EPDM의 초기 및 열화특성에 관한 연구

A Study on the Aging and Initial Characteristics of EPDM

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Abstract

Fractal mathematics is being highlighted as a research method for classification of image. But the application of Fractal dimension(FD) has been required the complicated calculation method because of its complex repetition progressing.

In this paper, it has been applied the new approach method to express FD for aging level calculation and investigated the relative degradation processing in outdoor EPDM insulator.

As a result after testing, new proposed method has a capability to estimate in case of the field operated EPDM and accelerating test. Therefore, we find the differency of operated EPDM according to field condition.

1. Introduction

Despite of the growing number if applications and development of outdoor power system, the question how the estimated discharge quantities relate to the residual lifetime of a specific test object still remains open.

The complexity and fuzziness of measured discharge signal patterns in the real noisy world, such as acoustically, chemically, electrically, thermally or any other methods, can be interpreted as a type of imprecision that stems from grouping elements into classes that do not have sharply defined boundaries. For recognition of our ambiguous, vague measured information of their pattern features from outdoor power system, fractal mathematics can be a better or effective representation model of measured human feeling than ideal crisp set information.

Recently, image processing of chaos/fractal engineering methodology has been introduced and addressed a variety of applications in many different fields. Fractal application of discharge image has ability to classification the estimation of aged system without knowledge if mathematical relationship.

In this respect, this paper presents anew novel adaptive fractal application recognizing system concerning analysis of measured discharge image performed on different aged apparatus and models are studied and discussed in respeat of practical applicability in the monitoring and diagnosis and maintenance of power system.

2. Fractal Mathematics

The fractal have been very successfull tool to express the naturally occurring phenomena and the shape which were impossible to descript numerics and quantitative analysis in conventional mathematical methods looks like an Euclidean geometry.

In Fractal dimension, we suppose the same pattern as the virtual existence sum of region(Nr) when those size of virtual area is the r(const). The Fractal dimension(FD) is defined as following

$$FD = -\frac{\log(N(r))}{\log(r)}$$

The method here for FD calculation used to carry out cover method which was one of the typical negative gradient value in logarithm graph between the virtual existence sum of region(Nr) and the variable size(r) of virtual area. In part of tree research, many researcher has been a tendency to select 2 dimensional observation system more than 3 dimension method, so those non-linear characteristics of 3 dimensional observation method was represented a broad area between 1.5 and 1.8 dimension. One of the other serious problem for on-line measurement in the

fractal application is some image noise during the processing, If image data has a some kinds of noise during the processing, Fractal dimension would value than original Fractal dimension. Furthermore, Fractal mathematics has a some boundary for exactly numeric expression of image data in case of 2 dimensional observation.

Most of typically cases, the Fractal dimensional is calculated by the virtual existence sum of region(Nr) which are results example of the size of virtual area(r) in image data. In this paper, we suppose that discharge image always exists in the some finite region(XYZ) and has a same pattern as the existence sum of region(NT).

3. Experimental Background

The important parameters to characterize discharge are structure appearance, a boundary of land and environmental aging factors.

The those distribution consist of the operation atmosphere, the electrical stress, environmental atmosphere, rainy(wet) day, dust&fog rate and the system ability, Many other monitoring characteristics, such as the maximum BD, the impulse discharge magnitude, the pulse repetition rate for given aging threshold can be derived from the discharge image distribution.

Most of typically cases, the outdoor power system is pretested by a accelerating testing of laboratory condition which are example of the IEC-60587. For the last couple of year, almost research works on outdoor power system has been concluded the experienced estimation by an aging level using visual inspection.

Our experimental selection of a land boundary was based the south sea-coast area in korea for the comparative of aging stress.

Aging map of outdoor power system represents 5 kinds of multi-point in south sea-coast of korea. The key-point in map construction can be divided into three research vision; possibility of estimation, difference of aging cycle and the capital environment.

4. Application and experimental study on Fractal Dimension

Using the supposed FD method, an experimental work have been carried out on the application of SD image data used to be calculated in FD processing.

The photo in Fig.1 is shown the result the FD algorithm. The method called FD has a good linear characteristics. But conventional FD method whose purpose is one-line measurement has long calculation time to numeric expression of electrical stress.

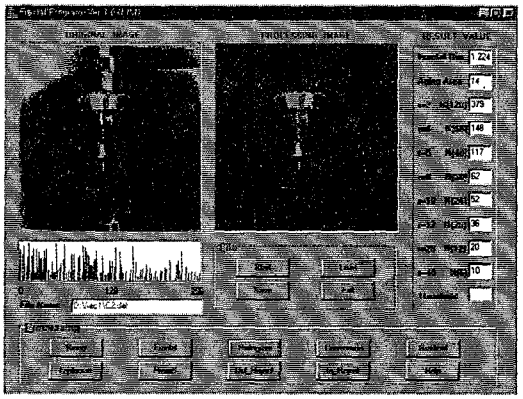
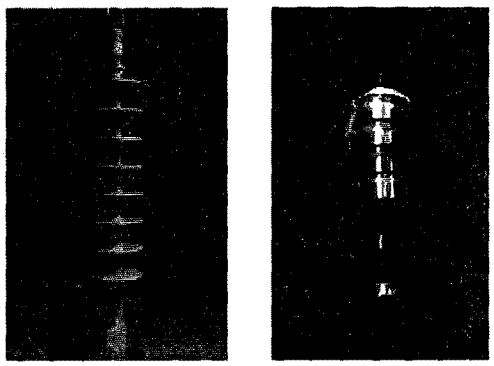


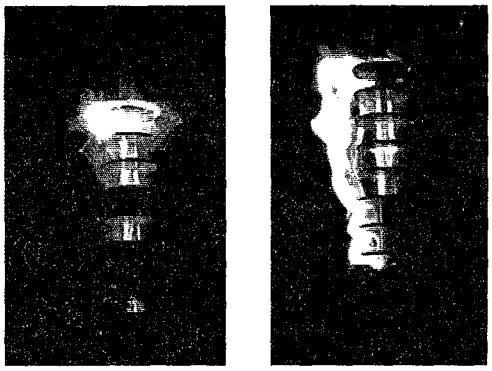
Fig. 1. FD Result after Image Processing.

The new method called FD has both a good reappearance characteristics and an estimation ability in part of aging level more than conventional visual observation method. Fig. 1 represent the computer result from FD algorithm.

We easily confirmed discharge characteristics. As results of FD, we take a quantitative value as electrical aging, resulting from supposed method define the accelerating level. Although the application of chaos/fractal mathematics to complex discharge image patterns obtained at this time would appear to be somewhat premature, there is some evidence that in terms of the changes in the OIT(Oxidation induction time) distribution patterns, it may be possible to predict the breakdown of outdoor power systems under intense discharge conditions. However, the most significant advances made in the area of aging pattern recognition primarily concern the discrimination between stress and environmental condition.



(a) Virgin (b) Che-Ju



(c) Mok-Po (d) Ge-Jae

Photo 1. The SD testing after 3-years (Company C)

The first important step is to select a type of discharge image pattern that has good discriminating power. Especially, FD of virgin sample and its derivatives such as image complexity have been extensively used for comparative estimation or separation. The shape of discharge image and various frequency spectra provide another way to discriminate of discharges. To reduce the dimension of original discharge data, 0.0 dimension of FD, characteristic feature or internal knowledge properties of the virgin data should be extracted from the data. Due to lack of a knowledge or information of concerned new systems, there in no unique way to do this.

Statistical parameters(average, deviation, skews) and fractal features(fractal dimension. chaos, complexity) are just few examples of such features. The trade-off between the number of features, time for the calculation of the features, discrimination power of the features and the final speed of classification should be considered when designing the features. To create a data base for reliable aging recognition, various aspects such as the effects of test voltage level, aging, availability of starting electrons. must be taken into account.

A number of mathematical methods are available to organize the database. Mapping techniques and cluster analysis methods can be used for this purpose but it should be realized that there is no 'best' method. Hence, the works reported in the literature are necessarily of a rather preliminary and rudimentary nature, and represents only the beginning in a much more formidable task of applying fractal pattern recognition techniques on actual power equipment and apparatus with the aim of deriving meaningful and reliable information from the discharge patterns in the cause of routine accelerating tests.

The present works in reference have demonstrated that even with the most simple of discharge patterns and sources the recognition capabilities of fractal application evaluated are not always perfect and reliable. Nevertheless, this positive result obtained on very simple artificial models and electrodes should not be misconstrued so as to impel indiscriminate application of fractal in areas where at this stage of their development and in terms of our current knowledge of the discharge process, their discharge image pattern recognition capabilities are clearly limited.

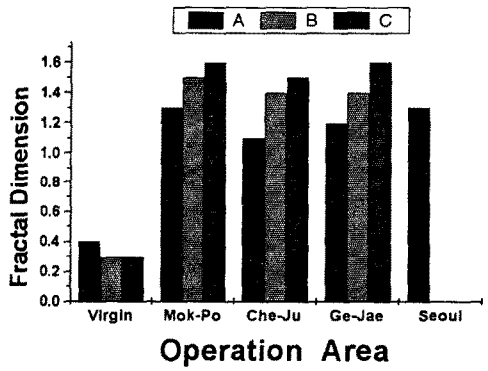


Fig. 2. FD Estimation of Selected Sample

Almost of aging experiment depends upon acceleration test for analysis of aging processing. In this paper, have investigated the availability applying different stress distinguished the availability appling different stress distinguished FD.

Those characteristics were predicted on the unclear pattern between 1.4 and 1.6 for FD discrimination, those results of the bellow FD test become more large than present FD data because of a progress character of surface deterialation. Testing involved higher FD was calculated to much interested phenomena according to the Mok-Po area. At the first, the ambiguous results group by company dependance is clear different aging slop of the above all condition.

The result was estimated on the fractal

characteristics as available possibilities of identification of manufacture state for long period stabilities. At the second, the dangerous area was easily found to the recurrent phenomena of FD output. However, such area is very difficult to analysis of mechanism and to predict the lifetime in present state, it is possible to discriminate by means of data accumulation.

5. Conclusion

In this paper a general outline of the development of image processing technique based fractal diagnostics is given with emphasis on problems of the validity of underlying models and the interpretation of results. Some major fractal based approaches are reviewed in this paper, with a discussion of certain problems that also are significant for modern approaches. After a discussion of primary discharge events and resulting degradation, some basic matters regarding measurement employing fractal techniques and testing are described and their problems are discussed. The new method called fractal dimension has been introduced and it has shown both a estimation characteristic and the capability of higher recurrency calculation comparing with the case of the conventional visual inspection. In the experiment, the fractal dimension for discharge image has a possibility to aging level of estimation for lifetime diagnostic system. Possibilities inspired by the chaos/fractal engineering for monitoring the aging of power system by means of discharge recognition should also be further investigated.

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