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A New Method for Evaluation on High Voltage Transmission Line Electromagnetic Environment Based on Inverse Problem

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For the evaluation of electromagnetic enviroment in the vicinity of high voltage (HV) transmission lines (TL), the most frequently used method is to calculate the electromagnetic field in the vicinity of HV TL according to the boundary condition of TLs, such as phase voltage, phase angle [1,2]. However, for some TLs, due to the change of actual loads, the actual phase voltage and phase angle is different from the standard value, in this case, it is necessary to measure the electromagnetic field at points in the objective area. Therefore the measurement work is time-consuming and tedious.

To avoid the tedious measurement work, a novel method based on the inverse problem of TL electric field is described to evaluate the electromagnetic enviroment in the vicinity of TLs. The process is as follows: firstly set a small amount measuring points (about 10 points) in the objective area, measure the electric field at these points. Then according to the principle of charge simulation method, an overdetermined equation can be formulated, by solving which the actual phase voltage and phase angle can be obtained. Hence the actual electric distribution can be obtained according to the actual phase voltage and phase angle. To avoid the illness of the solution to inverse problem, global regularization is adopted, and damping gauss - newton method (DGN) is adopted to search the solution to the inverse problem [3].

A three-phase 500kV double circuit transmission lines are taken as an example for this method, 11 measuring points are set up along the line which is 1.8m high from the ground, the distance between the adjacent measuring points is 5m. When the electric field at 11 measuring points are: 2.680kV/m, 4.718kV/m, 7.214kV/m, 7.250kV/m, 8.954kV/m, 10.706kV/m, 8.954kV/m, 7.250kV/m, 7.214kV/m, 4.718kV/m, 2.680kV/m repectively, the calculated electric field distribution is shown in Fig.1.

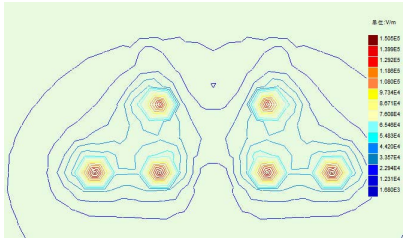

Fig. 1. Actual electric field distribution.

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Numerical Study on Improvement of Detection Accuracy for Wireless Magnetic Motion Capture System

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Detection technique with a high accuracy less than 1 mm is required for a body motion analysis in the field of medical treatment. Wireless magnetic motion capture system is effective way for the application. As shown in Figure 1, the system using LC resonant magnetic marker (LC marker) proposed by this study aims to be a candidate for such applications. As the former studies, the system capable of repeatable position detection accuracy under 1 mm was obtained if the system had adequate S/N ratio [1]. However, there are some cases where the detection results include unignorable error because some approximations, e.g. a magnetic dipole assumption of the LC marker, are applied to solve the inverse problem to determine the position and orientation of the LC marker. In this study, therefore, a numerical analysis was tried to optimize the design instruction of the motion capture system with high detection accuracy. To elucidate the problem of detection error, the influence of the size variation of the LC marker and pick-up coil were considered in the numerical simulation. After the investigation of analysis, the main cause of detection error was the size of the pick-up coil rather than that of LC marker. It was also found that the size of the pick-up coil under 10 mm in diameter with the wound coil width under 1 mm achieves the detection accuracy less than 1 mm. At the conference, further results will be discussed.

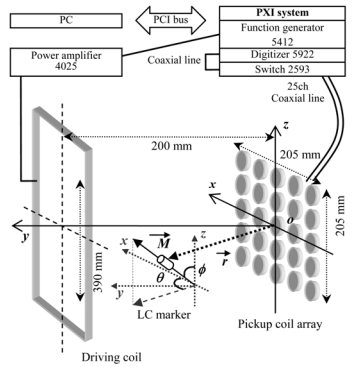

Fig. 1. Schematic diagram of the developed mo-tion capture system.

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