

# Use of dielectric spectroscopy in analysing the wood degradation due to weathering and ageing

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*Abstract*—Materials possess unique electrical characteristics that are dependent on their dielectric properties. As such, knowledge of dielectric properties can be utilized in manufacturing, condition monitoring and diagnostics. One such application that this work investigates is analysing the condition of wooden poles used in electrical distribution networks.

Due to weathering and ageing effects, wood can slowly degrade. Concept of leakage current measurements applying high voltages to the connected network has been analysed. However, there is significant interest in the development of non-destructive techniques to study the performance of wooden poles. Frequency response analysis in high-frequency range complemented with dielectric spectroscopy in low-frequency range can reveal features that are not currently identified using ultrasound or other non-destructive methods.

Both real and imaginary parts of permittivity are measured over a wide range of frequency; 10<sup>-4</sup> Hz to 1 kHz varying the applied voltage from 200V to 2000V; and 100 Hz to 2 MHz at 20V on different wood samples. The ageing effect is correlated with the polarizability of wood, and impedance spectroscopy plots. The trends can be used in detecting moisture content, dryness and other defects in wood structures.