

Study and problem identification for failure analysis of suspension springs of Indian railway engine WAG-9,Locoshed Ajni,Nagpur,India

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ABSTRACT : Helical springs are used as a suspension spring for the railway engine over the years. Railway locoshed maintenance department has observed that the suspension spring undergoes failure due to application of cyclic loads(i.e. static as well as dynamic load).The failure of spring is not uncommon,hence this calls for an study.Thus,the objective of this research paper is to study and formulate problem and analyse the causes of structural failure of suspension spring.To analyse the causes of structural failure we are using finite element analysis method(FEM).For analysis, we first prepare the design model of suspension spring according to details of design provided by Electric Locoshed Ajni,Nagpur,India.According to observation at site,the suspension spring fails at a much higher rate between first to third coil from the top end . Failure initiates at the inner radius of spring which progresses and shears the spring into two pieces. Thus, our study is around this matter.

IndexTerms - Cyclic load,FEM,Shear,Static,Dynamic

I. INTRODUCTION

In this paper we have discussed about the approach that we are going to adopt for the problem identification of the suspension spring of railway engine WAG-9 and how we are going to provide the alternative solution to the Indian Railways Regarding the material used for suspension spring.The investigation is focused around the failure of secondary suspensuion spring and primary suspension spring.first of all.The design of spring is prepared by using design data provided by railway officials .The Design of the springs is shown in following figures.

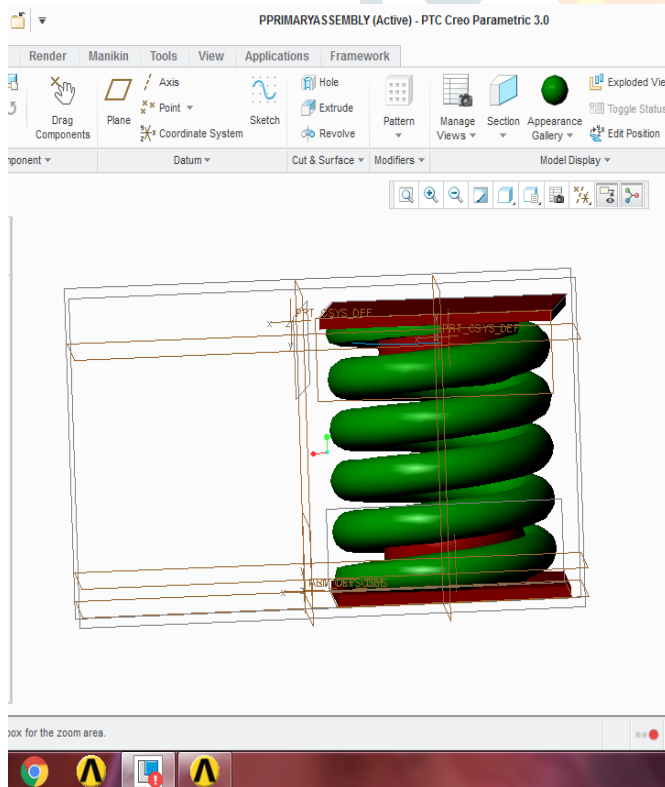
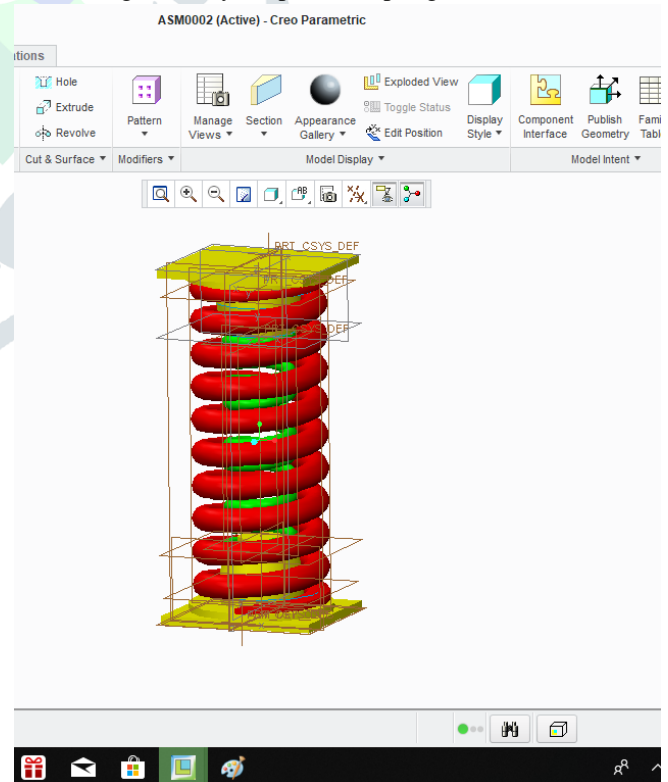


Fig. Primary Suspension Spring.



II. PROBLEM IDENTIFICATION

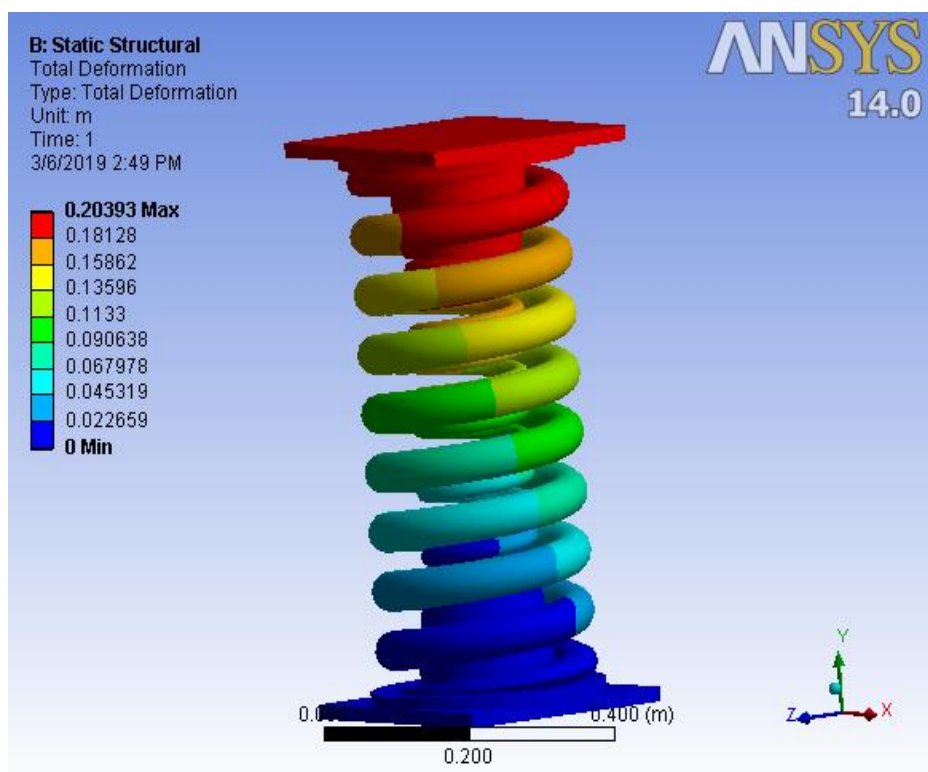
- The maintenance record at loco shed indicates that there is very high rate of failure of primary inner spring.
- For instance in 2009-10 the primary inner spring was replaced on 51 instances as against 8 instances of middle axle primary outer spring.

- **Following are the observations on failed spring:**
- The spring usually breaks between first to third coils.
- Failure initiates at the inner radii of spring which progresses and shears the spring into two pieces. (Refer figure 4).
- The scratches on the damper confirm the deformation of assembly by about 25mm more than the stationary condition indicating higher loads while running. (Refer figure 5).



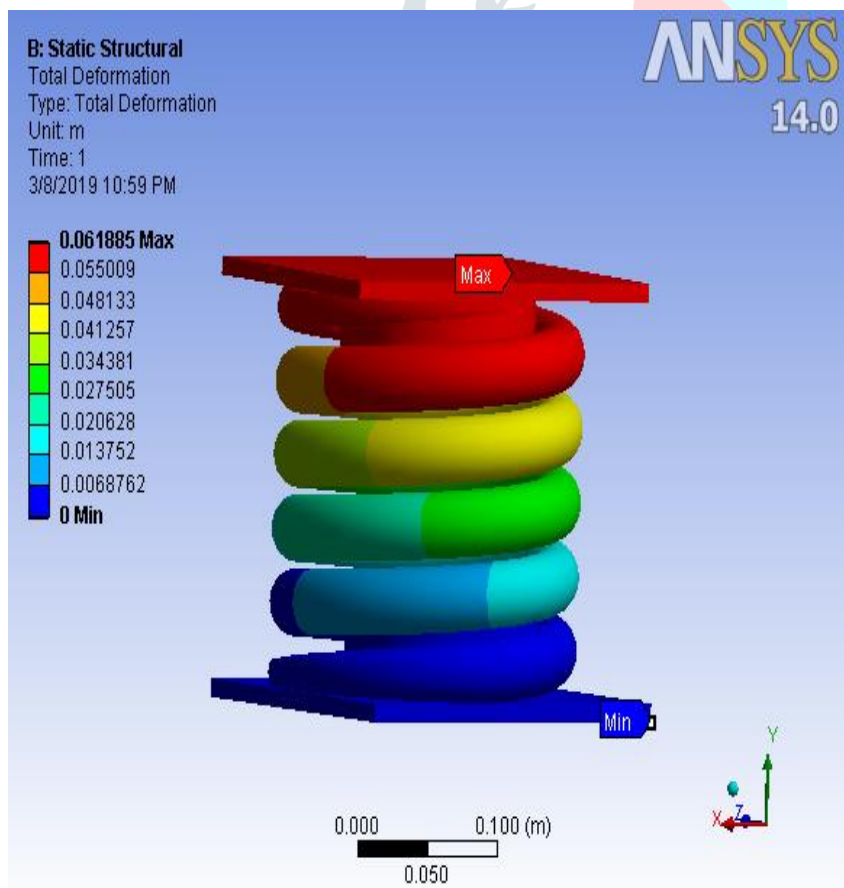
Fig.Broken Primary Spring

Below figure shows the problem identification of suspension spring.



MAXIMUM DEFORMATION AT FIRST TWO COILS

Fig.Secondary Spring



DEFORMATION MAXIMUM BETWEEN FIRST TWO COILS

Fig.Primary spring

III. RESULT AND CONCLUSION:

- ❖ The above mentioned approach is adopted for problem identification and failure analysis of Suspension Spring of Railway Engine WAG-9.
- ❖ By applying above mentioned approach the failure analysis of suspension spring of Railway Engine WAG-9 could be successfully carried out.

REFERENCES

- ❖ Failure Analysis of Inner Suspension Spring of Railway Engine: A Case Study Manoj A. Kumbhalkar¹, Prof. Y. L. Yenarkar² and Mr. A. K. Grover³.
- ❖ DESIGN AND ANALYSIS OF A FREIGHT LOCOMOTIVE SUSPENSION SPRING AND REDESIGN OF THE SPRING FOR DURABILITY AND RIDE INDEX. T Nikhil kumar¹, M Pramod reddy² and Dr p sampath rao³.

