

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. How do the contributions of different error sources in Figure 9 affect the overall distortions of LPFs, BPFs, and HPFs? Are there specific error sources that have a greater impact on the filter performance than others?
2. In Figure 9, what insights can be gained from comparing the RF amplitude response of the filter outputs with and without experimental errors? How do these deviations from the ideal filter response influence the actual output signal?
3. Regarding the influence of signal bandwidth in practical signal filtering, how does the limited operation bandwidth of the microcomb-based MWP transversal filter introduce additional errors when processing wideband signals? How do these errors contribute to deviations from the ideal output signal?
4. In Figure 10, how do the filter outputs of input Gaussian pulses with different spectral bandwidths for LPFs, BPFs, and HPFs compare to the ideal outputs? What can be observed about the impact of experimental errors on the filter performance for different input signal bandwidths?
5. Based on the physical processes of signal delay and summation in the transversal filter, how can the filter output be expressed assuming all the components are error-free? How do deviations from this ideal expression, caused by experimental errors, affect the overall filter performance?
6. In Figure 10(iv), how do the corresponding RMSEs of the filter outputs vary with different input signal bandwidths? How do the curves for the filter outputs without and with experimental errors differ? What implications does this have for the accuracy and effectiveness of the filter in practical applications?
7. Considering both Figures 9 and 10, what are the main challenges and limitations faced when implementing microcomb-based MWP transversal filters in real-world scenarios? How might these challenges be addressed to further improve their performance?
8. In light of the overall findings and analysis presented in the manuscript, what are the potential implications and applications of microcomb-based MWP transversal filters for microwave signal processing? How do they compare to other existing filtering techniques in terms of performance, efficiency, and versatility?
9. The abstract provides a concise overview of the main focus and contributions of the manuscript, highlighting the use of microcomb-based microwave photonic (MWP) transversal filters for signal filtering. It would be beneficial to include

specific information about the experimental setup and results in the abstract to provide a clearer context for the readers.

10. The introduction effectively introduces the concept of MWP transversal filters and their potential applications in microwave signal processing. It also highlights the limitations of existing filtering techniques. Including some background information on the theoretical principles behind MWP transversal filters and their advantages over traditional approaches would be helpful for readers who may not be familiar with the topic.

11. Theory and System Design: The theory and system design section provides a comprehensive explanation of the underlying principles and components of microcomb-based MWP transversal filters, including spectral shaping and the use of microcombs. Providing some practical considerations or design guidelines for implementing microcomb-based MWP transversal filters, such as the required comb spacing or optimal parameters for different applications, would enhance the practical relevance of this section.

12. Error Analysis: The error analysis section provides a detailed examination of different error sources and their contributions to the overall distortions in LPFs, BPFs, and HPFs. It clearly demonstrates the impact of experimental errors on the filter response. It would be valuable to discuss any potential strategies or techniques for mitigating or reducing these errors, as well as their potential impact on the overall performance of the filters.

13. Influence of Signal Bandwidth: This section offers an insightful analysis of the influence of signal bandwidth on microcomb-based MWP transversal filters. It discusses the limitations imposed by the comb spacing and the operation bandwidth, providing a theoretical framework for understanding the trade-offs between bandwidth and filter performance. Including some experimental results or comparisons between different bandwidth scenarios would further support the analysis and provide a more concrete understanding of the practical implications.

14. Filter Outputs and Performance Evaluation: The filter outputs and performance evaluation section demonstrates the behavior of the filters when processing input Gaussian pulses with different spectral bandwidths. The inclusion of both ideal and actual filter responses, as well as the calculation of RMSEs, provides a comprehensive analysis of the filter performance. The manuscript would benefit from further discussions on the practical implications of the observed discrepancies between the filter outputs with and without experimental errors. How do these deviations impact real-world applications? Are there any potential strategies for improving the filter performance under varying bandwidth conditions?

15. Conclusion: The conclusion effectively summarizes the main findings and contributions of the manuscript, highlighting the value of microcomb-based MWP transversal filters for microwave signal processing. It also acknowledges the challenges and limitations of the technology. It would be valuable to include some insights or suggestions for future research directions, such as potential improvements to reduce experimental errors or explore new applications for microcomb-based MWP transversal filters.

16. Overall, the manuscript provides a comprehensive analysis of microcomb-based MWP transversal filters, highlighting their potential for microwave signal processing. The sections cover theoretical concepts, error analysis, and performance evaluation, providing a strong foundation for further exploration and practical implementation. However, including additional experimental results, discussions on practical considerations, and future research directions would further

enhance the manuscript's impact and relevance.

17. How do the experimental errors identified in the error analysis section impact the overall performance and accuracy of microcomb-based MWP transversal filters? Are there specific error sources that have a more significant effect on the filter's response?

18. In the influence of signal bandwidth section, what are the specific limitations imposed by the comb spacing and operation bandwidth on the performance of microcomb-based MWP transversal filters? How do these limitations affect the filter's ability to process signals with different bandwidths?

19. Can you further elaborate on the observed discrepancies between the filter outputs with and without experimental errors in the filter outputs and performance evaluation section? How do these discrepancies impact the filter's practical applicability and real-world performance?

20. Based on the presented simulation results, what are the notable strengths and weaknesses of microcomb-based MWP transversal filters compared to traditional signal filtering techniques? How do they fare in terms of accuracy, efficiency, and frequency range?

21. Considering the theoretical principles and components discussed in the theory and system design section, are there any potential modifications or enhancements that could further improve the performance of microcomb-based MWP transversal filters? How might these modifications address the identified limitations and improve their practicality?

22. How do the findings and conclusions of this research align with and contribute to the existing body of literature on microcomb-based MWP transversal filters? What new insights or advancements does this work bring to the field of microwave signal processing?

23. In terms of future research directions, what are some areas that warrant further investigation in the context of microcomb-based MWP transversal filters? How might these filters be optimized or tailored for specific applications, such as communications, radar systems, or signal analysis?

24. Can you shed light on the potential challenges or limitations faced when implementing microcomb-based MWP transversal filters in real-world scenarios? How might these challenges be addressed to enhance the usability and reliability of these filters?

25. The abstract provides a concise summary of the study's objectives and main findings. However, it would benefit from more specific details on the methodology and results to give readers a better understanding of the research. Please consider revising the abstract accordingly.

26. The introduction effectively contextualizes the study and highlights the importance of MWP transversal filters. However, I recommend expanding the background information on microcomb-based MWP transversal filters and their advantages over traditional approaches. This will help readers, especially those less familiar with the topic, to grasp the significance of the research.

27. Filter Outputs and Performance Evaluation:

The filter outputs and performance evaluation section analyzes the behavior of the filters using input Gaussian pulses with different spectral bandwidths. This analysis is crucial for understanding the performance of microcomb-based MWP transversal filters. However, I urge the authors to carefully review the accuracy of the simulation results presented and provide detailed explanations of the methodology used for performance evaluation. Additionally, discuss the practical implications of the observed discrepancies between the filter outputs with and without experimental errors.

28. Readability and Style: The manuscript would benefit from improved organization and flow between sections. Ensure there is a logical progression of ideas, and each section contributes to the overall understanding of the topic. Pay attention to the clarity of language and provide sufficient explanations for complex concepts to make the manuscript more accessible to a wider audience.

29. Scientific Accuracy: It is crucial to thoroughly review the manuscript for any scientific inaccuracies. Double-check the methodology, results, and analysis. Verify that all data and simulations are accurately reported and include proper references or citations to support the claims and findings made in the manuscript.

30. The authors present a valuable contribution to the field of microcomb-based MWP transversal filters for microwave signal processing. With the minor revisions and necessary modifications suggested above, this manuscript will be even stronger in terms of its scientific accuracy and readability.

31. Can you provide a detailed explanation of the trends observed in Figure (10), where the results show varying performance with increasing input signal power? What factors contribute to these trends?

32. In Figure (10), what is the specific behavior observed in the filter response when processing signals with different bandwidths? Can you explain the characteristic features, such as the shape of the filters' frequency responses, and how they compare to traditional filter designs?

33. The results shown in Figure (10) demonstrate the filter output in the presence of experimental errors. What are the notable effects of these errors on the filter's frequency response and performance? How do these effects align with the theoretical expectations?

34. Table (1) presents comparative performance metrics for microcomb-based MWP transversal filters and traditional filters. Can you elaborate on the specific advantages or disadvantages observed in terms of key performance metrics such as insertion loss, bandwidth, and stopband rejection? What conclusions can be drawn from this comparison?

35. The results in Figure (10) provide RMSE values for different filter bandwidths. Can you explain the variations in RMSE across different bandwidths? Are there any specific bandwidth ranges where the filters excel or struggle in terms of accuracy?

36. References can be improved and updated up until the current year of 2023. Please consider adding recent references

that can enhance the manuscript's strength and contribute valuable insights to the field. I suggest adding more references applicable and effective and may be useful to the proposed framework. See the following papers that are more applicable and appropriate.

<https://doi.org/10.36227/techrxiv.23622846.v1>

<https://doi.org/10.3390/mi14071322>

<https://doi.org/10.3390/photonics10101110>

<https://doi.org/10.1109/ACCESS.2019.2924531>

<https://doi.org/10.3390/mi14091794>

<https://doi.org/10.1016/j.optcom.2020.125463>

<https://doi.org/10.1007/s11082-020-02497-0>

<https://doi.org/10.1007/s11082-022-04142-4>

37. Please see the following papers. These references encompass key aspects such as modeling, analysis, design, application, survey studies, and review articles. The author may need to compare this work with their paper published below to clarify the unique features and contributions that make this research superior.

[<https://doi.org/10.36227/techrxiv.23622846.v1>]

38. I recommend that the authors carefully address these comments and revise the manuscript accordingly. I look forward to seeing the updated version of this valuable research.