Claims

1. A method for separating partial discharge and noise signals, the method comprises:

receiving digital signals that are converted from waveforms of signals collected from a source;

generating a feature from a time domain for each of the digital signals;

generating a plurality of features from a frequency domain for each of the digital signals;

applying clustering algorithm on the generated features for all the digital signals to identify a plurality of distinct clusters; and

displaying each distinct cluster on a Phase-Resolved Partial Discharge (PRPD) chart;

wherein the step of generating the feature from the time domain for each of the digital signals comprises:

determining histogram bin width and the number of bins for all measured amplitudes in the digital signals, wherein the histogram bin width and the number of bins are determined via Freedman-Diaconis (FD) rule;

associating all measured amplitudes with their respective bin values;

building a global probability table; and

encoding information in the global probability table to generate the feature.

2. The method according to claim 1 wherein the source is data collection module comprising a sensor for measuring a wideband of electromagnetic signals in an

environment and an acquisition device for recording and translating the electromagnetic signals measured from the sensor to the digital signals.

3. The method according to claim 1 wherein the step of building the global probability table comprises:

determining the probability of the measured amplitudes in each bin with respect to the rest of the measured amplitudes to build the global probability table.

4. The method according to claim 3 wherein the information in the global probability table is encoded via Arithmetic Coding.

5. The method according to claim 4 wherein the step of generating a plurality of features from the frequency domain for each of the digital signals comprises:

applying a Fast Fourier Transform (FFT) for each digital signal to transform the digital signal from the Time Domain of N measured amplitudes to the Frequency Domain of (N/2)+1 magnitudes;

grouping the magnitudes according to respective frequency;

standardizing the magnitudes in each frequency to bring the magnitudes into a uniform format;

normalizing the standardised magnitudes based on global maximum and global minimum magnitude values;

determining histogram bin width and the number of bins for all normalized magnitudes in each frequency;

associating all normalised magnitudes with their respective bin values; and

scaling magnitudes in each bin are scaled to be between 0 and 1 to generate (N/2)+1 features.

6. A system for separating partial discharge and noise signals comprising:

a data collecting module configured to recording and translating electromagnetic signals measured from a sensor to digital signals; and

a data processing module configured to:

receive digital signals from the data collecting module;

generate a feature from a time domain for each of the digital signals;

generate a plurality of features from a frequency domain for each of the digital signals;

apply clustering algorithm on the generated features for all the digital signals to identify a plurality of distinct clusters; and

display each distinct cluster on a Phase-Resolved Partial Discharge (PRPD) chart

wherein the data processing module is configured to generate the feature from the time domain for each of the digital signals by:

determining histogram bin width and the number of bins for all measured amplitudes in the digital signals, wherein the histogram bin width and the number of bins are determined via Freedman-Diaconis (FD) rule;

associating all measured amplitudes with their respective bin values;

building a global probability table; and

encoding information in the global probability table to generate the feature.

7. The system according to claim 6 wherein the data collecting module comprises:

a sensor for measuring the electromagnetic signals; and

an acquisition device for recording and translating the electromagnetic signals measured from the sensor to the digital signals.

8. The system according to claim 6 wherein the data processing module is configured to build the global probability table by:

determining the probability of the measured amplitudes in each bin with respect to the rest of the measured amplitudes to build the global probability table.

9. The system according to claim 8 wherein the information in the global probability table is encoded via Arithmetic Coding.

10. The system according to claim 9 wherein the data processing module is configured to generate the plurality of features from the frequency domain for each of the digital signals by:

applying a Fast Fourier Transform (FFT) for each digital signal to transform the digital signal from the Time Domain of N measured amplitudes to the Frequency Domain of (N/2)+1 magnitudes;

grouping the magnitudes according to respective frequency;

standardizing the magnitudes in each frequency to bring the magnitudes into a uniform format;

normalizing the standardised magnitudes based on global maximum and global minimum magnitude values;

determining histogram bin width and the number of bins for all normalized magnitudes in each frequency;

associating all normalised magnitudes with their respective bin values; and

scaling magnitudes in each bin are scaled to be between 0 and 1 to generate (N/2)+1 features.