Aging model of dielectric insulation for medium voltage power cables based on partial discharge measurements

Summary

Power networks are growing and the use of underground cable is increasing around the globe. Incipient defects in the cable's insulation cause unplanned power shutdowns. The proposed work aims at enhancing the capability of condition monitoring and diagnostic solutions for power cables and hence at increasing the reliability of the power grid. Supervisor: Muhammad Shafiq. Co-supervisor: Ivo Palu.

Research field:	Electrical Power Engineering and Mechatronics
Supervisors:	Ivo Palu Muhammad Shafiq
Availability:	This position is available.
Offered by:	School of Engineering Department of Electrical Power Engineering and Mechatronics
Application deadline:	Applications are accepted between May 03, 2021 00:00 and May 31, 2021 23:59 (Europe/Zurich)

Description

Rapid proliferation of underground cables in the medium voltage grid is enhancing the network reliability in today's modernized grid. However, abnormal operational and environmental stresses cause insulation deterioration in the cables. These stresses accelerate the insulation degradation process which can lead to an unexpected failure of the cable and hence sudden power shutdown. The behaviour of cable degradation poses critical unawareness that demands for efficient condition monitoring in order to have a reliable and timely diagnostics of the incoming insulation threats. The proposed PhD project aims to acquire deeper understanding of the insulation degradation mechanism, enabling the development of the techniques and methodologies for predicting its aging behaviour.

Partial discharge (PD) is a key indicator of the insulation degradation. This project is based on the study of the variations of the PD characteristics during the defect progression in relation with the physical mechanism taking place inside the insulation defects. Complete stages of dielectric degradation from PD initiation to breakdown will be investigated in the laboratory, supported by simulations. Measured data will be processed using digital signal processing tools. PD patterns and trends will be configured considering PD characteristics in time and frequency domain. The established trends will enable to develop the statistical and probabilistic model to predict the aging profile and proximity of the breakdown. The study will be done on both; insulation based test samples and cable sections. Behavior of the test samples and cable sections will be compared to improve the accuracy of the developed models.

The significant outcomes of this PhD project will be published in the high impact journals, conferences, and as a PhD dissertation. The scientific results will be valuable to enhance the expertise of the high voltage group at TalTech, Estonian grid operators, and the scientific community.

Supervisor: Muhammad Shafiq
Co-supervisor: Ivo Palu

Applicants should fulfill the following requirements:

Mandatory:

- Engineering education BSc, MSc
- Specialization in MSc in electrical engineering
- Subjects passed in high voltage engineering
- Skills in data processing/programming and statistical analysis

Preferred:

- Good knowledge in the area of high voltage engineering
- Skills of FEM simulation environment

- Record of scientific publications
- Experience in the engineering field other than studies only
- Experience in the practical measurements/field measurements

Optional:

- Previous university track record as a teacher/researcher
- Career in a company in the field of electrical engineering
- Likes to develop ideas, implement them actively, and excited to transform the valuable outcomes into high level publications

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