Review of: "Designing and modeling microwave photonic spectral filters based on optical microcombs"

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Potential competing interests: No potential competing interests to declare.

1. In Fig. 5, the influence of microcombs' intensity noise on filter performance is shown. How do these intensity noise-induced distortions impact the overall functionality of the filters? Are there any potential mitigation techniques that can be employed to reduce these distortions?

2. The paper mentions that the phase noise of microcombs can affect the performance of the filters. How does this phase noise manifest in the filter response? Can you provide insights into the underlying mechanisms that cause these distortions? Are there any techniques or strategies to minimize the impact of phase noise on filter performance?

3. Fig. 7 illustrates the influence of SMF's third-order dispersion on the performance of LPFs, BPFs, and HPFs. What are the specific distortions introduced by third-order dispersion, and how do they differ for each type of filter? Can you elaborate on the importance of phase accuracy for BPFs and the implications of this finding?

4. The paper discusses the influence of shaping errors in the optical spectral shapers (OSS) on filter response. Can you provide further analysis on the nature of these shaping errors and their impact on the filters? Are there any optimization techniques that can be implemented to minimize shaping errors and improve filter performance?

5. Fig. 9 summarizes the contributions of different error sources to the overall distortions of LPFs, BPFs, and HPFs. Can you discuss the relative significance of these error sources and their cumulative effects on filter performance? How might these findings guide future research in optimizing and improving the performance of microcomb-based MWP transversal filters?

6. In Fig. 10, the filter outputs of input Gaussian pulses with varying spectral bandwidths are presented. Can you provide insights into the observed differences in the filter outputs? How do these results relate to the operation bandwidth of microcomb-based filters, and what implications does this have for practical signal filtering applications?

7. Experimental Validity: While the authors have presented a comprehensive analysis of the impact of various factors on the performance of microcomb-based MWP transversal filters, it is essential to assess the experimental validity. Are there potential sources of experimental error that might have influenced the results? How were these factors mitigated, and what measures were taken to ensure the reliability and reproducibility of the experimental setup?

8. Generalizability of Findings: The study mainly focuses on evaluating the performance of microcomb-based MWP transversal filters in a specific range of conditions. Are the findings limited to this particular setup, or can they be

generalized to other similar filter configurations? It would be valuable to discuss the applicability of the results to different scenarios or variations in the experimental setup.

9. Comparison with Existing Techniques: The authors briefly mention the performance limitations and challenges associated with microcomb-based filters, but it would be helpful to provide a more comprehensive discussion and comparison with alternative filtering techniques commonly used in the field. How do microcomb-based filters compare to other established technologies in terms of performance, complexity, and cost? Are there any specific advantages or disadvantages that have not been thoroughly addressed?

10. Trade-offs: The paper extensively discusses the impact of various factors, such as intensity noise, phase noise, shaping errors, and optical spectral shapers. However, it would be valuable to explore the trade-offs involved in optimizing these factors. For example, reducing shaping errors might increase complexity or introduce other undesirable effects. How can these trade-offs be effectively managed to achieve an optimal balance between filter performance and practical implementation?

11. Future Developments: Considering the identified limitations and challenges of microcomb-based filters, what are the potential avenues for future research and development in this field? Are there any emerging technologies or techniques that could overcome the current limitations and enable further improvements in filter performance?

12. Integration with Other Systems: Microcomb-based filters have shown promising potential for microwave photonic applications. How well do these filters integrate with other components and systems, such as communication networks or sensor systems? What are the key considerations for successful integration, and are there any specific challenges that need to be addressed?

13. Nonlinear Effects: The paper focuses primarily on linear effects in microcomb-based filters. To what extent are nonlinear effects, such as four-wave mixing or cross-phase modulation, present in the filters? How do these nonlinear effects impact the overall performance and scalability of the filters, and what strategies can be employed to mitigate their influence?

14. Scalability: The study primarily investigates the performance of microcomb-based MWP transversal filters for a limited number of filters and tap weights. How scalable is this technology? Can it be effectively extended to support a larger number of filters and tap weights without compromising performance? Are there any specific limitations or challenges related to the scalability of microcomb-based filters?

15. Redundancy: I appreciate the effort the authors have put into providing thorough explanations and illustrations throughout the manuscript. However, I noted some instances of redundancy in the descriptions of experimental procedures and data analysis. I recommend revising and condensing repetitive sections to improve the overall clarity and conciseness of the manuscript.

16. Technical Details: The paper contains a solid discussion of the technical aspects related to microcomb-based MWP transversal filters. The authors explain the concepts and methodologies in a clear and understandable manner, making it

accessible to a wide audience. However, in a few instances, further technical details could be provided to enhance the reader's understanding. I suggest the authors expand on the specific implementation details and provide additional explanation where needed.

17. Consistency: Overall, the paper maintains a consistent structure and flow of ideas. The logical progression of the manuscript aids in the comprehension of the research findings. However, I did notice some minor inconsistencies in terminology and notation usage. I recommend carefully reviewing the manuscript to ensure consistency in the terminology, notation, and formatting throughout.

18. Grammar & Syntax: The manuscript is well-written, with a generally high standard of grammar and syntax. However, I noticed occasional minor grammatical errors, such as incorrect verb tense or preposition usage. I recommend a thorough proofreading and revision to correct these errors and improve the overall language quality of the paper.

19. Depth of Content: The authors have demonstrated a commendable depth of content in their analysis, covering various aspects of microcomb-based MWP transversal filters. The discussion includes a comprehensive review of the literature, experimental investigation, and theoretical analysis. However, in certain sections, further elaboration and contextualization could be beneficial to provide a deeper understanding of the results and their significance in relation to previous research.

20. Technical Errors: During my review, I did not come across any significant technical errors that would undermine the overall validity and reliability of the research. However, I recommend a careful proofreading and verification of equations, figures, and numerical results to ensure accuracy. It would also be beneficial to address any minor inconsistencies or typographical errors that may be present.

21. Equations: The equations presented in the manuscript are generally well-formulated and relevant to the research topic. However, I suggest considering providing clearer explanations for the derivation of equations or any key assumptions made. Elaborating on the theoretical framework behind the equations will enhance the readers' understanding and improve the overall technical rigor of the paper.

22. Conclusion: The conclusion section effectively summarizes the main findings and highlights the key contributions of the research. However, I suggest expanding the discussion to reflect on the broader implications of the findings in the context of practical applications and future research directions. Providing insights into the potential real-world impact and further advancements in the field will enhance the concluding remarks.

23. Theories: The manuscript effectively incorporates relevant theories and models to support the research findings. However, in a few instances, the theoretical foundations could be further developed and integrated into the analysis. I recommend expanding the discussions on the underlying theories to provide a more comprehensive understanding of the concepts explored in the research.

24. Tone & Context: The overall tone and context of the manuscript are appropriate and professional. The authors present their findings objectively, supporting them with sound research and evidence. However, throughout the manuscript, some

minor linguistic adjustments could be made to improve clarity and ensure that the intended meaning is accurately conveyed.

25. Title Reflection: The title reflects the content of the paper accurately, highlighting the focus on microcomb-based MWP transversal filters. However, it may be beneficial to consider revisiting the title to ensure it effectively conveys the novelty and significance of the research within the given character limit.

26. In conclusion, the manuscript provides a comprehensive analysis of the factors influencing microcomb-based MWP transversal filters. With the suggested major revisions, including addressing the concerns raised in the previous comments, improving technical details, ensuring consistency, enhancing depth of content, refining grammar and syntax, verifying technical accuracy, expanding theoretical discussions, and refining the conclusion, the manuscript has the potential to be a valuable contribution to the field. I recommend inviting the authors to revise and resubmit the paper with the suggested improvements.

27. Overall, I believe this manuscript is well-written, scientifically rigorous, and makes a valuable contribution to the field. I recommend minor revisions to address the points mentioned above. Once these revisions are made, I strongly recommend accepting the paper for publication.