Research Article *ISSN: 2319-507X*
Abhay Dalal, IJPRET, 2013; Volume 1(8):647-654 *IJPRET*

INTERNATIONAL JOURNAL OF PURE AND APPLIED RESEARCH IN ENGINEERING AND TECHNOLOGY

A PATH FOR HORIZING YOUR INNOVATIVE WORK

A NEW APPROACH TOWARD SYMMETRICAL FAULT ANALYSIS USING HARMONIC IMPEDANCE

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Accepted Date:
27/02/2013

Publish Date:
01/04/2013

Keywords
Harmonic impedance,
Signal generator,
Fourier transforms.

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Abstract

To ensure the safe re-closing of the de-energized distribution feeder, a fault detection technique based on the measurement of harmonics impedance is used, in this technique the thyristor based signal generator is used to create transients in circuit and this transient is used to extract harmonics impedance, in this paper we are going to concentrate on the extraction of harmonics from single phase and three phase circuit and study the behaviour of harmonic impedance under healthy and fault condition.

I. INTRODUCTION

For a distribution service provider it is important to ensure the re-closing of de-energize distribution feeder in safe manner after fault, to ensure that whether the feeder still under fault condition or not. To ensure the safety harmonics impedance base technique is used [1]-[3]. In this technique the transient are created with the help of signal generator which consist of the thyristor in series with the inductor [4]-[5]. In this paper we are going to extract the harmonics impedance from single phase circuit. The single line diagram of the system and the equivalent circuit diagram under fault condition are as shown in fig. below.

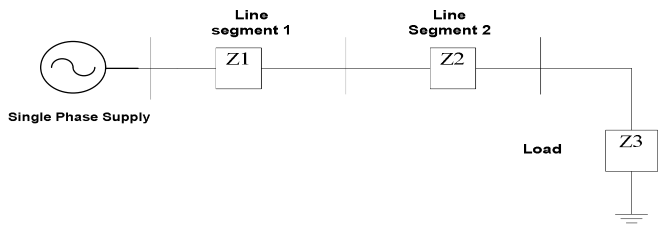

Fig.1 single line diagram for system

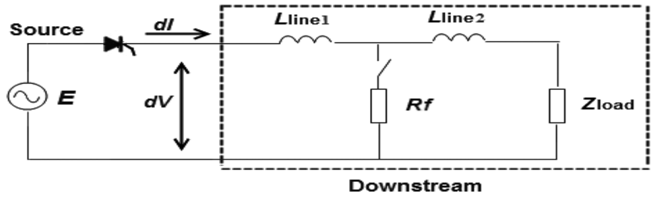

Fig.2 Equivalent circuit diagram under fault condition

II. EXTRACTION OF HARMONICS IMPEDANCE FROM SINGLE PHASE & THREE PHASE CIRCUIT

This scheme utilities the voltage and current disturbance signals to measure the harmonics impedance. For calculation consider a linear network disturbed with the help of signal generator which consist of SCR and inductor in series with it. Transient signals shows on the terminal voltage and current waveform and decay to an indiscriminate level regards as zero after a period. These signals are recorded during the whole transient process and are denoted as dv(t) and di(t) respectively. According to the Fourier transform of non periodic signals

$$dV(jw)=Z(jw)dI(jw)$$

Where dv(t)and di(t)are the Fourier transform of dv(t) and di(t), respectively and Z(jw) is the harmonics impedance of the network[6]-[8].

III. CIRCUIT FOR SINGLE PHASE SYSTEM

The circuit diagram or schematic arrangement for the extraction of the Harmonics Impedance is given below.

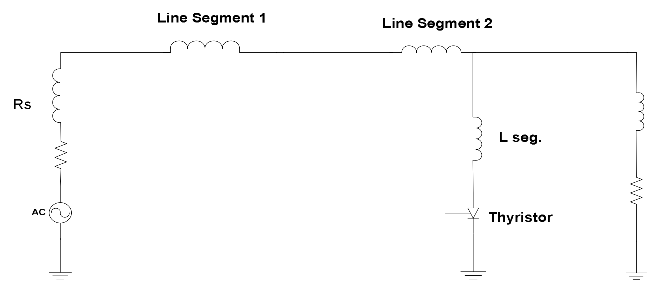

Fig.3 Schematic arrangement for extraction of Harmonics Impedance

The specification of the circuit are Rs=0.06Ω, Ls= 0.08mH, Line Segment 1=0.02mH, Line segment 2=0.02mH, Rl=7.2 Ω, Cl=178.43µf, Lseg.=0.2mH, R load=7.2 Ω, L load=9.2mH

Where the controlled rectifier and Lseg. Formed signal generator to create a transient in the circuit.

For three phase circuit the single line diagram is as shown in fig. below

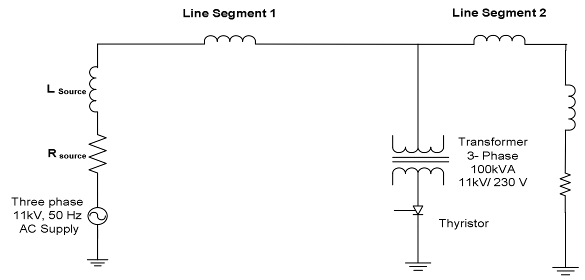

Fig.4 Schematic arrangement for extraction of Harmonics Impedance

For three phase system the system is supplied by 11kV supply having source inductance and resistance L_s= 0.0382H, R_s = 6.25Ω respectively and line is divided in two segments in which segment 1 is consisting of coupled inductance section having L_{self}=0.024H, L_{mutual}=0.013H, R_l=281Ω, C_L=1.698µf and segment 2 consist of the load having zero transmission length the specification of load is R_{load}=281Ω, L_{Load}=0.36H. In case of three phase harmonics extraction system we use 100kVA transformer and signal generator is connected to secondary side of transformer which is operated at low voltage.

IV. COMPUTER SIMULATION AND RESULTS

The simulation of the single phase circuit is carried out in MATLAB which is shown in fig.5

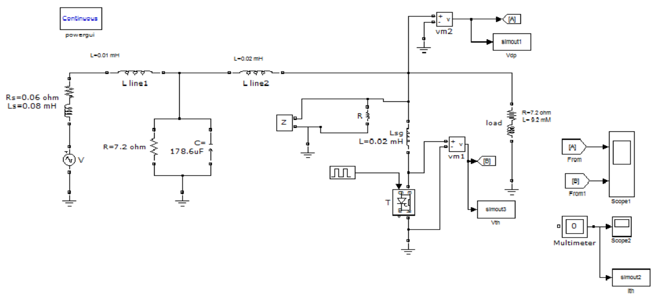

Fig.5 MATLAB simulation for single phase harmonic impedance extraction

The voltage at driving point, voltage across Thyristor, current through thyristor and transient signal of voltage at driving point is as shown below.

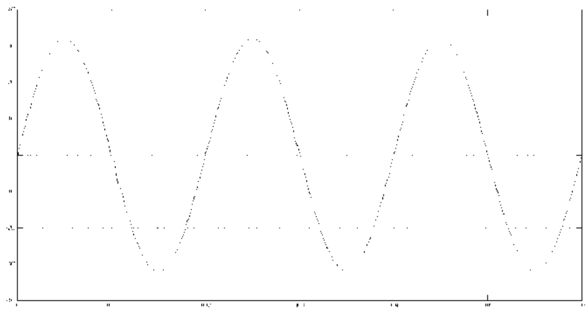

Fig.6 Voltage at Driving Point

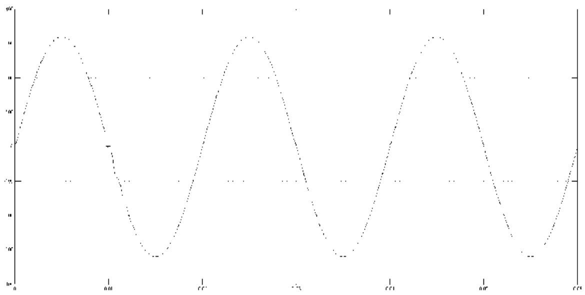

Fig.7 Voltage across Thyristor

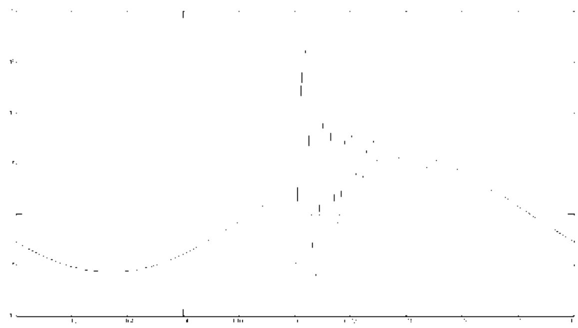

Fig.8 Transient occur at driving point due to signal generator

The current through thyristor is given in fig.9. The FFT is carried out on the current signal and behaviours of the current at different frequencies are shown below fig.10

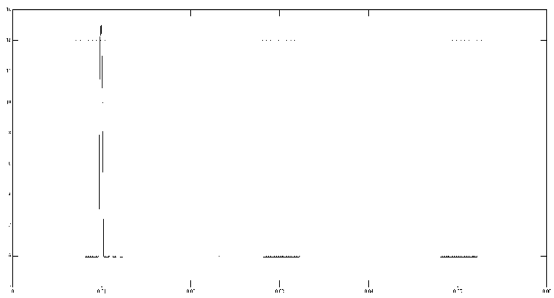

Fig.9 Current through thyristor under fault condition

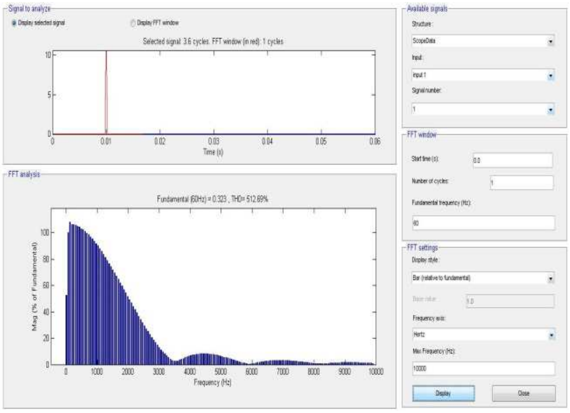

Fig.10 Behaviour of fault current under different frequency

With the help of powergui block the impedance vs frequency curve is obtained which is harmonics impedance and the real and imaginary part of the impedance at different frequencies are given below.

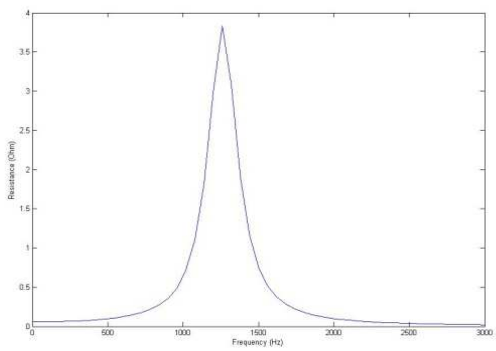

Fig.11 Real part of the harmonics impedance

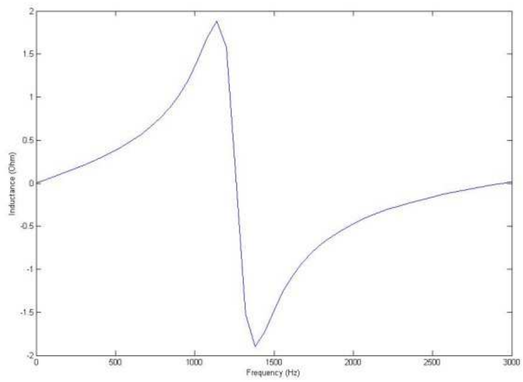

Fig.12 Imaginary part of the harmonics impedance

The three phase simulation model is as shown in fig.13

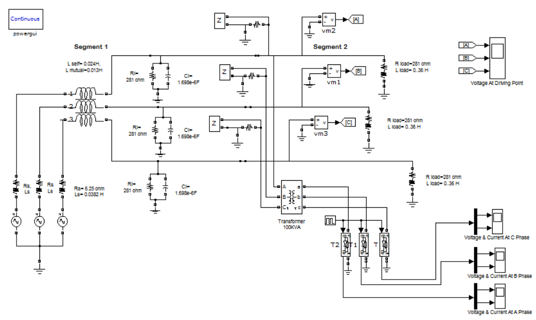

Fig.13 MATLAB simulation for extraction of harmonic impedance from three phase circuit

The impedance vs. frequency characteristic are obtained under fault and without fault condition for one (same for all phases) is as shown in fig.14 and fig.15 phase respectively. Since we are considering symmetrical fault the nature for all three phases are same.

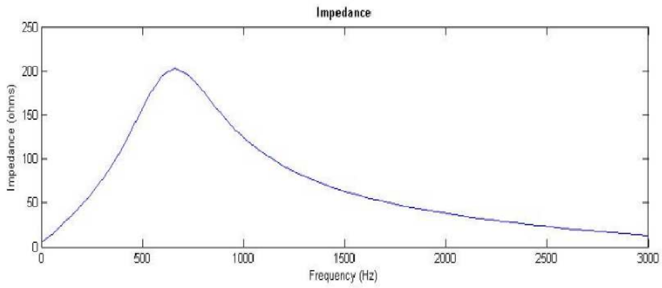

Fig.14 Impedance vs. Frequency curve without fault condition

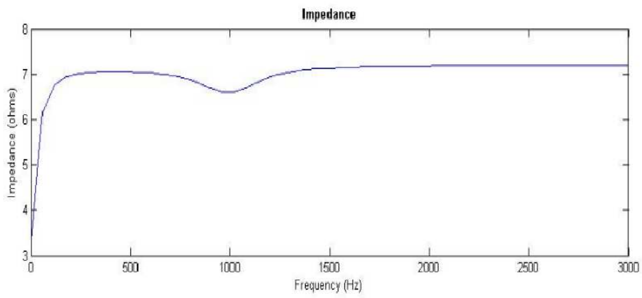

Fig.15 Impedance vs. Frequency curve under fault condition

The graphical representation of the resistance and inductance with respect to frequency with fault and without fault is shown in fig.16and fig.17 below..

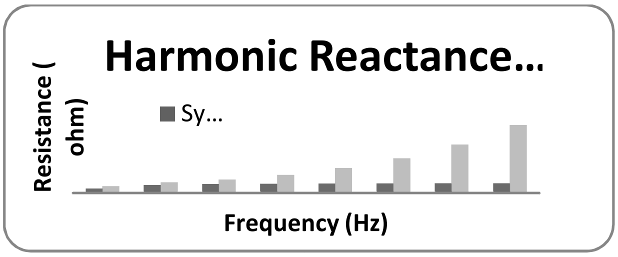

Fig.16 Resistance vs. Frequency (under fault and without fault)

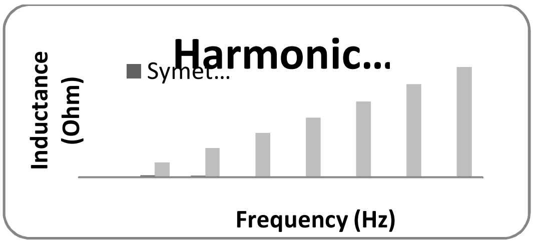

Fig.17 Inductance vs. Frequency (under fault and without fault)

V. Conclusion

This paper focuses on the extraction of harmonics impedance from single phase and three phase system. with the help of this extracted harmonic impedance we study the behavior of it under symmetrical fault and without fault condition for three-phase system. The measured system harmonic impedance coincides very well with the real impedance, which is calculated by using the system. And from the results it is observed that resistance and inductance under fault is constant and for without fault the resistance and impedance varies with respect to frequency.

VI. References

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