

Comments from Reviewer 2 and responses:

Comment: Several important statements would benefit from stronger and more specific literature support. For example, the sentence “The emergence of floating offshore wind turbines (FOWTs) further introduces platform-induced motions and additional dynamic loads, amplifying the operational stresses on critical components” should be supported by relevant and up-to-date references that explicitly quantify or demonstrate these effects.

- **Response:** We have made the suggested change. The indicated sentence has been updated with relevant and up-to-date references that support these effects. Further details on the restructuring and referencing of this section are provided in our response to the next comment.

Comment: In Section 1.2.2, I recommend restructuring the discussion. It would be clearer to first summarize the main failing components and dominant failure mechanisms that are common across wind turbines in general, and then explicitly highlight the additional or emerging challenges specific to offshore and floating offshore wind turbines (e.g., harsher environments, coupled dynamics, accessibility constraints)

- **Response:** Thank you for the suggestion. We have entirely rewritten Section 1.2.2. Addressing both this comment and Comment 1, we have added relevant citations to the indicated sentences, as well as to other statements that previously lacked clear references. Regarding the structure, we now clarify the general failure mechanisms first. However, we did not draw a strict distinction between fixed offshore and floating offshore wind turbines. This paper primarily focuses on onshore and fixed-bottom offshore systems. While the discussed challenges and condition monitoring techniques may apply to floating systems, a detailed analysis of floating wind turbines falls outside the intended scope of this review.

Comment: While the manuscript provides a comprehensive overview of existing condition monitoring (CM) techniques, the discussion remains largely descriptive. The authors are encouraged to more clearly articulate the methodological novelty of this review and to emphasize recent or emerging CM paradigms rather than primarily consolidating established approaches.

- **Response:** We thank the reviewer for this feedback. We agree that it is important to clearly state the novelty of our review and highlight newer technologies. To address this, we have added a new subsection at the end of the Introduction (Section 1.5: Contributions and novel perspectives of this review). This section outlines our focus on recent developments, such as digital twins, deep learning, and video-based analysis, and emphasizes how we connect raw data acquisition directly to practical O&M decision-making, rather than just summarizing established methods.

Comment: The current structure follows a technology- and method-centric organization, which makes it difficult to identify the underlying review logic. Reorganizing the manuscript around key CM problems (e.g., fault detection, diagnosis, prognosis, and decision-making) or fundamental challenges (e.g., data scarcity, generalization, interpretability) could significantly improve clarity.

- **Response:** We appreciate the reviewer's comment regarding the structure of the manuscript. While the subsections focus on specific technologies, the overall paper is actually organized around the key CM problems you suggested: fault detection and diagnosis (Section 3), prognosis

and RUL (Section 4), and decision-making (Section 6). To make this structure more obvious to the reader from the start, we have added a new subsection to the Introduction (Section 1.6: Organization of the manuscript) that clearly explains how the paper is laid out according to these core CM challenges.

Comment: Section 1.3 provides a solid conceptual overview of digital twins; however, it remains largely at the framework and terminology level. A more critical discussion comparing how different modelling strategies (data-driven, physics-based, and hybrid) actually improve CM performance would strengthen this section.

- **Response:** We appreciate this feedback. We have revised Section 1.3 and its subsections to include a more critical discussion. The updated text now explicitly compares data-driven, physics-based, and hybrid modeling strategies, detailing how each approach practically improves condition monitoring performance.

Comment: The SCADA-based CM section is extensive, but it does not sufficiently discuss fundamental limitations such as limited observability of early-stage mechanical faults, temporal resolution constraints, and confounding environmental effects. Explicitly addressing what SCADA-based methods cannot reliably detect would add critical depth.

- **Response:** We agree that this was a missing element in the original manuscript. To address this, we have added a new subsection (Section 3.1.4: Limitations and drawbacks of SCADA data for condition monitoring of wind turbines), which explicitly discusses temporal resolution constraints, environmental effects, and the limitations in observing early-stage mechanical faults.

Comment: While prognostics and remaining useful life (RUL) estimation are mentioned, the manuscript does not adequately analyze why these methods are still rarely adopted in industry. A discussion of challenges such as uncertainty quantification, validation difficulty, and integration with maintenance decision-making is recommended.

- **Response:** We agree that addressing the gap between academic RUL research and industrial application improves the quality of the review. We have added a new subsection (Section 4.4: Challenges in the industrial adoption of RUL estimation) that provides a focused discussion on uncertainty quantification, validation difficulties, and the integration of RUL estimates with actual maintenance decision-making, while keeping the overall length of the paper within reasonable limits.

Comment: Although offshore and floating turbines are referenced throughout the manuscript, their CM challenges are not systematically contrasted with onshore turbines. A clearer and more explicit comparison would help readers understand what genuinely changes for CM when moving from onshore to offshore and floating systems.

- **Response:** Thank you for this constructive feedback. While an explicit, systematic comparison of onshore, fixed offshore, and floating drivetrains would certainly broaden the scope of the paper, we decided against adding it to maintain conciseness. Our goal is to provide a comprehensive positioning paper on drivetrain condition monitoring generally, without expanding the

manuscript to a book-length comparison of specific operating environments. We hope the reviewer understands this editorial choice.