Response to Reviewer 2 Comments

The manuscript by Teng et al. presents a new set of very fast transient overvoltage (VFTO) measuring sensors. The structure, design considerations, and simulation methods are well described for each component of the sensor. In addition, the measurement shows significant improvement in the sensor compared to the previous generation by the same team through hundreds of disconnector operation tests. The reviewer believes the results are of importance to the community and interesting to the readers of Sensors. Therefore, it can be considered for publication on Sensors after revising the manuscript with respect to the following comments.

Point 1: In line 78-79, the authors mentioned the previous research results of their research group. The details or citation of the previous research should be included for better readability.

Response 1: Thank you for your review. We are extremely sorry for not clarifying the details of our previous research. Please allow me to introduce our previous research work to you in detail.

The previous research was mainly completed by another student in our research group. Similarly, his research work can also refer to reference 28 mentioned in our paper. As described in Reference 28, we have developed a VFTO measuring sensor, which called the old impedance converter in our paper. However, only a simple voltage following circuit was used to process the sampled signal, as shown in Figure 1.

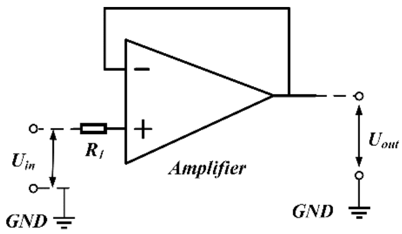

Figure 1. Schematic diagram of the old impedance converter circuit.

Although the low cut-off frequency of the old sensor was 0.003Hz from a numerical point of view, it cannot measure the quasi-DC component in VFTO. As described in line 353-364 of our paper, the old sensor still has problems when measuring the quasi-DC component of VFTO, which could show a measurement error of 5% to 45%. Therefore, we need to further optimize and improve the measurement performance of it.

According to formula (4) ($f \approx \dfrac{1}{2\pi R_L C_2}$) in our paper, the method to reduce the low- cut-off frequency of the sensor is to increase the capacitance of the low-voltage port of the capacitive voltage divider or increase the input impedance of the impedance converter. However, the capacitance of the low-voltage port is determined by many factors such as the size of the hand hole, the diameter of the electrode and the voltage division ratio of the capacitive voltage divider, and it is not easy to obtain a large value. Therefore, the relatively simple method is to increase the input impedance of the impedance converter.

In our research, we use the virtual off characteristic of the operational amplifier to obtain a large input impedance. In our previous research work, we also used the same method to obtain a large input impedance. However, as we described in Figure 1, the conversion circuit was very simple, with a limited input impedance and insufficient signal processing capacity. Therefore, we have designed a differential circuit and adopted an operational amplifier (ADA4817) with better performance in this research, thus obtaining greater input impedance and excellent common mode interference suppression performance and realizing the optimal processing of VFTO signals. Furthermore, through comparative experiments on a real 220kV GIS test platform, it is also verified that the new sensor has better measurement performance as described in Section 3 in our paper.

Point 2: Please add the references for COMSOL Multiphysics simulation software.

Response 2: Thank you for your review. We are sorry for our carelessness. We should clarify that the electrostatic field simulation (can be used to obtain the capacitance parameters) and circuit board simulation, which are based on the COMSOL Multiphysics simulation software, are both the first work carried out in our research. The result of electrostatic field simulation is shown in Figure 2 below, through which we mainly want to obtain the stray capacitance parameters between the high-voltage busbar, the hand hole electrode and the hand hole cover plate. Hence, we only give the capacitance parameter results obtained through simulation in our manuscript.

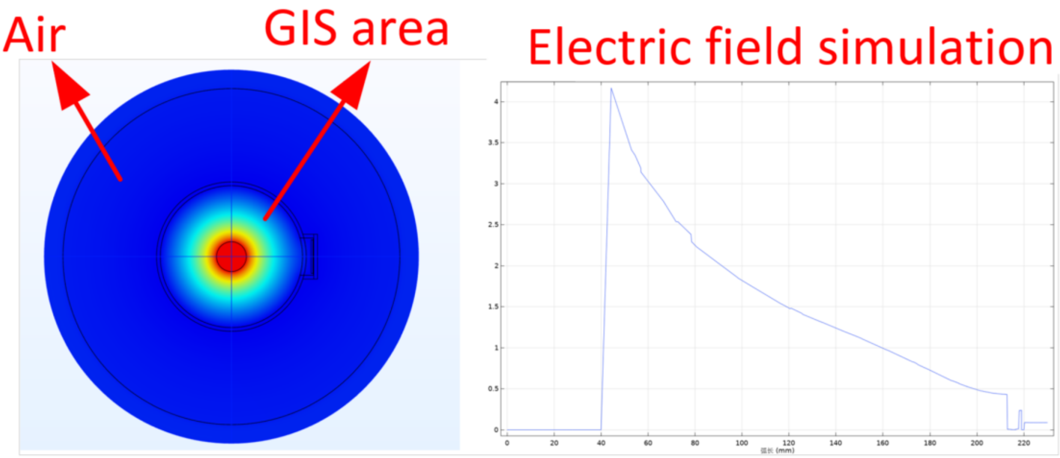

Figure 2. The result of electrostatic field simulation.

Moreover, the circuit board simulation is modeled according to the expected actual circuit board structure and circuit layout, so as to simulate the changes of the input and output responses of the signal conditioning circuit in practice. The simulation results are also shown in Figure 6 and Figure 7 in our manuscript.