Jr. of Industrial Pollution Control 33(2)(2017) pp 1754-1758
www.icontrolpollution.com
Research Article

DESIGN AND ANALYSIS OF STRUT ASSEMBLY COIL SPRING BY VARIOUS MATERIALS USING ANSYS

S. PRAKASH[1*], K. SURENDRA BABU[1], M. PRABHAHAR[1], C.K. MOHAMMED RASIDH[2] AND S.M. MUHAMMADMARJAN[3]

[1]Research Scholar, Aarupadai Veedu Institute of Technology, Vinayaka Mission University, India.

[2]Professor, Department of Mechanical Engineering, Aarupadai Veedu Institute of Technology, India.

[3]UG Student, Aarupadai Veedu Institute of Technology, Vinayaka Mission University, India.

(Received 25 May, 2017; accepted 22 December, 2017)

Key words: Strut, Spring, Autodesk inventor, FEA, Analysis

ABSTRACT

In automobile industries it's looking for safety, quality and optimum cost in vehicle components, but replacement of any components are very expensive. The suspension system is a mechanical device used in light motor vehicle, its reduce the effort of travelling over on rough surface but due to bad road condition the suspension spring get failure and also its get bump due to sudden loads. By using the Autodesk inventor software to analyzing the strut spring by varying materials such as Stainless Steel and Magnesium Alloy to avoid such failuresand also its design for withstand heavy loads. The design was drawn using Autodesk inventor software to analyzing the strut spring by comparing the deformation, stress, strain, shear stress and safety factor to carry better performance and longer life cycle.

INTRODUCTION

Suspension system is an important role for a comfortable ride for passengersto reduce the effort of travelling over on rough surface but due to bad road condition the suspension spring get failure and also its get bump due to sudden loads. Chassis, suspension spring and other working parts in automobile are getting failure due to road condition. If in a vehicle both front and rear axles the strut spring are fixed to the frame assembly, while vehicle is moving on the road, the wheels will be thrown up and down due to the irregularities of road, as such there will be much strain on the component as well as the journey for the passengers in the vehicle will also be very uncomfortable. This is the system that provide comfortable ride and also prevent damage to the working parts (Fig. 1).

OBJECTIVE

The objective of the present work is to design and analyzing a Strut coil spring based upon its different material properties by using Stainless Steel and Magnesium Alloy are used to analyze. The material of Strut coil spring will be analyzed for better result output. CAD model of strut coil spring will be modelled in Autodesk inventor and itsanalyzed by using Software. After analysis a comparison will

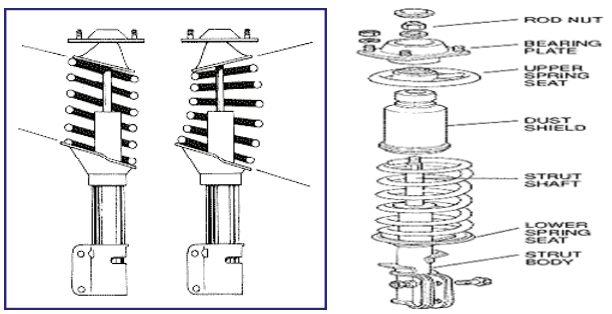

Fig. 1 Strut assembly components.

***Corresponding authors email: prakash@ktr.srmuniv.ac.in**

be made between existing material and alternate material which will be suggested for the suspension spring in terms of deformation, stresses and strain, shear stress and factor of safety to desired output results can achieved (Supriya, 2014; Dhananjay and Kuldeep, 2016; Rachel and Devaki, 2013; Niranjan, 2013).

MATERIALS AND DATA

Finite Element Analysis

The analysis of suspension coil spring design is carried out using Autodesk Inventor software Finite Element Method (Shrikant, *et al*., 2016; Chandrakant, *et al*., 2015; Khashayar, *et al*., 2013; Pyttel, *et al*., 2013). Firstly the model files prepared in the Autodesk Inventor for the material stainless steelto get the deformation, stress and strain and the design is assigned to Magnesium alloy to compare the result to get better performance for avoiding failure in design (Table 1).

METHODOLOGY

In this work design and analysis has been carried out on suspension spring for stain steel (Fig. 2-7). The work design and analysis has been carried out on suspension spring for Magnesium alloy (Fig. 8-19).

Table 1. Material data.

Properties	Unit	Stainless Steel	Magnesium
Mass Density	g/cm^3	8	1.82745
Yield Strength	Mpa	250	89.63
Ultimate Tensile Strength	Mpa	540	275.7
Young's Modulus	GPa	193	44.81
Poisson's Ratio		0.3	0.35
Shear Modulus	GPa	74.2308	16.59

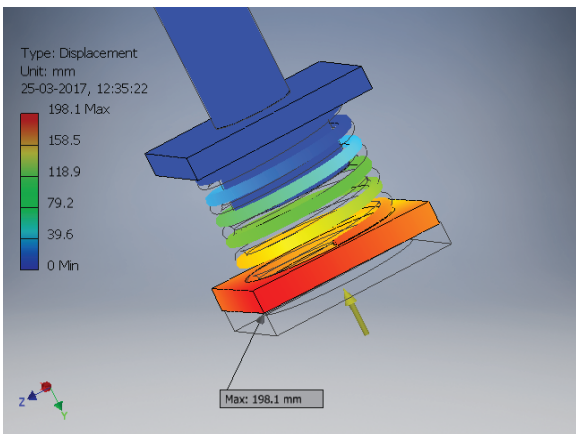

Fig. 2 Displacement for SS.

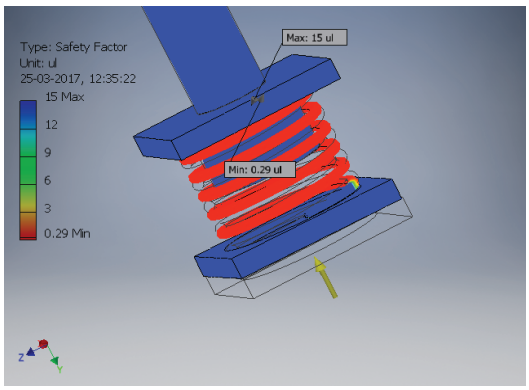

Fig. 3 Safety factor for SS.

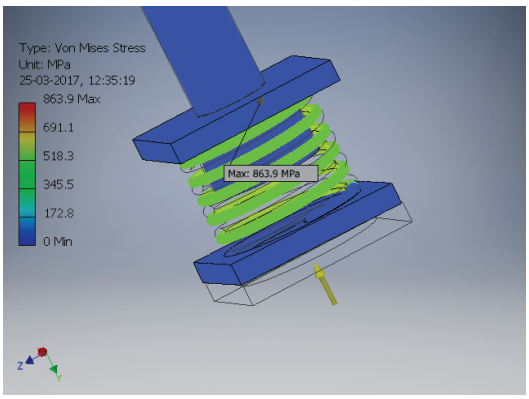

Fig. 4 Von Misses stress for SS.

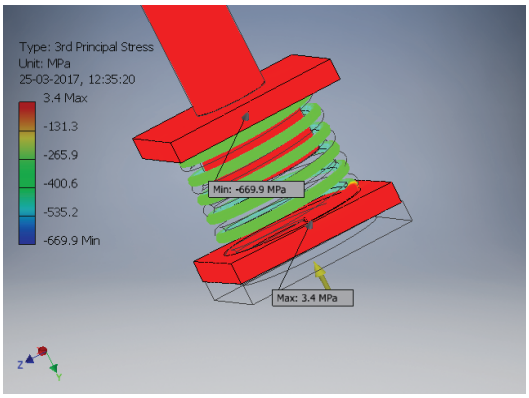

Fig. 5 Principle stress.

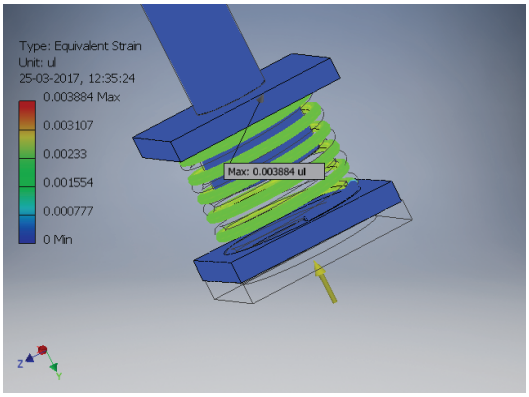

Fig. 6 Equivalent strain for SS.

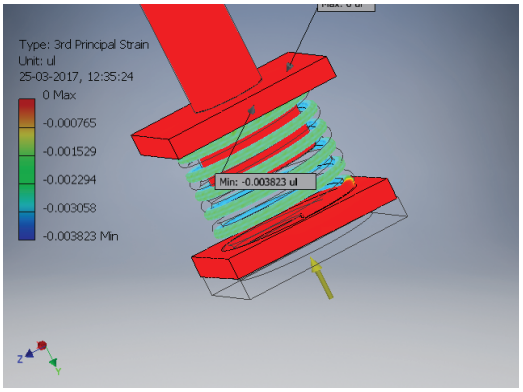

Fig. 7 Principle strain for SS.

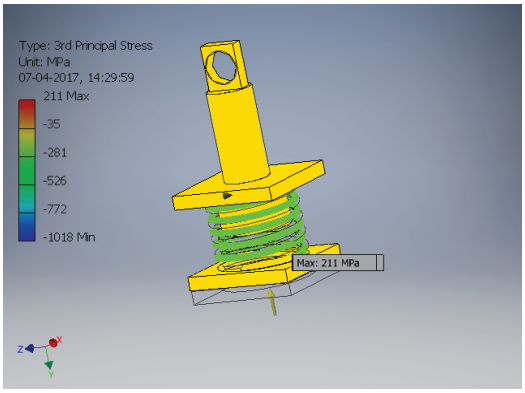

Fig. 11 Principle stress for magnesium.

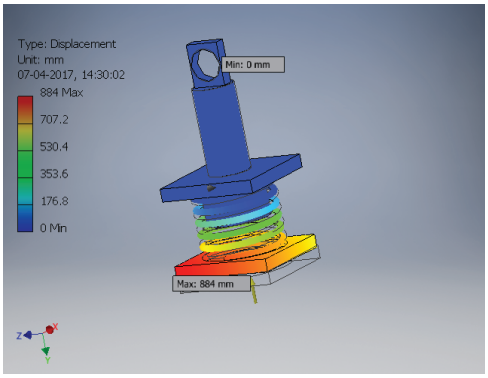

Fig. 8 Displacement for magnesium.

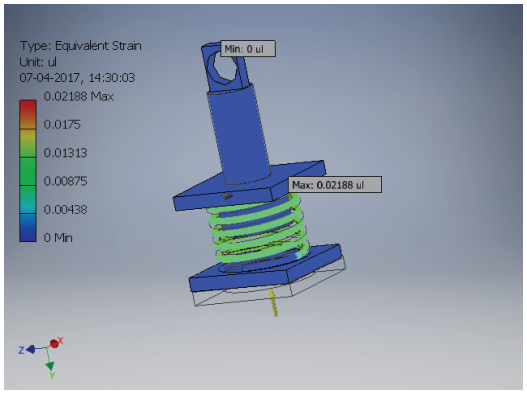

Fig. 12 Equivalent strain for magnesium.

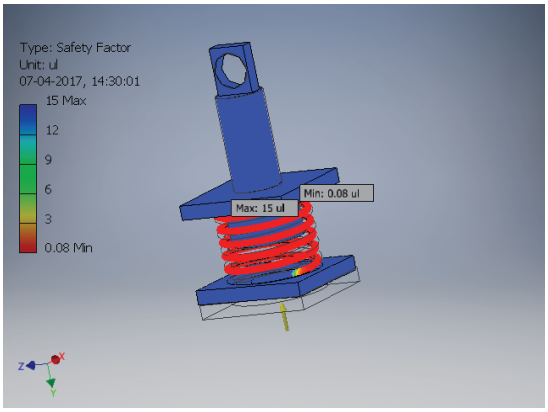

Fig. 9 Safety factor for magnesium.

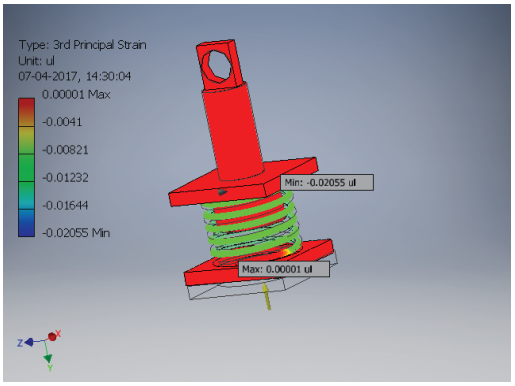

Fig. 13 Principle strain for magnesium.

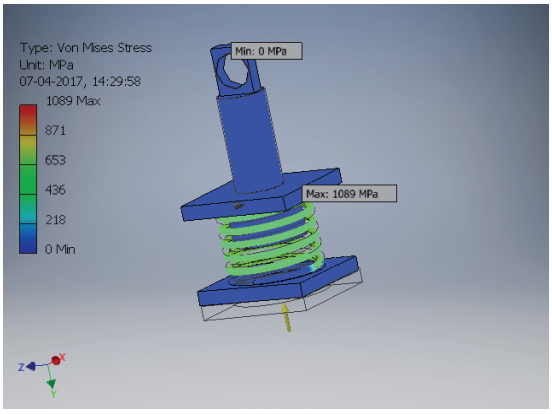

Fig. 10 Von Misses stress for magnesium.

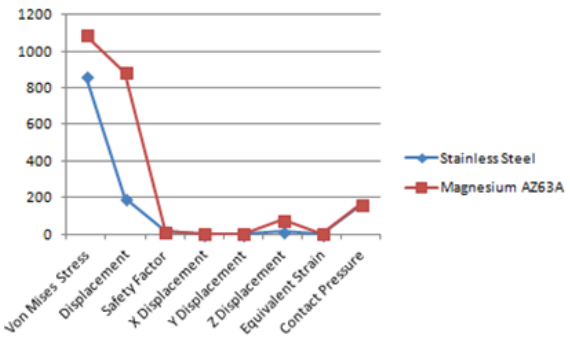

Fig. 14 Comparison factor for Ss and magnesium Az63a stress, displacement, strain and pressure.

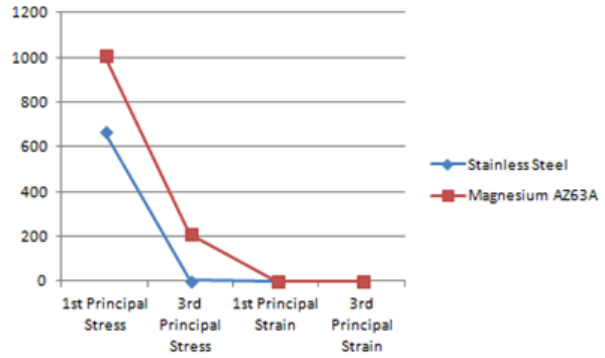

Fig. 15 Comparison factor for SS and magnesium Az63a, principal stress principal strain.

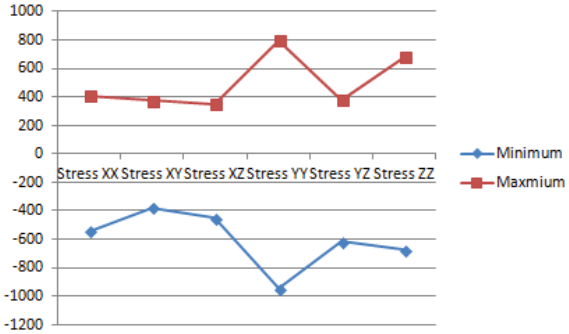

Fig. 16 Stress minimum vs. maximum curve for SS.

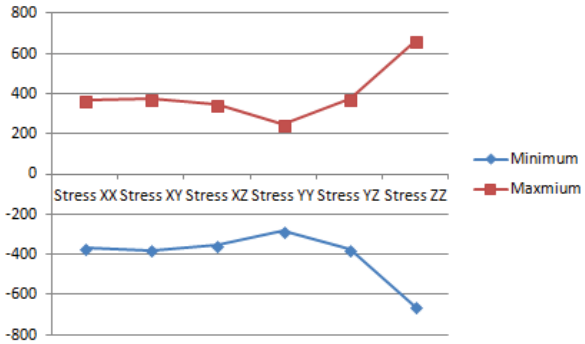

Fig. 17 Stress minimum vs. maximum curve for magnesium Az63a.

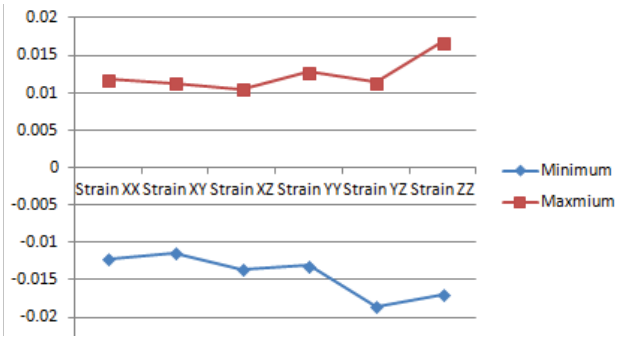

Fig. 18 Strain minimum vs. maximum curve for SS.

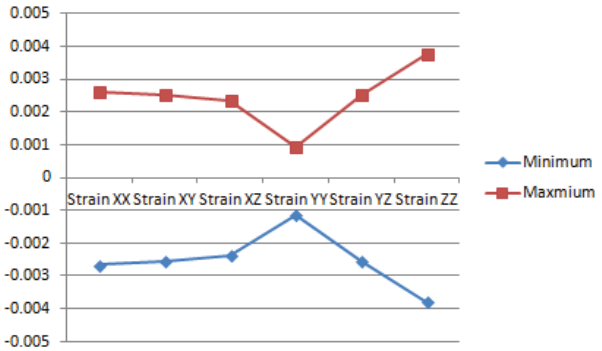

Fig. 19 Strain minimum vs. maximum curve for magnesium Az63a.

DISCUSSION AND CONCLUSION

The autodesk inventor software to analysis the displacement (deformation), vonmisses stress, strain, safety factor, principle stress and principle strain, The results or conclusion thus that can make on the bases of the output results by Autodesk Inventor can be as followed, It is observed that design for Stainless Steel value of displacement – 198.089 mm, vonmisses stress – 863.856 Mpa, Equivalent Strain - 0.00388394 ul, safety factor - 0.2894 uland principle stress - 3.37114 MPa and principle strain - 0.0000000355936 ul induced in the suspension springand its compared with Magnesium alloy and its observed that the design for Magnesium alloy value of displacement – 884.049 mm, vonmisses stress – 1088.81 MPa, Equivalent Strain - 0.0218808 ul, safety factor - 0.0823203 ul and principle stress - 210.924 MPa and principle strain - 0.0000145811 ul. By observing the analysis results, the present design and modified design, the displacement, vonmisses stress, strain, safety factor, principle stress and principle strain of Stainless steel and Magnesium alloy are closer to the results. So, the weight of the spring has also been reduced and it's safe.

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