

Stress Analysis and Fatigue Analysis of Front Axle of Heavy-Duty Truck using ANSYS Ncode Design Life for Different Loading Cases

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ABSTRACT

Front axle of heavy duty truck is the important component of vehicle and needs good design under the various loading conditions of the complete vehicle. Aim of the project is to stress analysis and predict the life of front axle for vertical, and vertical and braking loading case. The fatigue life of front axle is generally estimated by stress life approach and strain life approach method. Front axle beam assembly was modeled in the NX cad software. Meshing and Stress analysis is performed by ANSYS workbench and fatigue analysis is performed by NCODE design life ANSYS tool under different loading cases. Fatigue life of axle obtained by FEA method is more than 2×10^7 cycles, which is considered as safe for vertical loading case. Similarly, Fatigue life of axle obtained is more than 4×10^7 cycles, which is considered as safe for vertical and braking loading case. The max stress region is below spring pad of axle for vertical loading and in the goose neck of axle for vertical and braking loading case.

Keywords: Front axle beam, Stress Analysis, Fatigue Life, NCODE ANSYS tool, Heavy Duty Truck

I. INTRODUCTION

In global economic scenario optimum vehicle design & life prediction of different parts of vehicle like front axle, steering knuckle, crankshaft etc. is of major concern and at the same time improve a product quality. Present off-highway vehicle market demands low cost, light weight & long life components to meet the need of cost effective vehicle. Due to which, more effective use of materials and relevant surface treatments are required to increase the fatigue life components of vehicle.

Fatigue failure often occurs from cracks initiated below spring pad and at notches of front axle beam. It is generally described in sequential process consisting of three main stages, i.e. crack initiation, crack propagation and fracture [1]. Therefore, it is the need to develop durable products which are safe against fatigue failure.

Front axle beam takes about 30-35 % of total vehicle weight. The main three reasons of failure of mechanical components are Corrosion, wear and fatigue [2]. Main reason for failure of front axle beam is the fatigue damage due to continuous fluctuating loads which acts from irregular road surface. Therefore, the research on the fatigue life of different vehicle parts has important value.

Front axle is subjected to different loads in different direction under the dynamic condition of

vehicle. Bending occurs in axle, when vehicle takes turn and torsion due to braking load.

II. LITERATURE SURVEY

Min Jhang, Lijun Li (2015) analyzed stress and fatigue life of front axle beam by finite element analysis and experimental method. Also, investigate the effect of crack parameters like length and depth on fatigue life [1]. Topac (2008) evaluated the fatigue failure prediction and fatigue life of a rear axle housing prototype by using Finite element analysis of heavy duty truck. The expected load cycles required to fail during the vertical fatigue tests of a rear axle housing prototype is studied and mechanical properties were determined of housing material [3].

Various experiments and numerical methods were adopted by Leon et al. (2000) to obtain the stress analysis of a frontal truck axle beam and improved the quality of product by reducing the development time [4].

2.1 Closer Review

In this project our aim is to stress analysis and estimate fatigue life of front axle beam of heavy duty truck under different loading condition using Ancys NCODE Design Life software.

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Table of Contents Stress Analysis And Fatigue Analysis Of Front Axle Of

1. Understanding the eBook Stress Analysis And Fatigue Analysis Of Front Axle Of
 - The Rise of Digital Reading Stress Analysis And Fatigue Analysis Of Front Axle Of
 - Advantages of eBooks Over Traditional Books
2. Identifying Stress Analysis And Fatigue Analysis Of Front Axle Of
 - Exploring Different Genres
 - Considering Fiction vs. Non-Fiction
 - Determining Your Reading Goals
3. Choosing the Right eBook Platform
 - Popular eBook Platforms
 - Features to Look for in an Stress Analysis And Fatigue Analysis Of Front Axle Of
 - User-Friendly Interface
4. Exploring eBook Recommendations from Stress Analysis And Fatigue Analysis Of Front Axle Of
 - Personalized Recommendations

- Stress Analysis And Fatigue Analysis Of Front Axle Of User Reviews and Ratings
- Stress Analysis And Fatigue Analysis Of Front Axle Of and Bestseller Lists
- 5. Accessing Stress Analysis And Fatigue Analysis Of Front Axle Of Free and Paid eBooks
 - Stress Analysis And Fatigue Analysis Of Front Axle Of Public Domain eBooks
 - Stress Analysis And Fatigue Analysis Of Front Axle Of eBook Subscription Services
 - Stress Analysis And Fatigue Analysis Of Front Axle Of Budget-Friendly Options
- 6. Navigating Stress Analysis And Fatigue Analysis Of Front Axle Of eBook Formats
 - ePub, PDF, MOBI, and More
 - Stress Analysis And Fatigue Analysis Of Front Axle Of Compatibility with Devices
 - Stress Analysis And Fatigue Analysis Of Front Axle Of Enhanced eBook Features
- 7. Enhancing Your Reading Experience
 - Adjustable Fonts and Text Sizes of Stress Analysis And Fatigue Analysis Of Front Axle Of
 - Highlighting and Note-Taking Stress Analysis And Fatigue Analysis Of Front Axle Of
 - Interactive Elements Stress Analysis And Fatigue Analysis Of Front Axle Of
- 8. Staying Engaged with Stress Analysis And Fatigue Analysis Of Front Axle Of
 - Joining Online Reading Communities
 - Participating in Virtual Book Clubs
 - Following Authors and Publishers Stress Analysis And Fatigue Analysis Of Front Axle Of
- 9. Balancing eBooks and Physical Books Stress Analysis And Fatigue Analysis Of Front Axle Of
 - Benefits of a Digital Library
 - Creating a Diverse Reading Collection Stress Analysis And Fatigue Analysis Of Front Axle Of
- 10. Overcoming Reading Challenges
 - Dealing with Digital Eye Strain
 - Minimizing Distractions
 - Managing Screen Time
- 11. Cultivating a Reading Routine Stress Analysis And Fatigue Analysis Of Front Axle Of
 - Setting Reading Goals Stress Analysis And Fatigue Analysis Of Front Axle Of
 - Carving Out Dedicated Reading Time
- 12. Sourcing Reliable Information of Stress Analysis And Fatigue Analysis Of Front Axle Of
 - Fact-Checking eBook Content of Stress Analysis And Fatigue Analysis Of Front Axle Of

- Distinguishing Credible Sources
- 13. Promoting Lifelong Learning
 - Utilizing eBooks for Skill Development
 - Exploring Educational eBooks
- 14. Embracing eBook Trends
 - Integration of Multimedia Elements
 - Interactive and Gamified eBooks

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