CONDITION MONITORING ON SURGE ARRESTER USING IMPROVISED METAL OXIDE SURGE ARRESTER INTELLIGENT MONITORING SYSTEM

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Specially dedicated to my dearest wife, Varshalaxmi Bhatt, family and friends who have encouraged, guided and inspired me throughout my journey of education.

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ABSTRACT

A tool for condition monitoring for Metal Oxide Surge Arrester (MOSA) has been developed in Labview. The software (MOSAIMS) runs in Microsoft Windows operating system and features a user friendly graphic interface. The condition of the MOSA can be monitored by analyzing the leakage current from the arrester. The leakage current contains third harmonic component which varies as the MOSA degrades. The leakage current need to go through Fast Fourier Transform (FFT) to extract the third harmonic component from the leakage current. The third harmonic component is the most important parameter as it directly reflects the condition of the MOSA. Improvised MOSAIMS program was developed in such a way that it is compatible with Windows 8 and touch screen functions.

ABSTRAK

Satu perisian untuk memantau keadaan Metal Oxide Surge Penangkap (MOSA) dibangunkan di LabVIEW 2011. Perisian (MOSAIMS) berjalan dalam sistem operasi Microsoft Windows dan ciri-ciri antara muka mesra pengguna grafik. Keadaan MOSA boleh dipantau dengan menganalisis arus bocor dari penangkap. Arus bocor mengandungi komponen harmonik yang berbeza-beza mengikut MOSA mempersendakan. Arus bocor perlu melalui Fourier pantas (FFT) untuk mengeluarkan komponen harmonik daripada arus bocor. Komponen harmonik ke-3 adalah parameter yang paling penting kerana ia secara langsung mencerminkan keadaan MOSA. Program MOSAIMS spontan telah dibangunkan dengan cara yang serasi dengan Windows 8 dan fungsi skrin sentuh diaktifkan supaya ia akan menjadi lebih mesra pengguna.

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FFT	-	Fast Fourier Transform
MOSA	-	Metal Oxide Surge Arrester
ZnO	-	Zink Oxide

CHAPTER 1

INTRODUCTION

1.1 Introduction

In industry we have a lot of valuable equipment such as transformer which need to be safe guard from surge. Surge or impulse are normally generated during switching activity at power grid or because of lightning strike [1]. This surge will travel along the grid and make a permanent damage to the equipment which will cause a lot of waste in terms of money. In order to avoid the damage by surge or impulse, surge arrestors are installed in order to absorb the surge and safely discharge it to the ground [2]. Therefor condition monitoring on the surge arrestor is very crucial because any failure in surge arrestor will end up in catastrophic. Surge arrestors installed are Metal Oxide Surge Arrestors (MOSA) without gaps which means the arrestor have non-linear resistive component. This cause the surge arrestor comes with extremely non-linear voltage-current characteristics. [3]

Currently TNB is using SCAR 10 to monitor the condition of the surge arrestor [4]. MOSAIMS version 1 was developed with Modified Shifted Current Method (MSCM) and the output was compare with SCAR 10 result and the difference was about 40% [4, 5]. The difference is so high because MOSAIMS cannot eliminate the noise or random disturbance. In order to improve this, MOSAIMS version 2 with improvised function need to be developed. On top of that, MOSAIMS version 2 will input the total leakage current straight to FFT algorithm and output the 3rd harmonic current which directly reflects the condition of the surge arrestor. On top of it, MOSAIMS version 1 was supported by Windows XP only. With current condition, MOSAIMS version 2 need to be Windows 8 compatible with touch screen function enable so that it will be more user friendly.

Gapless physical configuration of MOSA enabled the measurement of leakage current from the arrester which contains resistive current and capacitive current.[11, 12, 13, 17] 3rd harmonic component in resistive current is consider as an important parameter to be analyze as it reflects the degradation of the MOSA. In this case, MSCM used to extract the resistive component and FFT algorithm identified the harmonic components out of it [1]. As MOSA in service for longer duration, the resistive leakage current increases incorporate with 3rd harmonic component which directly reflects the condition of the MOSA. The system voltage contains harmonic component, therefor there are few method to extract the harmonic component of the MOSA only [2].

A lot of methods are identified as ways to measure the condition of MOSA. One of the methods is via harmonic analysis of the total leakage current. Due to non-linear resistance of ZnO arresters, the leakage current contains harmonic component and it increases as the resistive current increases. Compensation technique is used to analyze the harmonic component in the total leakage current [10].

1.2 Background of Study

As condition monitoring on MOSA is so crucial, tools are created in order to monitor the health of it. The condition of the surge arrester is directly proportional to the 3rd order harmonic component from resistive current in the total leakage current. For this study, total leakage current is measured and FFT algorithm is used to extract the 3rd harmonic order.

1.3 Problem Statement

Surge arrester is a very crucial device in industry and used to protect other valuable equipment in power system network such as transformer from surge or lightning. In order to safe guard the equipment, surge arrester need to be consistently monitored to ensure the condition of the device is always good. MOSAIMS is one of the program developed to monitor the condition of the surge arrester and currently it can be only supported in Windows XP and the program have some bugs which makes it not user friendly.

1.4 Objective

The objectives of the project are:

- To input the leakage current from the surge arrestor to FFT algorithm and output the condition of the MOSA

- To upgrade the current program to Windows 8 compatibility with touch screen function enabled

- To test the program in the laboratory environment to ensure the reliability of the system.

1.5 Scope of Study

The scope of the project are:

- Understand the current MOSAIMS program and fix the existing bugs.

- Enable Bluetooth communication to transfer the raw input from clamp meter and the whole signal processing will be executed using Labview 2011

- Upgrade of existing model will only cover Windows 8 64 bit environment with touch screen capability.

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