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Design and Analysis of a Dual Shock Absorber Landing Gear for Commercial Airplane

Sk Sariful Islam
Research Scholar, Achutha Aerospace Research Organization
Visvesvaraya Technological University, Belgaum, India

Abstract:
Landing gear is a most important structural unit of an all kind aircraft which carry out the whole body during the take off and land safely on the ground. Many type of landing gear are used depending on what type and size of an aircraft. Generally tri-cycle arrangement are used with one front or nose landing gear unit and two main landing gear units. The major works of all kind shock absorbers is to absorb or dissipate energy. Fora commercial airplane, it decreases the effect of traveling over ground, leading to improved ride quality, and increase in comfort due to reduced amplitude of disturbances. In landing gear most important bouncing process is repeated over and over, with a little less each time, until the up-and-down movement fully stops. In this paper a signal and dual shock absorber landing gear is designed and a 3D model is created using CATIA v5 and analysis is done in ANSYS v12. Comparison is done for two type shock observer (signal and dual) to verify best Shock absorber.

Keywords: *CATIA v5, ANSYS v12, dual shock absorber.*

1. Introduction

A duel shock absorber is a instrumental designed to smooth out and dissipate all kind of kinetic energy.

1.1. Applications

Shock absorbers are very important instrumental part of all kind of aircraft landing gear, generally commercial airplane or large weighted airplane. As well as many industrial machines. Large shock absorbers are used by structural engineering to reduce to earthquake damage and resonance. The success of damping technologies are huge in world industry approximate it has a market size of around $ 4000 billion.

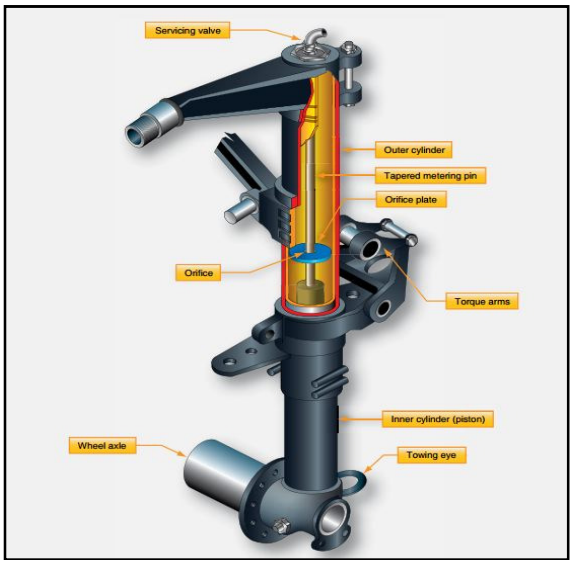

Figure 1: Single shock absorber landing gear.

1.2. Shock Absorber types

There are different methods of how to absorb the shock due to load vibration.

- Metal Spring
- Twin tube gas charge
- Coilover
- Collapsing safety Shock Absorbers
- Monotube
- Self-compensating Hydraulic

2. Introduction to Catiav5.

CATIAv5 is kind of industrial software which provided a range of design tools to enable the build the of a full digital representation of product design and parametric solid modeling program. It has ability to generate all kind of integrated design such as industrial engine. In this tools drafting process shows views of a part are created in the processing to describe the geometry. In this feature based modeling, every feature is individually described then integrated into the part. In paper we dealing with shock absorbers design parts are involved in below steps…

i. Part design
ii. Assembly
iii. Drawing (drafting)
iv. Sheet metal

3. 2-D and 3-D Model of Singal Shock Absorber Landing Gear Design by Catia V5.

3.1. Total Assembly

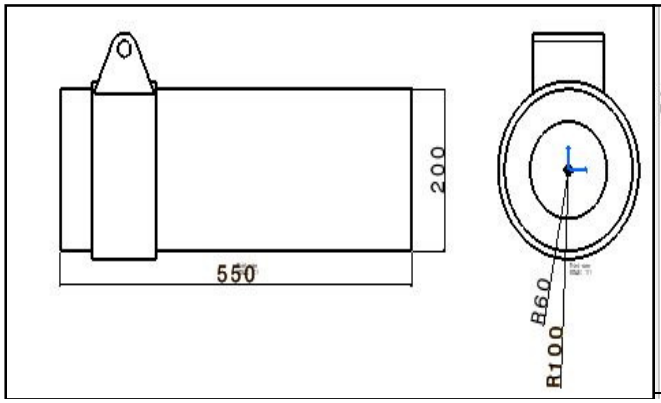

Figure 2: Upper case

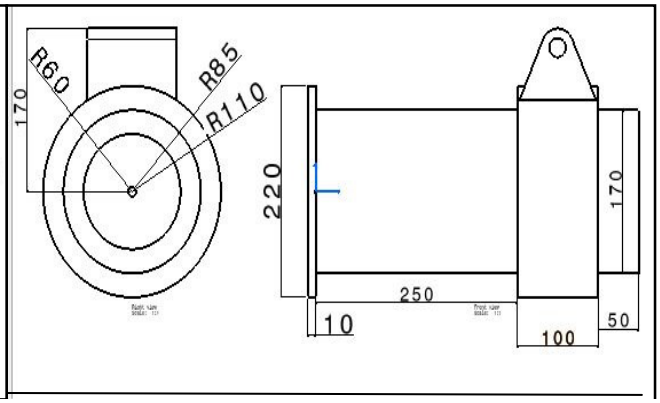

Figure 3: Lower case

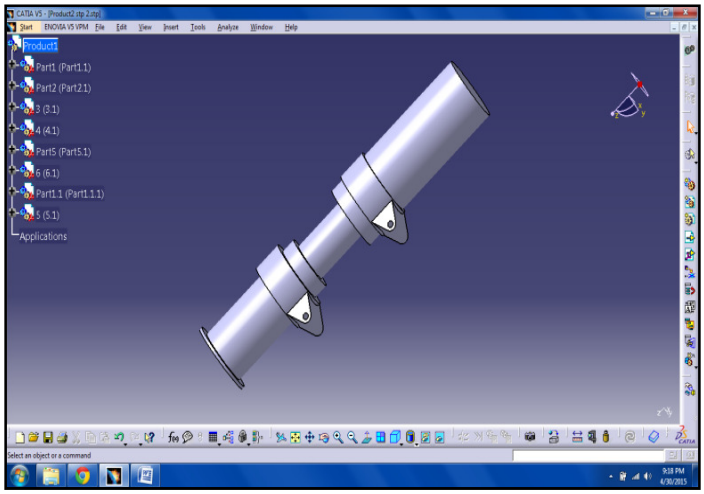

Figure 4: Assembly model of single shock absorber

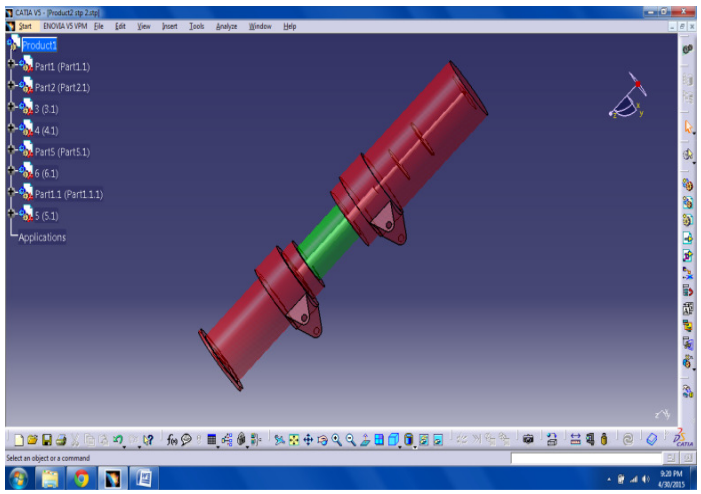

Figure 5: with internal Assembly model showing parts

3.2. 2-Dmodified Drawings of Dual Shock Absorber Landing Gear in Catia V5.

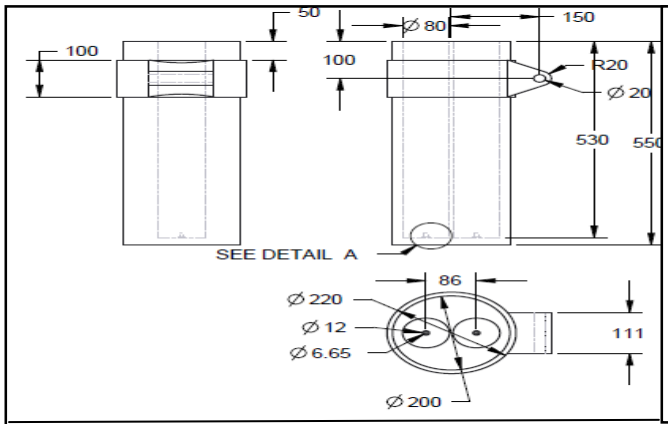

Figure 6: Upper case

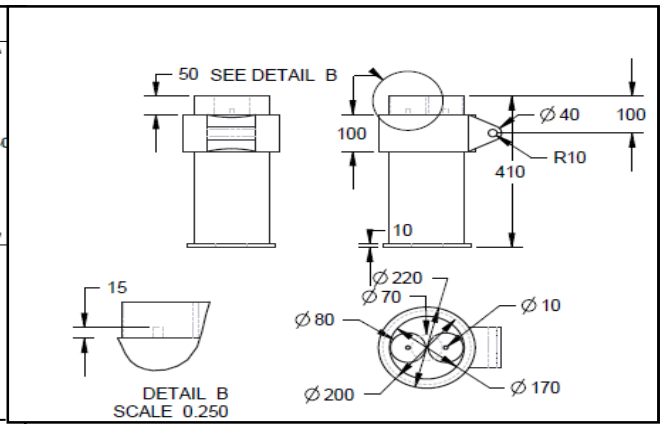

Figure 7: Lower case

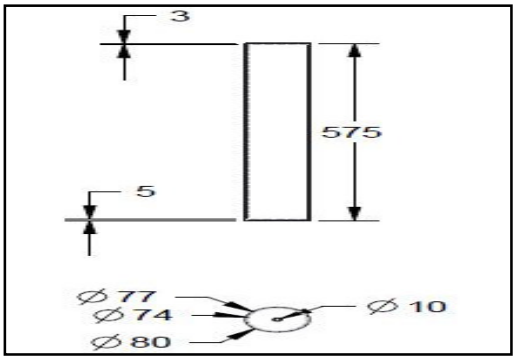

Figure 8: Middle part

3.3. 3-D Modifieddual of Shock Absorber Landing Gear

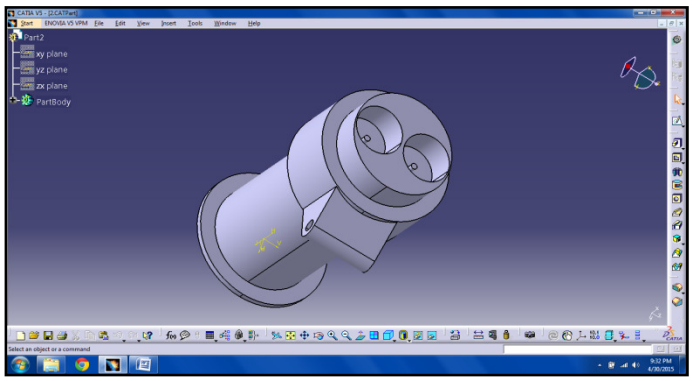

Figure 9: 3D design of lower case

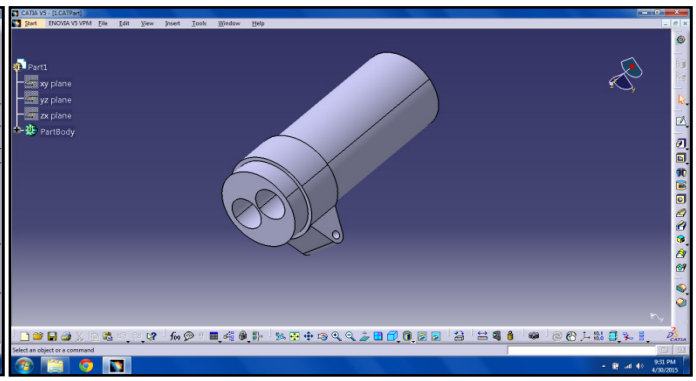

Figure 10:3D design of upper case

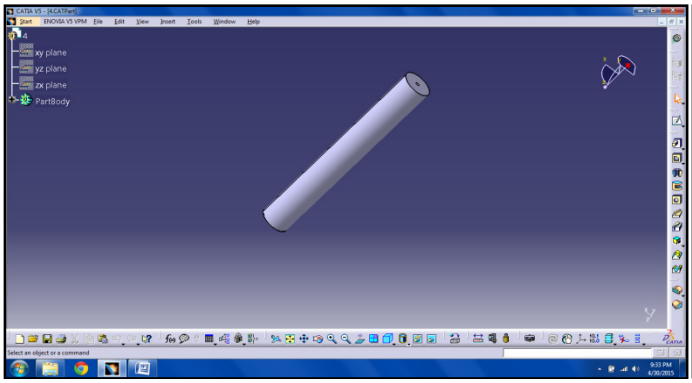

Figure 11: 3D design if middle part

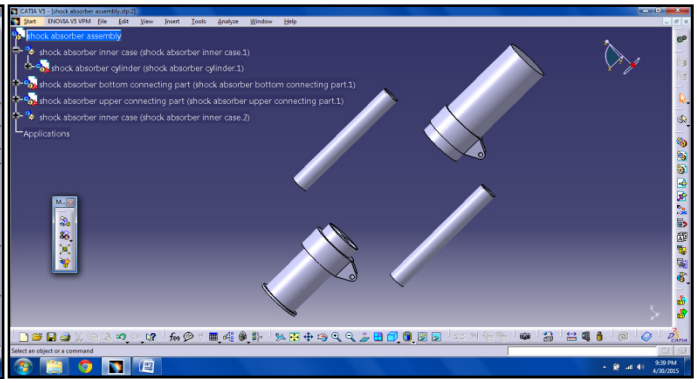

Figure 12: Explode view of dual shock absorber

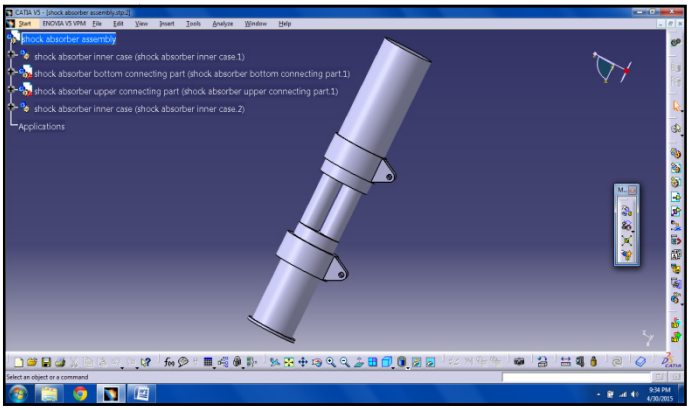

Figure 13: Assembly of dual shock Absorber

4. Introduction to Ansys v12

Finite Element Analysis is type of numerical method of complex system with very small pieces as known as elements. The software Implements equations which find out the behavior of all elements and solves them. These results are form of graphical with the governing equations.

4.1. Build Geometry

To build a two or three dimensional of the object to be modeled and tested with the help of work plane coordinates system into the ANSYSv12.

4.2. Generate Mesh

In the point of mashing how the Modeled system should be broken down within finite pieces.

4.3. Apply Loads

When the model is fully designed, then applying the loads with boundary conditions.

4.4. Obtain Solution

This is final and important step, because ANSYSv12 needs to solved within the require state (steady state, transient… etc.).

5 .Present Design of Shock Observer Landing Gear

5.1. Structural Analysis for Single Shock Observer

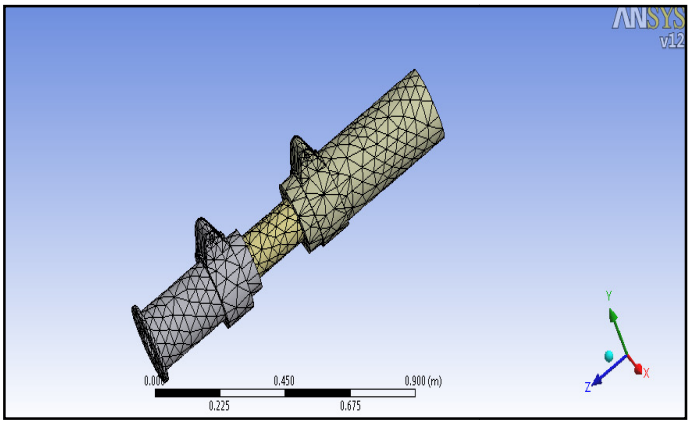

Figure 14: Meshing of single shock absorber

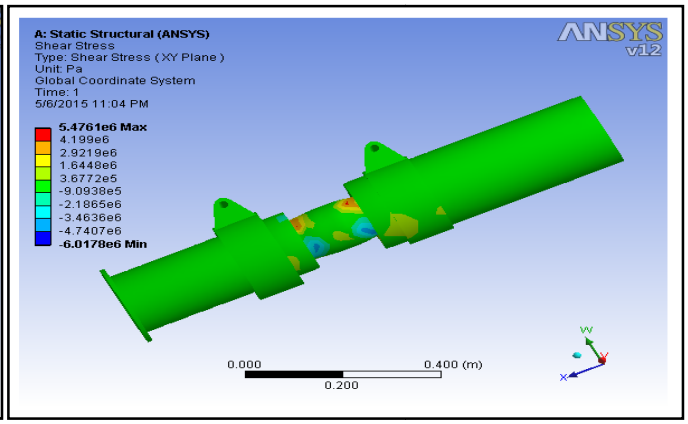

Figure 15: Analyzing for Shear stress for single shock absorber

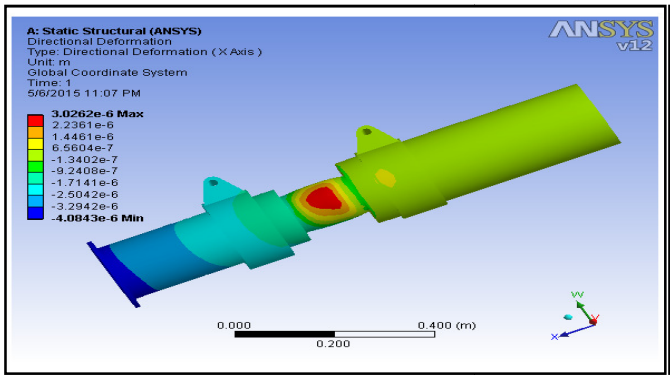

Figure 16: Analyzing for directional deformation for single shock absorber

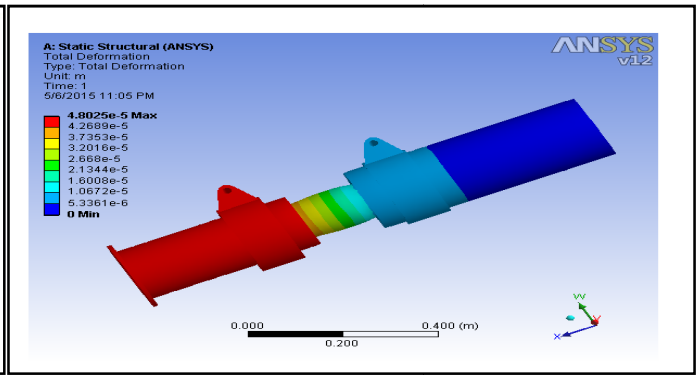

Figure 17: Analyzing for total deformation for single shock absorber

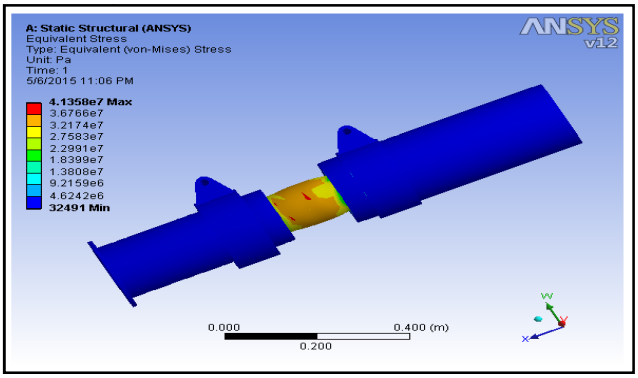

Figure 18: Analyzing for von-mises stress for single shock absorber

6. New Modified Design of Shock Absorber Landing Gear

6.1. Structural Analysis of Dual Shock Absorber Landing Gear

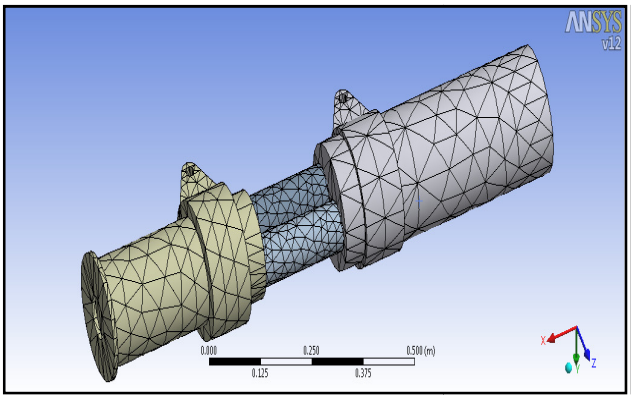

Figure 19: Meshing of dual shock absorber

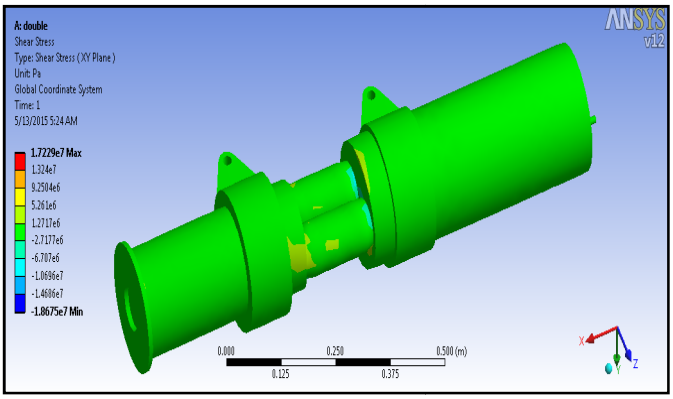

Figure 20: Analyzing for shear stress for dual shock absorber

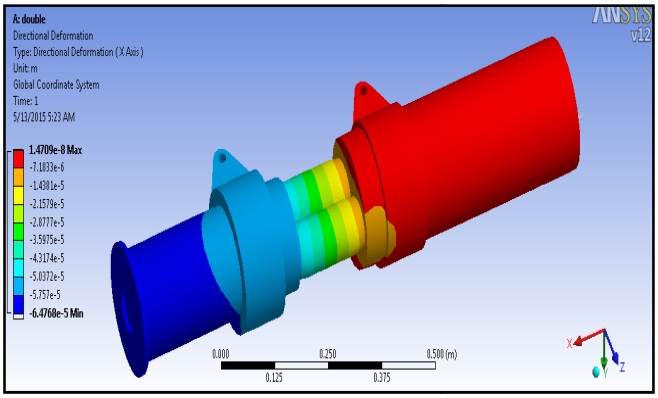

Figure 21: Analyzing for directional deformation for dual shock absorber

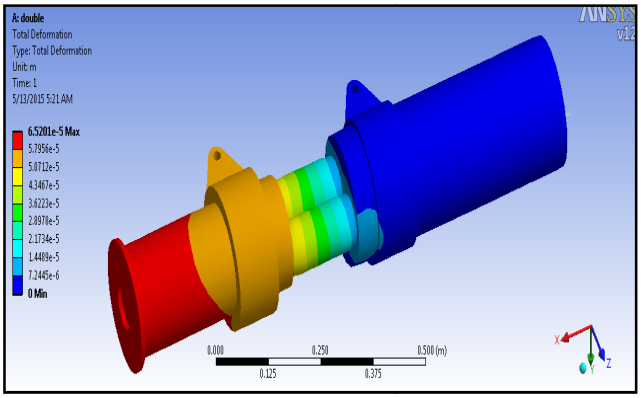

Figure 22: Analyzing for total deformation for dual shock absorber

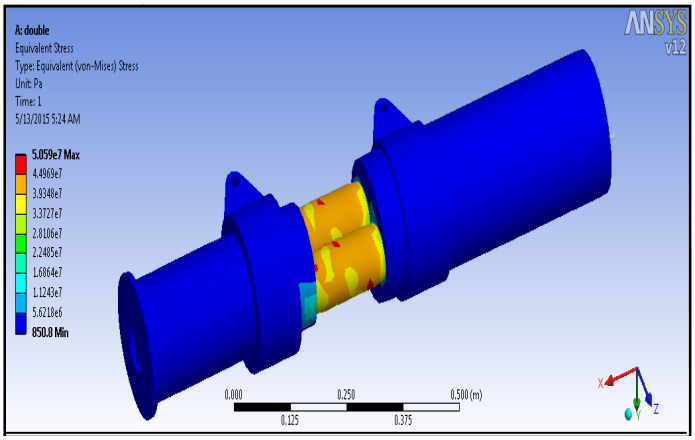

Figure 23: Analyzing for von-mises (equivalent) deformation for Dual shock absorber

7. Analysis and Results

7.1. Stress Analysis

i. The landing gears both single and double shock absorbers are analyzed with the loads for the shear stress under the maximum load of 66224 N.
We identified the failure is occurs in singleshock absorber but no such kind failure in the duel shock absorber with the same lode.
ii. The dual shock absorber can handle more load as compered to single shock absorber.
iii. In the single shock absorber we observed the swelling formation of the middle strut during the application of the load from sides of the landing gear. But in dual shock observed no such kind of change in dimensionsin landing gear.

8. Conclusion and Scope of Future Work

i. Dual shock absorbers can absorb maximum percentage of more shocks produced during landing in compare to single shock absorber.
ii. We can minimize maximum failure of landing gear.
iii. Dual shock absorber landing gear is more identical.
iv. In this shock absorber can minimize accidents during to landing.
v. With respect to time changing of landing gear strut changing is not needed.

9. References

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