

Problem 1.11: Bearing reliability, deep groove ball bearing

Calculate the operating reliability $R(t=1000\text{hr})$ of a deep groove ball bearing. The calculated L_{10} life expectancy of the ball bearing is $L_{10} = 500 \cdot 10^6$ rev. The rotational speed is 4000 rpm.

Hint: The life expectancy of the ball bearings is related to the L_{10} basic rating life according (eq. 4.66, page 129).

**Problem 1.12: Reliability factor for Fatigue strength**

A power supply is cooled by 3 fans. The correct functioning of at least one of the three fans is required to maintain sufficient cooling. The operating reliability of the system needs to be 99% for a service life of 10.000 hr, $R_s(10.000 \text{ hr}) = 0.99$. The rotational speed is 4000 rpm.

- Estimate the required operating reliability R_i of the individual fans.
- Calculate the required L_{10} of the individual bearings.
- Calculate C/P

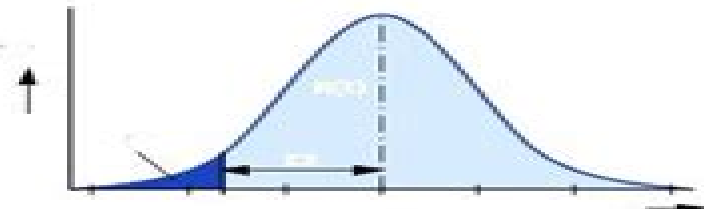
**Problem 1.13: Reliability factor for Fatigue strength**

Data published of the endurance strength are always mean values. In Norton (2000) is reported that the standard deviation of the endurance strength of steels seldom exceeds 8% of their mean. Estimate a correction factor for the endurance strength if a 99% probability is required.

**Problem 1.14: Component reliability**

Calculate the component reliability of a drive shaft (motor shaft) loaded in the High Cycle Fatigue (HCF) regime with $L_n = 2 \cdot 10^5$ load cycles.

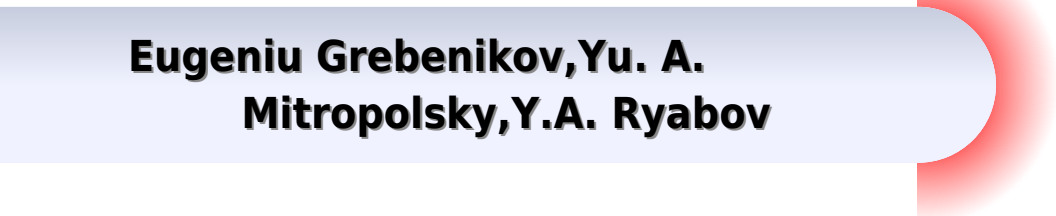
Consider the calculated fatigue life of $L_{10} = 3 \cdot 10^5$ load cycles and a standard deviation of $\sigma = 0.2$.

**Problem 1.15: Stress concentration factor**

"A chain is only as strong as its weakest link, regardless of the strength of the stronger links". Do you agree and what do you think about the reliability if the failure mode is fatigue?

Analytical Dynamics Solutions Manual

**Eugeniu Grebenikov, Yu. A.
Mitropolsky, Y.A. Ryabov**



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Hanspeter Schaub, John L. Junkins, 2003

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Table of Contents Analytical Dynamics Solutions Manual

1. Understanding the eBook Analytical Dynamics Solutions Manual
 - The Rise of Digital Reading Analytical Dynamics Solutions Manual
 - Advantages of eBooks Over Traditional Books
2. Identifying Analytical Dynamics Solutions Manual
 - 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 Analytical Dynamics Solutions Manual
 - User-Friendly Interface
4. Exploring eBook Recommendations from Analytical Dynamics Solutions Manual
 - Personalized Recommendations
 - Analytical Dynamics Solutions Manual User Reviews and Ratings

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