

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

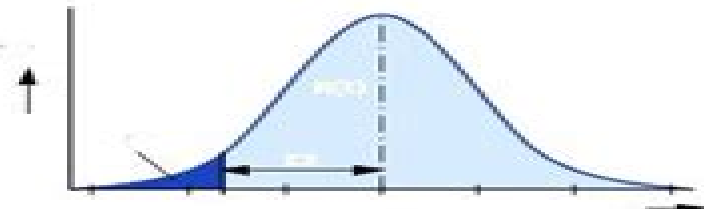
**Problem 1.13: Reliability factor for Fatigue strength**

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?

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