The following shows the comments of the reviewer. The author's response to each comment is in bold letters.

In this article, the authors present the experimental validation of a finite element (FE) model for a three-row roller bearing with an outer diameter of 5 meters designed for a wind turbine—an aspect that, as the author rightly points out, has been scarcely documented in the literature to date.

To validate the model, the experimental results are compared with those obtained through FE analysis, which includes modelling the actual test bench (Fraunhofer IWES BEAT 6.1) under representative conditions.

The study also examines the influence of various critical parameters, such as the friction coefficient, bolt preload, and nonlinear effects, on the validation results.

Regarding validation criteria, the author proposes two distinct approaches: first, the maximum deviation must be less than 10%, and second, the trend must match. These criteria are highly relevant, and although each author may define their own validation criteria, in my opinion, a minimum standardized criterion should be established.

The reviewer suggests addressing the following comments:

General suggestions:

- In the context of wind turbines, although both terminologies are accepted, I would recommend using the term pitch bearing in this article instead of blade bearing. The author should consider this as a suggestion; however, I believe it is important to standardize the terminology.

  The authors agree that a standardized version of using blade bearing or pitch bearing would help a lot. For this work, the authors choose to use the terminus blade bearing as this describes the assembly situation of the bearing while pitch bearing refers to the movement of the bearing in operation. However, one can imagine different bearing designs where the bearing is not only pitching but also performing other movements. If it is fine with editor, we would like to keep the wording as it is.

- Please improve the resolution of Figure 7.

  Will do, thank you.

Specific comments:

- As mentioned earlier, the author defines two criteria for accepting the validation of the model. On what assumptions has the author based the definition of these criteria?

This is a very good question. The authors firstly introduced those criteria in a paper where they validated a FE ball bearing model (see Validation of a finite-element model of a wind turbine blade bearing - ScienceDirect). There are only very limited works on validating large bearing models publicly available and to the knowledge of the authors none of them define criteria for successful validation. The authors talked to different experts in this field (e.g. bearing manufacturers, professors teaching FEM, and other researchers) and 10% accuracy of the FE model seemed to be commonly acceptable although it was not publicly documented. However, for very small strains on the bearing ring, even a few µm/m differences would result in large percentile errors. Therefore, the authors suggested using only the largest occurring strain to ensure the FE results are within 10% of the experimental results and added the number and location of maxima and minima to ensure the same overall behavior between model and experiment. If the reviewer has additional thoughts on that or even ideas about what other criteria can be introduced for an even better validation, I would be very happy to have a detailed discussion on that topic even beyond this review process. If the reviewer, or any other, is interested in detailed discussions about model validation please contact the corresponding author.

- In the FE model of the three-row roller bearing, the axial rollers are represented by five springs and the radial rollers by three. Could the author clarify which guideline was followed to determine this number of springs? Additionally, was a sensitivity analysis performed to evaluate the influence of the number of springs? Finally, was this choice supported by references in the literature?

  To the knowledge of the authors, there is no guideline available. Regarding the number of springs, WANG et al. (2017) and HE et al. (2018) who are cited in the paper compared the results of a bearing model with solid modeled rollers and one with rollers that are represented by springs. They showed that the minimum of springs to model one roller is 3 to get reasonable results. They got better results by using more springs of up to 8. Because of that, the authors of the present work decided to use the minimum of 3 springs for the radial rollers as there are many of them to save some computational effort, and 5 springs for the axial rollers to have a better distribution of the forces along the roller length as the axial rollers are of main interest. In addition, internal investigations have shown that the bearing behavior regarding roller forces and ring deformation are the same when the rollers are modelled with 5 springs and 31 springs (minimum odd number as stated in ISO 16281 for a discretization of a roller). That investigation is part of a different paper which is currently in the review process and unfortunately cannot be cited right now. However, the information about the internal investigation will be added to the paper.

- According to Figure 2, and as I understand it, the contact between the spring and the raceway appears to be defined over a larger area than the actual contact between the roller and the raceway. The entire raceway is divided into green segments, which suggests that there are no areas without contact. Is this interpretation correct? If so, the contact between the spring and the raceway would be greater than in reality. Has the potential impact of this on the results been analysed?

  Yes, the reviewer is correct, the entire raceway is divided into segments according to the number of rollers and every segment is connected to springs. The authors started simulating ball bearings where the approach of using nonlinear springs that connect to the raceway comes from. With ball bearings, the authors showed that using small parts of the raceway and stiff connections (MPCs) between springs and raceway artificially stiffens the bearing behavior (see https://doi.org/10.1016/j.finel.2023.103957). With small parts of the raceway connected to the springs, the authors saw local indents in the mesh which led to a less accurate behavior of the bearing. To overcome that, the authors used larger sections of the raceway and deformable connections (FDCs) and achieved better results. This method was then transferred to roller bearings resulting in the approach of this work.

- The non-linear behaviour of the spring elements is controlled by a force–deformation curve derived from analytical calculations. As I understand it, this force–deformation curve is obtained for a cylindrical roller, whereas the actual roller used in the bearing is logarithmic. Could the author clarify how the formulation was modified to account for this difference?

  The logarithmic profile shapes the surface of the rollers in the range of micrometers to reduce edge loading. These adaptations of the roller geometry are not implemented in the global FE model. The main result of the FE model is spring forces. Internal investigations with 31 springs showed no significant differences for the spring forces whether the profile is considered in the FE model or not. To calculate the pressure distribution along the roller length, the spring forces are then used as input for a half space model.

- In the finite element model, frictional contacts between the flanges are defined with coefficients of friction of 0.2 and 0.5. Furthermore, the flanges of the bearings toward the surrounding structures are coated to increase the coefficient of friction to 0.67. Could the author explain the assumptions made to define these values? Additionally, was a sensitivity analysis performed regarding these coefficients?

  The coefficient of friction of 0.2 is used for dry uncoated steel to steel contact. The coefficient of friction of 0.67 results on a specific coating on the

bearing surfaces and was tested and provided by the bearing manufacturer. However, this coefficient was tested for coated steel to steel contact. The inner ring of the bearing connects to the GFRP flange of the FTE. To be more conservative with the coefficient of friction, it was slightly reduced to 0.5 for coated steel to GFRP contact. For bolt preload set 1 only the internal contact of the bearing outer ring is exposed to gap opening and radial sliding. For that contact, different coefficients of friction are investigated in the paper to match the experimental results (see Figure 8). All other contacts have no gap opening and no sliding at all. Therefore, the coefficients of friction were not varied. For bolt preload set 2, no sliding in the entire model is occurring.

- In line 141, the author states that the reaction frame is the bottom white steel structure that connects the rig to the foundation. Could the author clarify how this connection is modelled? What boundary condition has been defined for this connection?

  For the boundary condition of the reaction frame all degree of freedom for all nodes at the bottom of the reaction frame are locked. In reality, the reaction frame is mounted to the basement through anchors. This is not considered in the FE model. The information about the boundary condition will be added to the paper.

- In line 149, the author states that in the first step gravitational loads and bolt forces are applied. Has the influence of the pretensioning sequence on the results been analysed?

  The authors assume, the reviewer is referring to the stepwise tightening of the bearing as in reality not every bolt is tightened at the same time. This has not been investigated yet but might be an interesting topic for further investigations.

- In line 170, it is stated that the measurement uncertainty is less than 2%, but its potential impact on the results is not analysed. I suggest adding a paragraph discussing the effect on the outcomes.

  Initially, this work aimed to compare the extent of deviations between the simulation model and the measurement data. Since these deviations partly exceed the ranges attributable to measurement uncertainty, this aspect was not pursued further in the present work; however, it presents a highly interesting topic for future research. The primary factors contributing to the discrepancies between simulation and reality were assumed in the domain of finite element test rig modeling.

- In general, for the experimental measurements using strain gauges (figures 8-12), the scatter appears to be very low; the difference between maximum and minimum values across different points is minimal, although in some points the difference is noticeable. Could the author explain the reason for such low variation? Or what typical deviation do we observe across the different points?

Care was taken to minimize the disturbing effect of electromagnetic interference as much as possible. Therefore, the scatter is on the order of at most a few tens of micrometers per meter. This is very low as a percentage compared to the magnitude values of the measured strains, which can amount to several hundred micrometers per meter. Some measurement points exhibit greater fluctuation. This can have two causes: Either the corresponding strain gauge was more strongly affected by interference sources, or the test rig setup shows greater local deformation behavior at the corresponding location.

- The results presented in Table 3 correspond to strain gauges. Although it may extend the length of the paper, in my opinion, it would be valuable to also include the results from the other sensors.

  As also requested from reviewer 1, radial displacements measured by laser sensors will be added to the paper to rely the validation not only on the strain of the bearing rings but also on the deflection. In the opinion of the authors, further measurement results like friction torque or results from inductive sensors would distract the focus of this work.

I would like to the authors for their work. This is a very interesting and neccesary contribution, as there are currently no references in the literature addressing this topic. By incorporating the suggested changes, I sincerely believe the manuscript will become a much more comprehensive and robust piece of work. Therefore, once the comments have been addressed and clarified, the reviewer considers that the manuscript is suitable for publication.