Docket #: S24-105

A Non-Invasive Method For Partial Discharge Detection and Device Reliability Assessment

Stanford scientists have developed a method incorporating Hall-effect sensors and machine learning models to localize partial discharge for insulation defect detection and reliability assessment.

Partial discharge (PD) refers to the localized dielectric breakdown in an insulating material when the voltage exceeds its threshold. This PD gradually weakens insulation, often leading to catastrophic failures such as transformer or motor malfunctions. Current PD detection method such as capacitor coupling, wideband measurements, and withstand voltage testing with oscilloscopes are typically conducted offline, require specialized and expensive equipment, and can be invasive. These techniques are also prone to interference from external noise and require calibration, which limiting their practicality in real-time monitoring scenarios.

This invention utilized Hall-effect sensors to provide non-invasive and low-cost PD monitoring. It can be integrated into systems like motors, enabling real-time PD monitoring. Their inherent resistance to temperature fluctuations and mechanical shocks further enhances reliability. Combining with the machine learning algorithm, it can further localize the PD sites for precision defect diagnosis, preventing malfunctions of industrial devices.

Applications

- High-Voltage Equipment Monitoring
- Electric Motor Diagnostics
- Renewable Energy Systems
- Electric Vehicles

- Aerospace Applications
- Laboratory & R&D Applications

Advantages

- Provide continuous real-time monitoring
- Low cost
- Non-invasive
- Robust and reliable data collection
- Defect sites localization

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