We would like to thank the editor for helpful comments. Below, we respond to each point and describe the changes made to the manuscript.

The combination of two highly specialized topics (structural reliability and bearing design) in the present manuscript makes it challenging to find reviewers with such profile – or at least challenging to find reviewers that can cover both topics simultaneously. I therefore see it necessary to supplement the other reviews with a "review by editor", where I am mostly focusing on topics related to the structural reliability and load calculations.

General comments

1) Grammar: the use of the definite article "the" is not correct in a number of places in the paper, there are both examples of unnecessary "the" and examples of missing "the" or "a". An example with the abstract – the first few sentences should read: "This study presents a reliability analysis of a blade bearing against ultimate limit state failure. The National Renewable Energy Laboratory 5 MW Reference Wind Turbine is selected for the study, and a Monte Carlo simulation (or "the Monte Carlo simulation method") is used for reliability analysis and estimation of the probability of failure….". Please correct the entire manuscript for grammar.

- Answer: A thorough language edit has been performed.

2) Blade bearing or blade pitch bearing? In my view, it is better to mention it is a pitch bearing.

- Answer: Blade bearing and pitch bearing are both common. In order to make it clear for the reader, the following text is added in the introduction:
  "with blade bearings, also named pitch bearings,"

3) Section 1: The authors list references that deal with fatigue of rolling bearings. However, I am missing the discussion about the fundamentally different loading pattern that blade bearings are subject to – they work as so-called "oscillating bearings" which is the main reason for specific failure modes (such as static failure) being more relevant. I suggest the authors discuss the specific loading pattern of oscillating bearings, add any necessary literature, and link the loading pattern with the choice of failure mode.

- Answer: The following text is added in the introduction part:
  "A common and distinguishing feature of blade bearings is that they involve a rather slow oscillatory motion (Harris et al., 2009). This movement pattern differs from that of bearings in most other industrial applications, where bearings usually rotate continuously (Menck et al., 2020). Unlike most oscillating bearings, blade bearings perform stochastic oscillations rather than constant amplitudes back and forth (Stammler et al., 2024). They oscillate through only a few degrees, up to 20∘(Keller and Guo, 2022) during normal power operation, depending on wind conditions and turbine sizes, and up to 90∘in emergency feathering, rather than completing full revolutions. The limited rolling distance, long dwell periods at fixed pitch angles, and frequent load reversals with high axial offsets concentrate stress cycles within a small contact zone on the raceways. Blade bearing failure consists of different damage modes, including rolling contact fatigue, core crushing, edge loading, ring fracture, rotational wear,

fretting, false brinelling (Andreasen et al., 2022), and cage damage. Because these modes initiate in the same high-stress regions, the static-overload reliability analysis developed here directly addresses the most critical damage mechanisms for oscillating blade bearings. As a part of the design and certification process in a blade bearing, the static safety factor of the blade bearing in the ultimate limit state (ULS) must be assessed, as mentioned in (IEC 61400-1, 2019; DNV-ST-0437, 2016; Harris et al., 2009; Germanischer Lloyd, 2010; Stammler et al., 2024)."

4) Figure 2: I am not sure the uncertainties on the loads side are so clear. I believe they should be split more clearly between aleatory uncertainties (like the short-term wind conditions), and epistemic uncertainties – which could be further subdivided into 1) model uncertainties in the climate model, the dynamic loads calculation model and the bearing model, 2) measurement uncertainties, and 3) statistical uncertainties due to finite sampling periods. It is also fine if some of these uncertainties are considered irrelevant or small enough to be omitted, but the current description does not make it clear what is the source of each uncertainty is and why it should be included or not.

- Answer: We agree that a clearer distinction between different types of uncertainties would help the reader better understand the structure of the reliability model. Therefore, we have updated Figure 2 to clarify the sources and types of uncertainty involved in the loads. In particular, we now distinguish between:
  Aleatory uncertainty represents inherent variability, such as the stochastic nature of short-term wind conditions (e.g., turbulence and seed number variability).
  Epistemic uncertainty, which we further divide into:
    Model uncertainty — including simplifications in aerodynamic load modeling, and structural response
    Measurement and parameter uncertainty
    Statistical uncertainty — arising from finite sampling periods.

  To make this clearer, we drew a light dotted rectangle around them, labeled "*combined → uncertainty on wind-induced loads*", and the following text is added right after the figure:

  "The dashed box represents uncertainty on loads that have distinct uncertainty sources -(i) external wind variability and (ii) Epistemic uncertainty arises from model, measurement, and stochastic uncertainties, which are sampled separately and then combined to generate the stochastic wind-induced loads. The uncertainties of the measurement and statistics are not considered in this study."

5) Page 10, line 183: the authors use the maximum likelihood estimator (MLE) for fitting extreme probability distributions. While the MLE is the standard way of fitting parametric probability distributions to data, it is often insufficient when the aim is proper representation of the tails of the data. Further, the current format of Figure 3 is not clearly showing the quality of the fit in the tails. I hereby remind my earlier comment which the authors suggested will be addressed in a revised version: "When considering reliability analysis with respect to ultimate limit state with small probabilities, the failures normally occur under rare conditions which fall within the tails of the underlying distributions. Therefore, when evaluating the quality of fit of distributions,

normally the most useful way of graphical evaluation is plotting the exceedance probabilities (1 minus the CDF) on a logarithmic y-axis. Sometimes also the max likelihood method may not be the most applicable fitting method as it will ensure the best fit to the main body of the distribution but not necessarily the tails. I suggest you replace Figure 3 by an exceedance probability plot, and based on that reevaluate which may be the best fitting distribution, and whether you may need other fitting method than the MLE or other quantitative criteria than the CE indicator. For the exceedance probabilities of the actual data, you can use the empirical CDF formulas based on data ranking."

- Answer: Thank you for this valuable comment. We agree that proper representation of the distribution tails is crucial for reliability analysis, especially when evaluating rare events. In our study, the fitted distribution is constructed using extreme load values extracted from each simulation run. Therefore, the body of the resulting distribution is itself composed of extremes, and capturing its overall shape, including the center and tail, is essential.
  We chose the Generalized Extreme Value (GEV) distribution because it is widely used for modeling block maxima and rare events. While we applied the maximum likelihood estimator (MLE) for parameter fitting, as is common practice, we acknowledge that MLE may not always provide the best fit to the tail region. To address this, we used the Coefficient of Efficiency (CE) as a goodness-of-fit criterion across the entire distribution, and not just the central tendency. Additionally, the exceedance probability plot has been included as a separate figure.

6) Could changes in the bearing geometry affect the maximum ball force?

- Answer: The analytical expression we use for the maximum ball force is an explicit function of three geometric quantities—pitch-circle diameter Dpw, contact angle α, and number of balls Z; However, the probability of failure is not sensitive to small variations of these parameters.

7) Page 14, line 241: Ball diameter: in my view the changes "fine to coarse machining" will not affect the nominal ball diameter, but rather the tolerances which will be larger for coarse machining, correct? If that's the case, then the probability distribution of the ball diameter for "coarse machining" will correspond to a worse-case scenario. Further, we may assume that the diameters for balls within the same bearing will vary, and we will have a population of ball diameters in a single bearing. So, a ball diameter distribution can be taken into account by defining what could be worst-case ball dimension (the ball with highest deviation from the nominal diameter within the bearing) and base the reliability calculation on this worst-case ball dimension. Could the authors discuss how this can affect their assumptions?

- Answer: In our study, the balls were assumed to be equal in diameter, and a range of diameters according to ISO 2768 was studied. If we assume a distribution of ball diameters in the bearing, the highest probability of failure won't be exclusively due to ball diameter but also the position of the ball. In other words, it could happen that the ball with the least diameter doesn't experience maximum force, therefore it wouldn't have the highest probability of failure. It should be added that balls are usually

considered in a batch with fine tolerance. The text is revised as follows to clear our intention and assumptions.
"The nominal size of the ball diameter is 75 mm. Although the balls are usually manufactured and sorted in a batch with fine tolerances in diameters, it is assumed that the ball diameter can change from fine to very coarse machining according to ISO 2768-1 (ISO 2768-1, 1989). In every analysis, the balls' diameters are assumed to be the same, and a range of diameters was studied. However, the extreme tolerances are not realistic; they can help to observe the trend of changes in reliability. The assumption leads to a 0.15 to 1.5 mm variation in the ball diameter."

8) Failure probabilities always are with respect to a certain reference period. What is the reference period here, I believe it is annual failure probability (as in Fig.7)? Please specify, and define Pf as annual probability of failure the first time you mention it in the text.

- Answer: Thank you for catching this omission. The reliability calculations are indeed referenced to one year. To make this explicit, we have made the following change:
  "The annual probability of failure, Pf,"

9) Figure 8, load index: this is a discussion/observation rather than anything that is used further in the paper, right? Maybe extend the discussion on how this information can be used (for example for tuning safety factors).

- Answer: You are correct that the load-index plot was originally presented only as an observation. We have now expanded the accompanying text to explain its practical value:
  "This observation has important implications for reliability analysis and simulation practice. It shows that using only 15 seeds, as typically done in standard simulations, can lead to a non-negligible underestimation of extreme ball loads, especially in complex wind site conditions. The load index provides a simple and effective measure to quantify this underestimation. It can help practitioners evaluate whether their simulation setup sufficiently captures the load extremes, and when limited seed numbers are used, the load index can offer a basis for applying correction factors to improve the accuracy of failure probability estimates. Additionally, the variation in load index across different wind sites emphasizes the need for site-specific assessment when evaluating blade bearing reliability."

Specific comments

10) Abstract: please include a description of the bearing configuration (e.g., a double-row, four-point contact ball bearing).

- Answer: The description of the bearing configuration has been added to the abstract.

11) Page 1, lines 14-15, "changing the broken blade bearing is costly" – I agree, but please support with a reference and/or an indicative number.

- Answer: We have now supported this statement with a relevant reference. As shown in Mishnaevsky and Thomsen (2020), the cost of renting a crane for major repairs such as blade or bearing replacement can reach up to $350,000 per week. This high logistical cost, primarily related to crane transportation, setup, and operation, is a major contributor to the overall expense of replacing a blade bearing. The manuscript has been updated accordingly.
  "The cost of replacement with a crane can reach up to $350,000 per week (Mishnaevsky Jr and Thomsen, 2020)."

12) Page 6, equations 2,3,7: I suggest to denote the trigonometric functions with regular text rather than italic, e.g., sin α rather than $sin\alpha$.

- Answer: The trigonometric functions changed to regular text.

13) Figure 5 d): there is a typo (cotact instead of contact).

- Answer: The caption has been corrected.

14) Page 17, line 273: "class IA has a reliability of 0.999979". I suggest changing to "class IA has annual probability of failure of 2.1e-5". In the same sentence, you both define reliability numbers and probability of failure numbers, which is confusing. I suggest to stick with failure probabilities in scientific format.

- Answer: The sentence has been revised to present the probability of failure and the scientific format only used.

15) Pf: I suggest changing the notation to a formula-like format, such as "Pf".

- Answer: The notation has been changed to formula format (Pf) throughout the paper.

16) Conclusions: when you summarize the paper in the first paragraph, please add description of the bearing configuration.

- Answer: The bearing configuration is added in the conclusion as below:

  "The presented work studies the static overload probability of failure in the double-row, four-point contact ball blade bearing at the ultimate limit state."