

High Voltage Insulation Systems (ELEC6089)

“Black-box” Classification of Partial Discharge Data -Assignment Brief

Introduction

The lecture will cover aspects of partial discharge theory, sources of discharge, detection techniques and classification methods. It is often useful for partial discharge (pd) data to be classified as to its source when using pd detection as a means of assessment of insulation systems since this will aid location and repair/redesign.

The task

The class will be split into pairs to form teams. Each team will be assigned a different partial discharge (pd) classification technique which they will have to research and understand. The two analysis techniques are:

1. ϕ -q-n plotting (PRPD)
2. pulse sequence analysis

The assigned classification technique is to be implemented by the team as a simple program to accept real partial discharge data (supplied) and analyse the data. Several data sets will be supplied including partial discharge data from several sources, e.g. corona, surface, void. The supplied data will be clearly labelled at this stage. The project teams are required to make a short presentation (10 minutes) to other teams and a small group of invited members of the Tony Davies HV laboratory who are knowledgeable about pd detection, analysis and classification. The presentation is to include an introduction to the analysis technique assigned. Students should research and present the theory underlying their assigned technique; it will be useful to consider the technique's applicability, advantages and limitations; comparison against other techniques and method of implementation. The presentation should also present the implementation of the program, i.e. a flow diagram and description of the tasks performed at each stage; consider the use of example plots to illustrate procedures within your program. Present the plotted results of analysis of the supplied data and identify key features that can be used to classify the pd source. **All members of the team must present** and the teams should aim to split the “talk-time” amongst members as equally as possible.

“Black-box” or “blind” test.

After the presentation new partial discharge data will be given to the team to analyse using their program as a demonstration for the audience. The team will be asked to classify the source of the pd data using their program output and justify their decision.

Note: the classification task is to be done by the student teams NOT automated by the program!

Information

Data format

Initial pd data supplied and “black-box” test data will be in the same format.

The data has been collected using a digital storage oscilloscope (DSO). The data is arranged in four files each with pd data collected over one second; i.e. 50 power cycles. The data will require conditioning prior to the analysis technique and plotting; a method of reading in all four files at once and reducing the raw signal to a series of magnitudes and timestamps will be required. For the experiment to collect data the DSO was triggered using a zero crossing

detector circuit to ensure the file starts at the start of a power cycle (a near 50Hz sinusoid), i.e. files start at zero degrees phase.

You will need this information to ensure correct phase information is used for the analysis tools to be developed. (In reality the supply voltage used during a pd test is rarely exactly 50Hz, in the format supplied the data has less than 1.8 degrees phase shift error.)

Teams may use any programming language, but programs must be able to analyse and present output plots within a reasonable time, i.e. less than 1 minute per data set.

Teams must arrange with the lecturer availability of computing and programs required for the presentation in advance. A PC with MSpowerpoint and MATLAB will be available for the presentations. It is recommended MSpowerpoint be used for the presentation.

Assessment

Marks will be awarded on the basis of the presentation by the teams, there is no written submission for this assignment. Marks will be awarded for technical knowledge and ability assessed against how well the teams match the brief as outlined above, and ability to clearly and concisely demonstrate understanding by a short technical presentation. Both an individual and team mark will be awarded. Marks will be decided amongst the invited pd experts in attendance of the presentation. The program to be developed and presentation will carry a half of the total ELEC6089 course marks.

As agreed, the presentation with demonstration of working programs and “black-box” testing are to be made in the tutorial room (2001) in BLD 16, from 9:00am on 27 May, 2014. The exact time for your team presentation will be published in due course.