

# Leaf Spring FE Model Creation using TCL/TK Scripting

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**Abstract** - Leaf spring (elliptical) is the component used in the automobiles to reduce the vibrations coming on the vehicle. While doing FEA it is important to create finite element model of the leaf spring quickly and accurately. This can be done by doing scripting in TCL-TK i.e. tool command language. Analysis software used for this is hypermesh and coding language of hypermesh is tool command language. Automation done to build the FE model of leaf spring leads to improve the efficiency and reduce the process runtime. This reduction in the process runtime ultimately results in the cost saving.

**Key Words:** Leaf Spring, Hypermesh, FE Model, Automation, TCL/TK Scripting

## 1.INTRODUCTION

Leaf springs are an integral part of your vehicle's suspension system. Leaf spring helps to support the entire weight of your vehicle. Also helps in maintaining the grip of tyre on the road. regulate the wheelbase lengths when it is speeding up or slowing down. leaf springs plays an important role in controlling the height of the ride and axel damping. There are many types of leaf springs as, semi-elliptical spring, quarter elliptical spring, transverse elliptical spring etc. In the commercial vehicles, mostly elliptical type of leaf spring is used. There is scope to build FE model of leaf spring developing an automated tool with TCL/TK scripting. This automation tool will reduce the process runtime and this leads to the cost saving.

## 2. COPARISON OF MANUAL METHOD VS AUTOMATED METHOD

Below figure 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 clean-up. After the just use the automated tool to build leaf spring.

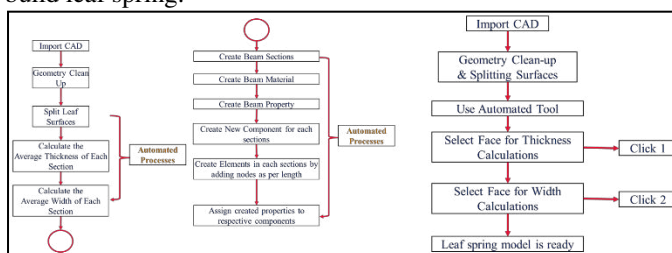


Fig-1: Method Comparison

### A) Steps in Manual Method:

1. CAD Input: Review the received input CAD geometry of leaf springs
2. Geometry Clean-up: Do the geometry clean-up if required. This is optional step.
3. Split Surfaces: Split the surfaces in the smaller sections. It effects the accuracy of model built.
4. Calculate Average Thickness: Calculate of average thickness for each sections.
5. Calculate Average Width: Calculate of average width for each sections
6. Create Beam Sections: beam sections are created using calculated thickness and widths
7. Create Beam Material and Property
8. Create Component, Add Elements and Assign Properties

### B) Steps in Automated Method:

1. Thickness Selection: automated tool will ask us to select the thickness surface first for the thickness calculations. If there is change in plane of thickness surfaces, select one surface on each plane.

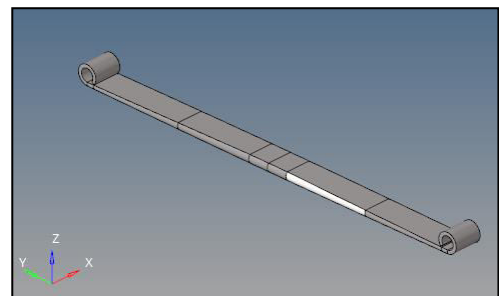


Fig-2: Thickness Selection

2. Width Selection: Second selection is to select width of leaf. We just have to select one surface for width calculations.

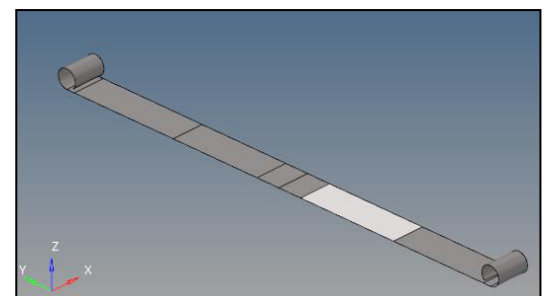


Fig-3: Width Selection

Manual method required 2hrs i.e. 120mins to build one leaf spring. With automated method, leaf is modelled within 2mins/per leaf. So if there are 10 leafs are there it will take 20mins. That means there is time saving of 100mins.

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

Time Saving				
Sr. No.	Method Used	Process Run Time in min	Time Saving in min	% Time Saving
1	Manual Method	120	100	83.33
2	Automated Method	20		

**Table -1:** Time Comparison

There is time saving of 118min and in terms of percentage time saving is 83.33%. This time saving leads to cost saving as well.

### 3. CONCLUSIONS

- 1) Automated method leads to error-free FE modelling. It reduces the process runtime.
- 2) Use of automated method leads to time savings of 100mins.
- 3) Percentage time saving is about 83.33% and is considerably high.
- 4) Time saving ultimately leads to the cost saving

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