

Response to reviewer #4

First of all, we would like to express our sincere thanks to the reviewer for his/her constructive and positive comments and careful work. We have revised the manuscript, and the amendments are highlighted in blue in the revised manuscript. The modifications abided by the reviewer #3's comments are highlighted in red in this revision.

Although the title implies a strategy to monitor the displacement and direction of land-slides, the article itself is focusing on the development and testing of an optical fiber transducer. Thus, the title is misleading and should definitely be changed. The text requires a careful proof reading and even some rewriting in certain parts. The language should be revised and the use of personal pronouns should be avoided.

Answer: We have modified the title as '[New improvement of the combined optical fiber transducer for landslide monitoring](#)'. We also have revised some part of the paper to make it more clear and readable.

The organization of the chapters was unclear and vague, especially chapter 2 and 3. Instead of defining a chapter as "Double-shearing test" and "Study on the fourth-generation transducer", a main chapter titled as "Methodology" can be added. This "Methodology" chapter may include descriptions of the third and fourth generation transducers, the test setup and experimental program. The following chapter "Results & Discussion" may present the results of the single and double shearing tests and also the discussion part.

Answer: Thank you. We have conducted serial tests to design, improvement the combined optical fiber transducer (COFT). This paper is about shearing tests on the third and fourth generation transducer, we think divide them into two parts will be clearer. So we have modified the title of chapter 2 as 'Test on the third-generation transducer'. The Results and Discussion section, we think present them separately is better. So we don't modify them.

The references, descriptions, advantages and disadvantages of the first three generations should be included in the text. A table containing this information might be useful. Also, a

drawing or a photo of the test setup might be useful. The possibility and efficiency of the use of these transducers in the field should be also considered.

Answer: 1. We have modified those sentences as the following,

In our previous studies, firstly, we reviewed the application of some electro-optic technology, such as TDR, OTDR, BOTDR, et al, in slope stability monitoring, and we point out that the electro-optic technologies are to become a new choice for slope stability monitoring (Zhu et al., 2009). Then, we designed a serial combined optical fiber transducer (COFT) try to make this idea into reality. The first and second generation COFTs were put into public in 2011 (Zhu et al., 2011). We employed the spatial construction principle of reinforced beams, the optical fiber micro-bending loss mechanism and OTDR technology. We used a base material, some capillary stainless steel pipes and optical fiber as the sensing element. Bending resistance tests were performed on the first and second generation transducers. Results showed that the performance of the first-generation COFT was poor. Its initial measurement precision and dynamic range were 5mm and 0-7mm respectively. The performance of the second-generation COFT was better than those of the first-generation. Its initial measurement precision, sliding distance and dynamic range were 1.2mm, 21.8mm and 0-20.6mm respectively. However, the second-generation COFT cannot measure the movement direction of loadings. So we designed the third-generation COFT. Bending resistance tests performed on the third-generation transducer grouted with concrete C40, and proved that such sensor has higher initial measurement precision, larger sliding distance, and dynamic range.

2. As we have mentioned in section 5. ‘The combined optical fiber transducer we invented is used for field monitoring of slope stability.’ So we have considered the use of these transducers in the field.

Page 6850 Line 21: monitorslides should be monitor landslides.

Answer: We have modified it.

Page 6850 Line 21: It is better to call the GPS as Global Positioning System instead of Global Position System.

Answer: We have modified it.

Page 6850 Line 26: The name “optical time domain reflectometry” should be written before the use of abbreviation (OTDR).

Answer: We have modified it.

Page 6851 Line 27: “other significant findings” should be written clearly.

Answer: We have modified the last sentence as ‘Laboratory results confirmed our previous assumptions and conclusions, such as higher initial measurement precision, the determination of the moving direction, etc.’.

Page 6857 Lines 15-20: Please consider revising that part

Answer: We have modified this paragraph as the following,

The combined optical fiber transducer we invented is used for field monitoring of slope stability. The characteristic parameters (e.g., strength and friction angle) of the monitored slopes are different. For a given slope, in order to ensure successful monitoring, the transducer we invented must be suitable for those parameters. That is, the base material of the transducer, as well as its dimension, and grouting strength must be matched with the parameters of the given slope. Thus, these are discussed in the following subsections.

Page 6859 Line 20: The title of section 5.6 can be “Further enhancements for the performance of the optical fiber transducer”

Answer: Thank you. We have modified it.

Page 6866 Table 4: It is very hard to read. Please increase the font size

Answer: We have increased the font size as 12 point.

Page 6867 Table 5: Please correct the units of the parameters (Determination of the loading – Unit Price)

Answer: We have modified it.

Page 6871 Figure 4: “forth-generation transducer” should be “fourth generation transducer”

Answer: We have modified it.

Figures 2 – 3 – 6 – 7 are not clearly visible.

Answer: We have replaced these figures.