

# Modelling of insulation degradation for improved condition monitoring and diagnosis of power components

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## Summary

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*Insulation degradation is an unavoidable issue in power components which get accelerated by different operational and environmental stresses. This PhD project aims at numerical modelling of insulation degradation process and statistical analysis of the distinctive features of partial discharge signals based on efficient data processing technique.*

Research field:	Electrical power engineering and mechatronics
Supervisors:	Prof. Dr. Jako Kilter Dr. 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 June 01, 2022 00:00 and June 30, 2022 23:59 (Europe/Zurich)

## Description

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Insulation degradation is an unavoidable issue in the medium and high voltage power components which get accelerated by different operational and environmental stresses. While mechanism of insulation degradation is known for its complex behaviour, its improved understanding is critical in order to develop efficient tools for predictive diagnostics and life time estimation of the power components.

Despite of having valuable contributions of the available solutions based on theoretical and experimental studies, there is a lack of mathematical models, tools, and methodologies that provide reliable or accurate behaviour of the insulation degradation stages. It is especially important while considering the remaining life time or time to failure stages which is very essential for the detection of the fault at incipient stage.

This PhD project aims at numerical modelling of the insulation degradation process (using measurements such as partial discharges) under smart grid operation. The major objectives of the project will be to develop simulation models under different operational/environmental conditions emerging in the evolving power grid and statistical analysis of the distinctive features of obtained PD data/activity to achieve aging patterns based on efficient data processing technique. The operational and environmental conditions include the degradation under AC, DC, switching transients, and temperature. Statistical analysis and pattern study will be carried out with the help of intelligent data processing techniques. The goal of the project is to formulate the aging behaviour of electrical insulation in order to enhance the predictive maintenance capability.

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: Dr. Muhammad Shafiq  
Co-supervisor: Prof. Dr. Jako Kilter

## Requirements for Applicants

### Mandatory:

- Engineering education (BSc, MSc), with specialization in MSc in electrical engineering
- Excellent skills/experience of simulation tools such as Matlab, COMSOL, FEM, PSCAD, etc.
- Skills in data and signal processing/programming and statistical analysis
- Good knowledge in the area of electrical/high voltage engineering

### Preferred:



- Record of scientific publications
- Experience in the practical measurements/field measurements
- Motivated to develop ideas, implement them actively, and excited to transform the valuable outcomes into high level publications

Optional:

- Previous university track record as a teacher/researcher
- Career in a company in the field of electrical engineering



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