

Development of a Flexible Rogowski Coil Sensor for Partial Discharge Detection in Power Cables

ABSTRACT

Partial discharge (PD) is a prevalent problem in power cables that must be detected early to avert power outages and ensure system reliability. Despite the fact that numerous Rogowski coil (RC) designs, none of them can accommodate all cable sizes. The purpose of this research is to investigate the sensitivity of flexible RC sensors and develop a prototype that uses Thermoplastic Polyurethane (TPU) for enhanced flexibility and accuracy. This study emphasizes the significance of flexible RC sensors in early PD detection for enhanced flexibility and potential benefits for power system monitoring and maintenance. The RC construction is designed in AutoCAD and 3D printed in TPU. The RC is wound with 20 turns and employs a return loop method to reduce interference from external electromagnetic fields. According to experimental validation, the sensor sensitivity is directly proportional to the greatest amplitude of the recorded PD signal, demonstrating the potential to improve power system dependability and safety through early PD detection. These findings highlight the need to consider the PD signal's maximum amplitude for sensor sensitivity, ultimately adding to the power system's reliability and safety. The proposed design, characterized by its novelty with TPU materials, yields promising results in terms of flexibility, establishing flexible RC sensors as a feasible asset in power cable PD detection and boosting monitoring and maintenance practices