue is why leaf springs are so critical for trucking — they promote safety on the road and protect cargo from damage. If a truck is carrying fragile or dangerous goods, these vehicle elements become especially important.

A leaf spring can either be attached directly to the frame at both ends or attached directly at one end, usually the front, with the other end attached through a shackle, a short swinging arm. The shackle takes up the tendency of the leaf spring to elongate when compressed and thus makes for softer springiness. Some springs terminated in a concave end, called a spoon end (seldom used now), to carry a swiveling member.

II. PROBLEM STATEMENT

Problem statement of a automated leaf spring:

1. Build the leaf spring automatically using scripting

2. Reduce the human efforts

3. Minimize the errors

4. Reduce process time by Automated FE Modelling Steps

Earlier for the analysis of leaf spring there are so many step used in analysis process now we can reduce process time by Automated FE Modelling Steps.

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First two steps i.e. CAD Input and Geometry clean-up steps are common in manual and automated processes. After geometry clean-up we have to use the developed script/automated tool.

While using automated tool, we just have to do only 2 clicks, one is for thickness calculations and second is for width calculations. All further processes are automated.

III. METHODOLOGY

➢ **Methodology Comparison:**

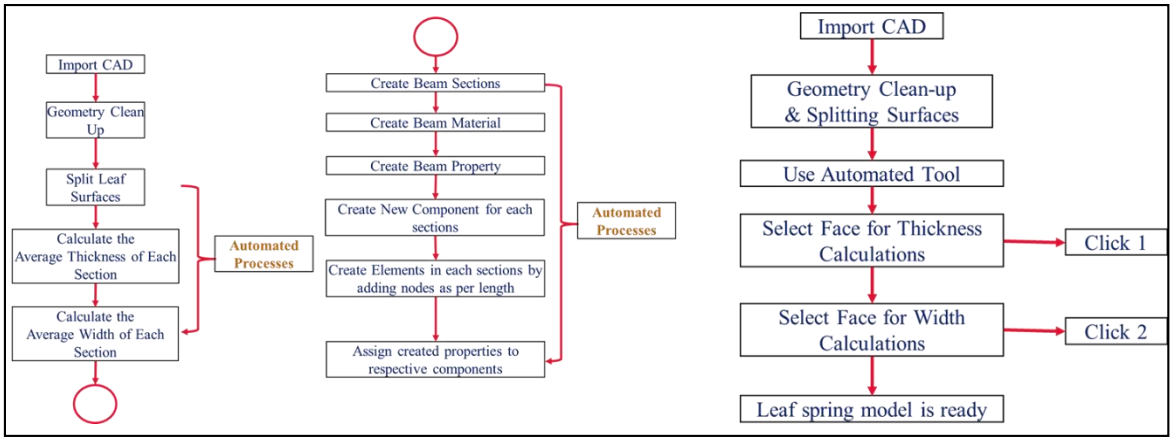

Fig-1: Method Comparison

Above figures gives the comparison between manual method and automated method. As we can see there many steps need to be followed in manual method. But in case of automated method, there are only two steps import the CAD and do the geometry cleanup. After the just use the automated tool to build leaf spring.

IV. EXPERIMENTAL RESULTS

RESULT:

Process Run Time Comparison:

Manual method required 2hrs i.e. 120mins to build one leaf spring. With automated method leaf is modelled within 2mins. That means there is time saving of 118mins.

$$\%\text{Time Saving} = \frac{\text{Manual Time-Automated Time Manual Time}}{\text{Manual Time}} * 100$$

Table 1: RunTimeSSS Comparison

Time Saving				
Sr. No.	**Method**	**Time Required (in mins)**	**Time Saving (in mins)**	**% Time Saving**
1	Manual Method	120	118	98.33
2	Automated Method	2		

There is time saving of 118min and in terms of percentage time saving is 98.33%. This time saving leads to cost saving as well.

Methodology is divided in to two parts : 1) Dataset generation to train Machine Learning Model by using FEA 2) Development of Machine Learning Model by model training and testing.

V. OBJECTIVES

1. It reduced cycle time.
2. Increased accuracy of the product as very less step is involved.
3. We just have to do only 2 clicks, one is for thickness calculations and second is for width calculations.

VI. CONCLUSION

The study done by us here gives a review on previous paper and journals based on different ideas and modifications with the help of mathematics, experiments, and computational methods. Now in this portion we concluded here the Study of automated leaf spring give us knowledge about how we reduce cycle runtime and made it cost effective.

VII. FUTURE SCOPE

1. Automated method leads to error-free FE modelling. It reduces the process runtime.
2. Use of automated method leads to time savings of 118mins.
3. Percentage time saving is about 98.33% and is considerably high.
4. Time saving ultimately leads to the cost saving.

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