

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 measurements are performed on glass insulators. The results show that the prototype can accurately measure 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

Conference Title : ICHVE 2018 : International Conference on High Voltage Engineering

Conference Location : London, United Kingdom

Conference Dates : November 19-20, 2018