Dear reviewer,

thank you for reading the paper and thank you for your feedback. You can find responses to your comments and questions below in blue.

In this paper, the authors describe a methodology for a rolling contact rolling contact fatigue life calculation for a three-row roller bearing. An example calculation is provided. Several interesting clarifications compared to the approach described in the NREL DG03 are made, along with some interesting technical results gleaned from the example calculations . I was going to read this paper in depth no matter what, and in doing so, figured I would make some hopefully helpful clarifying comments.

Thank you for the kind words and for your efforts.

Abstract

- Line 8: I'm not sure I understand "the bearing is modified slightly" pertains to the model or the actual bearing (or both). I believe this really relates to the aspect of confidentiality in the next sentence. To be honest, I think stating "Exemplary calculations…" states all that is needed here, as the actual dimensions or other structural and material aspects of the bearing are not given in the paper. Another option might be stating "Exemplary calculations are carried out using a slightly modified version of an extensively validated FE model of a three-row roller bearing of a wind turbine."
  The modification pertains to the bearing model used for this paper only.
  The sentence was changed as suggested.
- Lines 9-10: I understand this sentence "Since…confidentiality…", but I'll admit it feels a bit odd to state in the Abstract. I recommend it be deleted here and only stated in the text if really necessary. Indeed, this is done on line 56 and it feels sufficient and appropriate there.
  Removed the note about confidentiality from the abstract as suggested.
- In the Abstract, I do recommend adding a statement better summarizing the main findings in the paper. From the Conclusions my main takeaway was that "The axial rows were found to have a much lower fatigue life than the radial row, and thus the axial rows are the main determinant of the fatigue life of the bearing. They also were shown to have a much lower uncertainty than the radial row."
  Added the sentence as suggested.

1 Introduction

- Lines 21-22: Strictly speaking, cyclic changes in subsurface stress don't *cause* inclusions or material defects themselves to grow, so I think slightly modifying this sentence to something like

  "Cyclic changes in sub surface stress near inclusions or material defects cause microcracks that grow into larger, macroscopic spalls."

  Changed as suggested

2.1 FE bearing model and validation

- Lines 106-108: I'm not sure I understand the meaning of "The scatter bars in the plots indicate the fluctuation in the measured signals which is caused by the pitch movements of the bearing". As is, I took this to mean that the uncertainty would be in the horizontal axis rather than the vertical. Rather, I interpret this statement to mean that the rolling elements may not be in exactly the same location relative to the strain gauge as the bearing rotates (pitches) and the rollers orbit – I would assume this to possibly be related to some amount of sliding, even very small. Is that correct? So maybe "…caused by small differences in the locations of the rollers relative to the strain gauge as the bearing pitches" is a clearer way to say it? I can understand then that for smaller bearings this effect is more pronounced (as the size of the gauge is a larger proportion to the bearing circumference). I also think adding "…differently pronounced between both test bearings in Figure 6" would be helpful in line 108.
  The strain gauges are in one constant position but as the bearing rotates, they fluctuate somewhat. We have observed this behavior on all our test rigs and it is not specific to the one in this paper, neither can we say for sure that it is due to the rolling elements' movement, as previous publications have shown that manufacturing anomalies within the tolerances can also affect the strain gauge results (https://doi.org/10.1016/j.finel.2024.104268). Differences in the scatter bars are observable in Figs 4-6, not only 6.

3.1.1 Approximation of Fx and Fy for blade 1

- I think Section 3.1.1 is quite interesting as it's the first time I have seen anyone look at and propose this. However, I wonder, if one is doing the aeroelastic simulations anyway, what is the value of approximating Fx and Fy? Can the authors comment? Is this maybe because if one is interested in relating field testing measurements of blade root loads to RCF calculations, it is only really possible to measure the blade root moment and not the force? If this is the intent, it might be worthwhile mentioning it.
  The intent here is just to be able to reduce the number of simulations that are being done in FE. It is only feasible to do a small number of FE simulations and therefore we need to reduce the DOFs as much as possible. This approximation of Fx and Fy is thus used to perform FE simulations that only use Mres, the load angle, and Fz as DOFs, but still include a "realistic" Fx and Fy by determining them based on the bending moment Mres and its load angle.

3.1.2 Choice of grid simulation points for Fz for blade 1

- Line 212: A very minor point that the statement "Since high forces are those that affect the life the most" is really only partially true – it's really the combination of force and the

number of cycles at that force that affect life the most. At least the rolling contact fatigue life. Or maybe the authors intend this statement to be generally the “life” due to all failure modes, rather than just the rolling contact fatigue life.
You are entirely correct in stating that high forces in combination with movement affect the life, but here we are discussing one given load distribution and we are commenting on the loads within that load distribution. In that context, it is not possible for the area around 180° to have significantly less movement than that around 90° unless (very) strange slippage effects occur.
Changed the sentence to “*Since highly loaded rolling elements are those that affect the life the most, this result is adequate for the life calculation*” to clarify this.

3.3 Loads at blades 2 and 3

- Line 240: Can a citation for “Note this influence of blade 2 and 3 is more significant for other damage modes such as ring cracks” be added?
  There is no clear source for this but “ Multi-MW Blade Bearing Applications –Advanced Blade Bearing Design Process and Pitch Bearing Modul Development Trends“ by Daniel Becker, presented at IQPC 2023, states
  Edgewise loads do not play a significant role for raceway fatigue, but do for ring / bolt fatigue …
  Edgewise loads are influenced by blades 2 and 3, hence their effect on ring cracks.
  However as no clearer source could be provided we changed the sentence to
  Note this influence of blade 2 and 3 is likely more significant for other damage modes such as ring cracks, as they influence the edgewise loads, which are known to affect ring cracks (Becker, 2023)

4 Rolling contact fatigue life for individual load cases

- Line 256: The NREL DG03 describes more than 1 method to calculate rolling contact fatigue life, so I recommend this sentence be revised to “The rolling contact fatigue life calculation adheres closely to the ISO/TS 16281-based methodology described in the NREL DG03 (Stammler et al. 2024).”

  Changed as suggested

- Line 263: I’m not sure if the adjective “operational” for fatigue life is really needed, compared to the other uses in the document of simply “fatigue life” or “rolling contact fatigue life”. If “operational” does not have an intended meaning, I recommend deleting it.
  Deleted as suggested.

5.2 Combined operating life

- Line 493: What is the variable x_i?
  It’s a multiplier (based on the Weibull distribution), this is stated 5 lines before (*This process takes into account the multipliers x_i. […])*

- Line 501: I am often struck of our practice of doing quite detailed load and pressure calculations, but then when calculating a modified fatigue life, we use relatively large modification factors that are "based on experience". In the case of pitch bearings, the NREL DG03 suggests a_srv = 3. Having said that, outside of a relatively small community I'm not sure how many end users are aware of such estimates when compared to the basic fatigue life calculations themselves. With that opinion in mind (and a bit of humility and honesty), I recommend revising this sentence to at lease allude to this with something like "Further factors may be multiplied with this basic fatigue life yielding a modified fatigue life. The highest is a suggested value of 3 based on experience of the manufacturer, as well as on……..(Stammler et al. 2024)."
  Changed to:
  Further factors may be multiplied with this basic fatigue life yielding a modified fatigue life. These values may be based on experience of the manufacturer, as well as on properties of the bearing like its hardening depth, raceway hardness, or desired reliabilities other than 90 % used for L10, see Stammler et al. (2024). The highest factor is a suggested value of 3, see Stammler et al. (2024)

5.3 Simplified life calculation

- I suggest adding a clarification to the middle of the paragraph from lines 510 to 513 summarizing the NREL DG03 simplified calculation method, based on previous correspondence with the authors. The main reason being that Eq. 13 refers to m = 1 to 3, with the axial rows (m = 1 and 2) and radial row (m = 3). So, a reader is again expecting m = 1 to 3 here. However, my understanding of the authors intent is that only two parts are used: an axial row (m =1) and the radial row (m=3). That is, the difference is that only 1 of the axial rows are used, not that the radial and axial rows are calculated separately (they are calculated separately both in section 4.1 and here in section 5.3). Thus, using consistent terminology as section 4.1 and Eq. 13 but highlighting the important difference, I believe it is clearer to state here "They propose calculating the life of only one of the two axial rows L10,2 = (Ca/Pa)^10/3 because it is assumed only one axial row at a time carries the axial load, where Pa = …, and combining it with the life of the radial row L10,3 = (Cr/Pr)^10/3, where Pr = … The life of the entire bearing is then calculated using Eq. 13 from just these two results (i.e. m = 2 to 3)." I believe this is the clearest description.

  No, there appears to be a misunderstanding, both axial rows are used for the calculation of L10,a. The load rating Ca is defined for a single row, since an axial bearing under an *axial* load would only carry on one of the rows. This definition follows ISO 281 (see our reply to RC1, comment 8). For a *bending moment*, both rows carry load, and hence for the *life*, the loads of both rows are considered.

- Line 516: Another minor clarification, difference in radial load life between the methods is valid for the bearing and turbine loads studied in this paper, but I agree it is a trend likely to occur in other cases. With that, I recommend adding "This is incorrect: for the current example, the actual life of the radial row…."
  Changed as suggested

- Line 527: Similar to my previous comment regarding lines 510 to 513, I recommend another clarification here such as "Thus, for an even more simplified approach than the NREL DG03, the life of the bearing L10 = (Ca/Pa)^10/3 can be determined using from just Eq. 4 for Ca and Eq.21 for Pa, if the factor kM is adjusted. This simplified approach can be useful for parametric studies, for example of the effect of different pitch bearings, wind speed distributions, or controllers."

Changed as suggested

6 Equivalent time for an accelerated fatigue life test on a pitch bearing test rig

- In general, this section "sticks out" a bit, as it's not really connected to the rest of the paper. I wonder if it would be worthwhile to highlight the fact that such a fatigue life test could be useful in assessing uncertainties with the radial row fatigue life, or the factor kM. I understand from the rest of the manuscript that the axial rows have a lower fatigue life….I suppose…but can one really say that confidently with such a high degree of uncertainty on the radial row fatigue life? Can something be added here that better connects this section with the rest of the paper?
  We agree that the section is poorly connected to the rest of the paper and adds little to the available literature. Section 6 and all references to it were therefore removed from the manuscript.

7 Conclusions

- Line 549: Please add "…approach to calculate the fatigue life

of…"

Added as suggested

Minor grammatical comments:

- Line 32 (and elsewhere): ISO/TS 16281 (2008 edition) was recently revised and upgraded from a technical specification to international standard as ISO 16281 (2025 edition). It may be worthwhile considering whether to refer to the well-known TS versus the IS, depending on whether or not there are any relevant differences for this manuscript.
  There are no relevant differences between ISO/TS 16281 and ISO 16281:2025 for this manuscript, therefore, all references were changed to ISO 16281. This does not include any references to the approach in NREL DG03 based on ISO/TS 16281, where the reference to ISO/TS 16281 remains, as here for example in the introduction:
  The calculation approach shown herein follows closely the abovementioned NREL DG03, the rolling contact fatigue calculation approach of which is based closely on ISO/TS 16281 (now replaced by ISO 16281).

  Neither this manuscript nor NREL DG03 are affected by any differences between ISO/TS 16281 and ISO 16281:2025 to the best knowledge of the authors.

- Lines 39 and 45 (and elsewhere): "Keller, Jonathan and Guo, Yi" should read "Keller and Guo, 2022"
  corrected
- Line 47 (and elsewhere): "Stammler et al." should be "Stammler et al., 2024".
  corrected