

For research article

Response to Reviewer 2 Comments

1. Summary

Dear Reviewer,

Thank you very much for your insightful comments and suggestions on our manuscript. We have carefully considered each of your points and have made the necessary revisions to improve the quality and clarity of our work. Below, please find our detailed responses to your comments:

2. Questions for General Evaluation

Reviewer's Evaluation

Response and Revisions

Does the introduction provide sufficient background and include all relevant references?

Can be improved

Are all the cited references relevant to the research?

Can be improved

Is the research design appropriate?

Yes

Are the methods adequately described?

Yes

Are the results clearly presented?

Can be improved

Are the conclusions supported by the results?

Can be improved

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

Comment 1: The summary of previous technologies in the Introduction lacks a clear logical structure and reads more like a list. Moreover, only one reference from the past 5–6 years is cited, raising concerns about whether the latest technological advances have been adequately included. Given that the paper focuses on displacement monitoring at key locations in caverns, it is strongly recommended to incorporate more recent and relevant literature, particularly those offering technical comparisons within the same domain.

Response 1: Thank you for the valuable comments. We have systematically restructured the Introduction section, presenting the discussion in the logical framework of “the development of

technology - existing challenges - solutions.” We have also added core literature from the past five years related to this field (such as the comparative study of deep underground cavern monitoring by Li et al. 2023, and the application case in the Brenner Tunnel by Monsberger et al. 2024) to supplement the latest technologies (p1 line25-44).

Comments 2: It is suggested to include a parameter-based comparison between the proposed method and other similar techniques in the field, to highlight the advantages and limitations of the DFOS approach.

Response 2: Thank you for your suggestions. We will add a parameter-based comparison to clearly highlight the strengths and limitations of the proposed DFOS method in comparison with other similar technologies in the field. (p1 lin33-39) This comparison will help readers better understand the uniqueness of the DFOS method and its applicability in practical applications. Thank you for your valuable comments!

Comment 3: The numerical simulation analysis is presented in Section 4, after the experimental process. A rationale should be provided for not conducting finite element simulation as a preliminary design step to assist in experimental planning and fiber layout optimization.

Thank you for your suggestions. We will amend Section 4 to include a discussion on the fundamental principles of using finite element simulation as a preliminary design step. This will help readers understand how finite element analysis can be utilized to optimize experimental planning and fiber optic layout. Specifically, we will elaborate on the basic design of finite element simulation and its application in experimental design, adding relevant content (p11 line381-394) to ensure that readers fully recognize the importance of this method in enhancing experimental efficiency and accuracy. Thank you for your valuable comments!

Comment 4: The paper currently evaluates model performance using linear fitting parameters alone. It is recommended to include a more comprehensive error analysis, such as repeatability, drift, or resolution-related uncertainties, as linear metrics may not fully reflect the accuracy or robustness of the model fitting.

Response 4: We appreciate the reviewer's suggestions. In our evaluation of model performance, we not only examined the linear fitting parameters but also conducted residual analysis within the fitting system. Given that the R^2 values for all data points after linear fitting exceeded 0.9, we concluded that

there was no evidence of drift. The computational data derived from both experiments and simulations, as well as the curves obtained under various parameter settings, consistently demonstrated a clear linear relationship. Therefore, we posit that the linear relationship is reproducible under the conditions of our experiments. However, as the reviewer correctly pointed out, it is essential to establish boundaries to verify the accuracy and stability of the model beyond the conditions of our experiments. We have incorporated a relevant description in Section 5 of the manuscript (p18, lines 557-561). In conclusion, we affirm that the model fitting is accurate and stable under the settings of our experiments. Thank you for your valuable comments.