A Novel Very Low-Frequency Voltage Generator for Diagnosis Testing in 10-kV Power Cables

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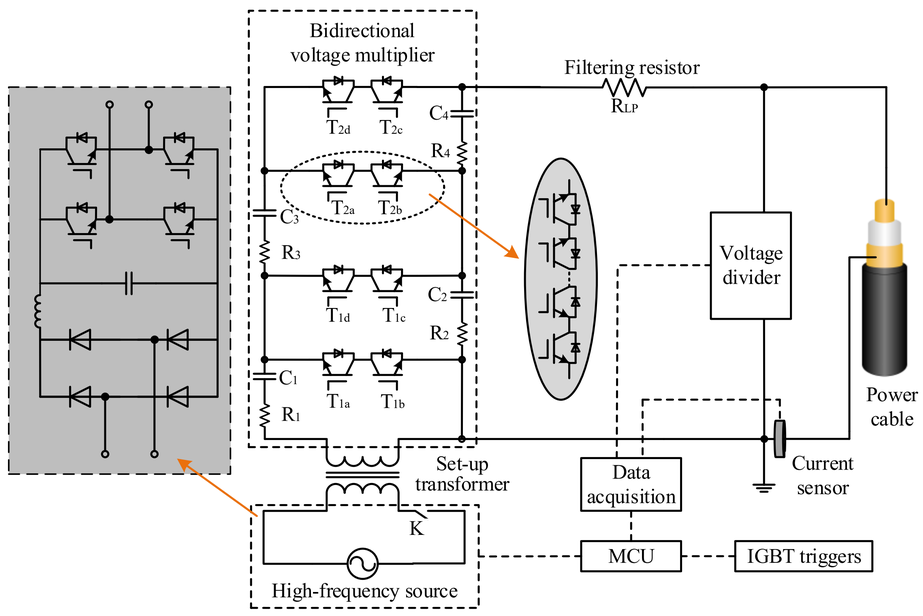
Introduction

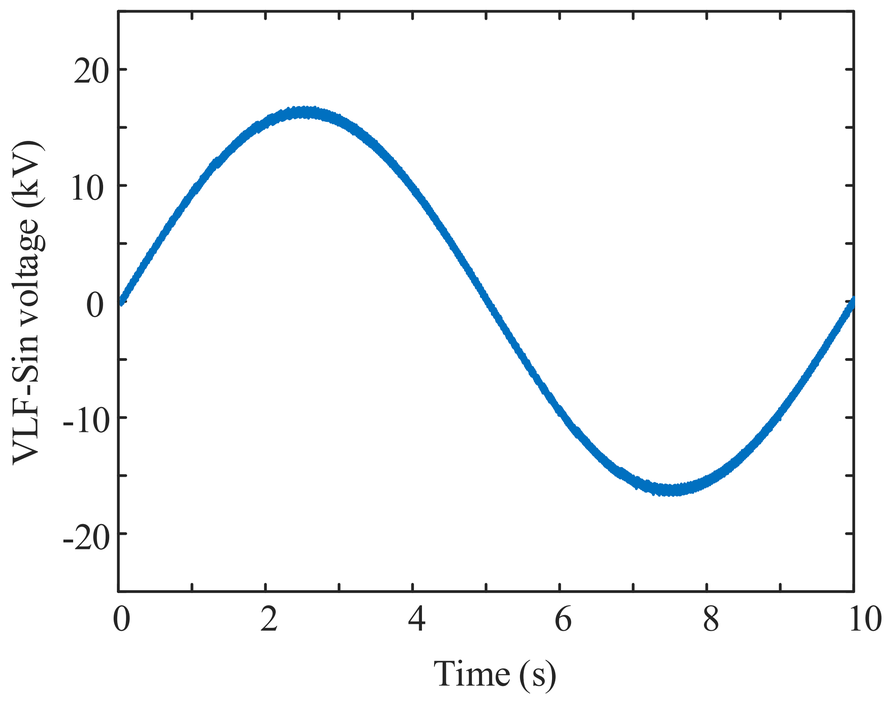
This paper describes a novel VLF-Sin voltage generator for the insulation diagnosis of the medium voltage power cable. The contribution takes the traditional voltage multiplier and improves it in order to integrate the charging and discharging circuits, which is the focus of this paper. By using this strategy, it is possible to achieve the VLF-Sin voltage through simple control.

System Overview



As shown in the figure, the system architecture of proposed integrated technique is illustrated, which is consisting of a high-frequency voltage source, a step-up transformer, a bidirectional voltage multiplier (VM) module, a filtering resistor, a control system, a data acquisition unit, and a capacitive specimen such as a power cable. Such a structure allows the system to achieve light-weight and compact. The hysteresis loop control principle is the basis for the VLF-Sin voltage generation. The VLF-Sin voltage that meets the test requirements can be generated by presetting different reference voltages with different frequencies and peaks.

Experimental Tests



In the experimental tests, it is applied to a capacitor as a load to verify the characteristics of the output voltage when this proposed test system is operated in VLF-Sin mode. As a result, the output voltage is desired as shown in the figure. Obviously, it can be observed that the result is consistent with the simulation, verifying the correctness of the technical route proposed in this paper.

Conclusions

In this study, a comprehensive analysis of the proposed insulation-testing method on the system topology, operation principle, hardware construction, and experimental testing was conducted. Simulation analysis of the system parameter provides an effective reference for hardware implementation. A laboratory prototype system was built, and testing was conducted on capacitive loads. The results validate the proposed technique.