Response to Reviewer 2 Comments

1. Summary

Thank you very much for taking the time to review this manuscript. Please find the detailed responses below and the corresponding revisions in the re-submitted files.

2. Questions for General Evaluation	**Reviewer's Evaluation**	**Response and Revisions**
Does the introduction provide sufficient background and include all relevant references?	Must be improved	
Are all the cited references relevant to the research?	Must be improved	
Is the research design appropriate?	Yes	
Are the methods adequately described?	Must be improved	
Are the results clearly presented?	Must be improved	
Are the conclusions supported by the results?	Must be improved	

3. Point-by-point response to Comments and Suggestions for Authors

Comments 1: The text requires a careful revision. It is very often confused and the message is not properly conveyed in good English.

Response 1: Thank you very much for your advice and please forgive my poor English as a non-native English speaker. According to your suggestions, I have made professional revisions to the full text, so as to express our team's thoughts completely and without error.

Comments 2: The introduction is missing to put the work in perspective of the decadal work performed by the LISA Pathfinder mission on the very same topic of the paper. References to papers describing the LISA Pathfinder inertial sensor electronics are missing. Ref 17, that describes a development very similar to the work reported in the paper, is mentioned only at page 4 without commenting on the content of that work.

Response 2: Thank you very much for your suggestion. According to your suggestion, we have added the description of LISA Pathfinder's mission and related literature citations, and supplemented the comments on the work content of reference 17. (page2, row48)

Compared with other research results, this paper focuses on the restriction relationship of circuit noise, and further analyzes the influence of TIA feedback resistance and feedback capacitance on its noise. According to your suggestion, we have revised the description of the introduction and conclusion in the manuscript for the innovation of this paper. (Page2, row 88 and Page15, row 378)

Comments 3: Pag 2. The description of the working principle of the system is confused and errors in the text are observed (e.g. TIA stands for trans-impedance amplifier)

Response 3: Thank you very much for your comments. We have redescribed and polished the working principle of the system, and finally checked and corrected the text. The revised text is as follows:

The tiny capacitance tolerance causes an imbalance of the currents inside the transformer primary winding, which generates differential voltage on the transformer secondary winding. This voltage is amplified by trans-impedance amplifier (TIA) and AC amplifier circuit, band-pass filtered and then a demodulation signal consistent with the excitation signal frequency (100kHz) is employed to convert the AC carrier signal containing tolerance information into a DC differential voltage. Only the frequency component in phase with the injection frequency is extracted using synchronous demodulation. The analog signal is finally converted to a digital form by an analog-to-digital converter. This facilitates the high-precision assessment of residual acceleration noise in inertial sensors for space gravitational wave detection. A schematic of the capacitor-sensing circuit is shown in Figure 1. (page2, row70)

Comments 4: pag 2 row 82.A previous research is mentioned but the reference and a description of such research is missing.

Response 4: Thank you very much for your suggestion. The previous research refers to our team's previous testing process using planar transformers and non-discrete TIA circuits. We have added a brief description of this study on page 2, row 58 and page 14, row 353. A more detailed description can be found in Reference 15, which has been cited.

Comments 5: pag 13 row 336. It is not clear how the 89% reduction is calculated. A 89% reduction with respect to 19.7 uV/sqrt(Hz) would make 2.17 uV/sqrt(Hz) and not 17.5 uV/sqrt(Hz)

Response 5: Sorry for my poor English, what we mean here is that the noise is reduced by 11%, which is 89% of the original value, that is, 19.7*89%=17.5. The modified text results are as follows:

The noise of transformer 1 measures approximately 19.7uV/rtHz, while the noise of transformer 2 exhibits an 11% reduction to approximately 17.5uV/rtHz, which is closely aligned with the anticipated theoretical calculations. (page 12 row313)

In response to such problems, we have carried out professional English polishing and checking of the full text to avoid such ambiguity.

Comments 6: pag 13 row 347. It is not clear what is intended with the sentence "The TIA input terminal is suspended"

Response 6: This means that the TIA input is not connected to the transformer bridge and is in an open state, which helps to eliminate the influence of transformer noise. We have edited and polished the English expression of this part again, and the revised text is as follows:

The noise performance was verified in the configuration with the open TIA input, and the results are shown in Figure 11. (page 12 row331)

Comments 7: pag 14 row 366. The measurement showing 1.095 aF/sqrt(Hz) is missing and it should be presented for comparison and completeness

Response 7: Thank you very much for your advice. The measurement results here are quoted from the literature [15]. According to your suggestion, we have quoted this part of the test results into the text. (page14 row355)

4. Response to Comments on the Quality of English Language

Point 1: The text requires a careful revision. It is very often confused and the message is not properly conveyed in good English

Response 1: Thank you very much for your advice, which is very necessary. According to your suggestions, we have looked for a professional team to polish the full text.

5. Additional clarifications

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