Design of a Hand-Held, Clamp-on, Leakage Current Sensor for High Voltage Direct Current Insulators

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Abstract : Leakage current monitoring for high voltage transmission line insulators is of interest as a performance indicator. Presently, to the best of our knowledge, there is no commercially available, clamp-on type, non-intrusive device for measuring leakage current on energised high voltage direct current (HVDC) transmission line insulators. The South African power utility, Eskom, is investigating the development of such a hand-held sensor for two important applications; first, for continuous real-time condition monitoring of HVDC line insulators and, second, for use by live line workers to determine if it is safe to work on energised insulators. In this paper, a DC leakage current sensor based on magnetic field sensing techniques is developed. The magnetic field sensor used in the prototype can also detect alternating current up to 5 MHz. The DC leakage current prototype detects the magnetic field associated with the current flowing on the surface of the insulator. Preliminary HVDC leakage current in the specified current range of 1-200 mA. The influence of external fields from the HVDC line itself on the leakage current measurements is mitigated through a differential magnetometer sensing technique. Thus, the developed sensor can perform measurements on in-service HVDC insulators. The research contributes to the body of knowledge by providing a sensor to measure leakage current on energised HVDC insulators non-intrusively. This sensor can also be used by live line workers to inform them whether or not it is safe to perform maintenance on energized insulators.

Keywords : direct current, insulator, leakage current, live line, magnetic field, sensor, transmission lines

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