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Improved Traveling Wave Method Based Fault Location Algorithm for Multi-Terminal Transmission System of Wind Farm with Grounding Transformer

Authors : Ke Zhang, Yongli Zhu

Abstract : Due to rapid load growths in today's highly electrified societies and the requirement for green energy sources, large-scale wind farm power transmission system is constantly developing. This system is a typical multi-terminal power supply system, whose structure of the network topology of transmission lines is complex. What's more, it locates in the complex terrain of mountains and grasslands, thus increasing the possibility of transmission line faults and finding the fault location with difficulty after the faults and resulting in an extremely serious phenomenon of abandoning the wind. In order to solve these problems, a fault location method for multi-terminal transmission line based on wind farm characteristics and improved single-ended traveling wave positioning method is proposed. Through studying the zero sequence current characteristics by using the characteristics of the grounding transformer(GT) in the existing large-scale wind farms, it is obtained that the criterion for judging the fault interval of the multi-terminal transmission line. When a ground short-circuit fault occurs, there is only zero sequence current on the path between GT and the fault point. Therefore, the interval where the fault point exists is obtained by determining the path of the zero sequence current. After determining the fault interval, The location of the short-circuit fault point is calculated by the traveling wave method. However, this article uses an improved traveling wave method. It makes the positioning accuracy more accurate by combining the single-ended traveling wave method with double-ended electrical data. What's more, a method of calculating the traveling wave velocity is deduced according to the above improvements (it is the actual wave velocity in theory). The improvement of the traveling wave velocity calculation method further improves the positioning accuracy. Compared with the traditional positioning method, the average positioning error of this method is reduced by 30%.This method overcomes the shortcomings of the traditional method in poor fault location of wind farm transmission lines. In addition, it is more accurate than the traditional fixed wave velocity method in the calculation of the traveling wave velocity. It can calculate the wave velocity in real time according to the scene and solve the traveling wave velocity can't be updated with the environment and real-time update. The method is verified in PSCAD/EMTDC.

Keywords : grounding transformer, multi-terminal transmission line, short circuit fault location, traveling wave velocity, wind farm
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