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Failure of Distribution Transformer Causes and it's Remedial Methods -A Case Study in operation sub Division (OSD), 33/11kv indoor substation/town4/ Guntur.

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ABSTRACT: Distribution transformers are essential components of electrical power distribution networks, but they can fail because of a number of things, including overloading, unbalanced load, short circuit currents, lightening strikes, failure of earthing, insulation and maintenance. The objective of this study is to investigate the mechanisms underlying these faults, their effect on overall efficiency, and potential corrective actions to lessen them. This project aims to give a comprehensive understanding of distribution transformer failures and suggest ideal strategies to increase their efficiency, thereby contributing to a more dependable and sustainable power distribution system. It does this by thoroughly reviewing the reasons of failures, case studies, and simulations. Faults affect the reliability of the power system network. The frequency and degree of faults determine the downtime (outage time) of a power system network. The more frequent fault occurs, the less reliable the power system is. To ensure a high degree of reliability and provide quality service at a reduced cost to consumers, protection, and control of fault are required. Successful protection and regulation of faults in the power system demand adequate knowledge and analysis of faults. This research work deals with the analysis of faults in Three Phase Transformer using MATLAB/SIMULINK.

I. INTRODUCTION

A distribution transformer is one of the important elements in power system. It is a piece of electrical equipment that needs continuous monitoring and fast protection since it is very expensive and an essential element for a power system to perform effectively. Distribution transformer internal faults may cause extensive damage or power system instability. Thus different transformer protection schemes are used to avoid interruptions of the power supply and losses. The tasks of protecting these systems can no longer be held in the traditional form because Electrical Power Systems have grown so big to meet a growing demand for electrical power.

Protective relaying principle exhibits certain limitations in applications with distribution transformers. This is because the detection of a differential current does not clearly distinguish between internal faults and other possible conditions. Transformer conveyed bulk power from the power generating station to consumers through the distribution lines, it does this at a high voltage to reduce losses along the transmission line. Three Phase transformer normally experience various faults abnormalities. A fault in any power system network circuit is any failure that interferes with the proper flow of electric current. This can be unexpected creation of conducting path, says short circuit fault and interruption to the flow of electric current says open-circuit fault. When fault current flows in a power system network, the short circuit electric current will become typically high say about six to ten times more than the proper or standard full load electric current in such power system circuit Typical Faults in an electric Power System circuit is said to take place when conductors or any two Three phase transformer comes in contact with each other or earth includes; Single -line- ground fault, Double -line- ground fault, Three -line- ground fault, and line- to line faults. These faults can also referred to as short circuit faults, which are common to a transmission line. There such power transmission system must be protected from the flow of heavy short-circuit currents, which can affect the safety of personnel and cause permanent damage to major equipment by disconnecting the faulty section of the system. The safe disconnection can be guaranteed if the current does not exceed the capacity of the circuit protecting equipment. Professionally in such situation these abnormal current flows need to be mathematically evaluated and its obtained results compared with the ratings of the various protective devise such as circuit breakers as a routine practice aim at enhancing preventive maintenance of the system. Depending on the location, the nature, the time involve and as well as the system network

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condition grounding, short circuits can results to I, Interference of electromagnetic discharge with conductors found within such vicinity. ii. Thermal or mechanical stress (that is, damage effect on equipment, personnel danger). The transmission line has resistance R, inductance L, capacitance C, and shunt or leakage conductance G. These parameters along with the load and the transmission line determine the performance of the power transmission line system.

II. OBJECTIVE

The objective of this study is to investigate the mechanisms underlying these faults, their effect on overall efficiency, and potential corrective actions to lessen them. This project aims to give a comprehensive understanding of distribution transformer failures and suggest ideal strategies to increase their efficiency, thereby contributing to a more dependable and sustainable power distribution system. It does this by thoroughly reviewing the reasons of failures, case studies, and simulations. Faults affect the reliability of the power system network. The frequency and degree of faults determine the downtime (outage time) of a power system network. The more frequent fault occurs, the less reliable the power system is. To ensure a high degree of reliability and provide quality service at a reduced cost to consumers, protection, and control of fault are required. Successful protection and regulation of faults in the power system demand adequate knowledge and analysis of faults.

III. DESIGN CONSIDERATIONS

The proposed digital differential relay is designed using a simulation technique in matlab/simulink environment. The aim is to protect the power transformer against internal faults. A distribution transformer functions as a node to connect 2 different voltage levels. Therefore, the continuity of its operation is of vital importance in maintaining the reliability of

Power supply. The differential characteristic of differential relay provides fast, sensitive and reliable tripping for internal faults and security against operation on large external faults. This paper includes modelling and simulation of the differential relay by using MATLAB and using this model to study all the environments affecting the operation of the protective relay for power transformer protection.

In this research a High Voltage Power Transformer line model was developed, faults simulated and analyzed such as R Phase, Y Phase and B Phase faults during the simulation study of the various faults, the FFT tool was used to analyze the harmonic content of the various faults. The effect of faults was observed and discussed. A discrete powergui with sampling time Ts=5e-05s was used for the simulation study under various fault conditions

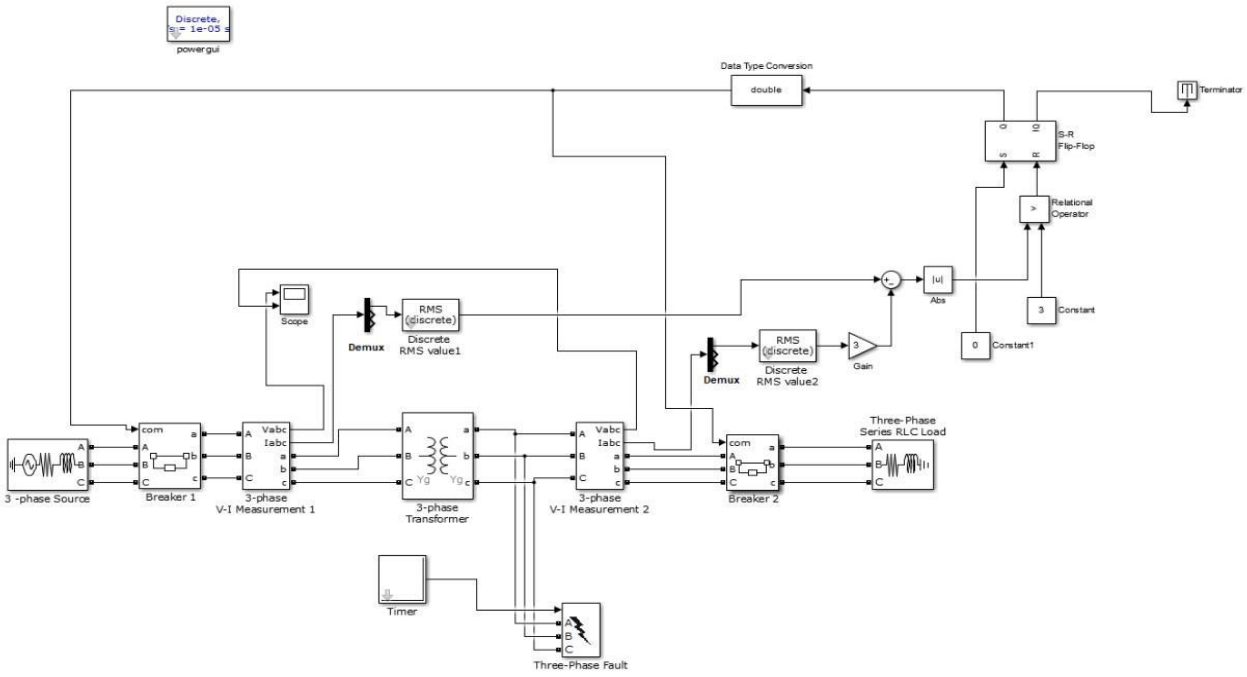

Fig-1: Differential protection of a three phase transformer

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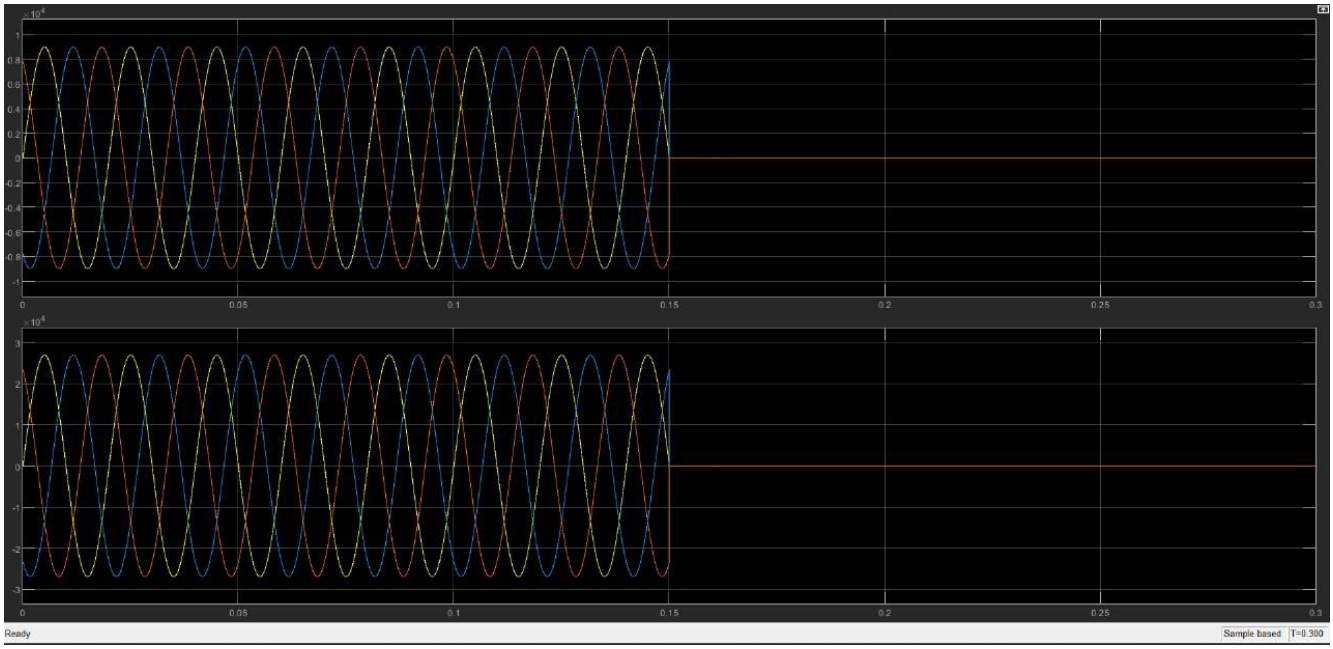

Fig-2: The result of the differential protection of a transformer

Protective relaying principle exhibits certain limitations in applications with distribution transformers. This is because the detection of a differential current does not clearly distinguish between internal faults and other possible conditions. So we proposed a method that how the converter will be efficient than relay to protect the transformer.

BLOCK DIAGRAM:

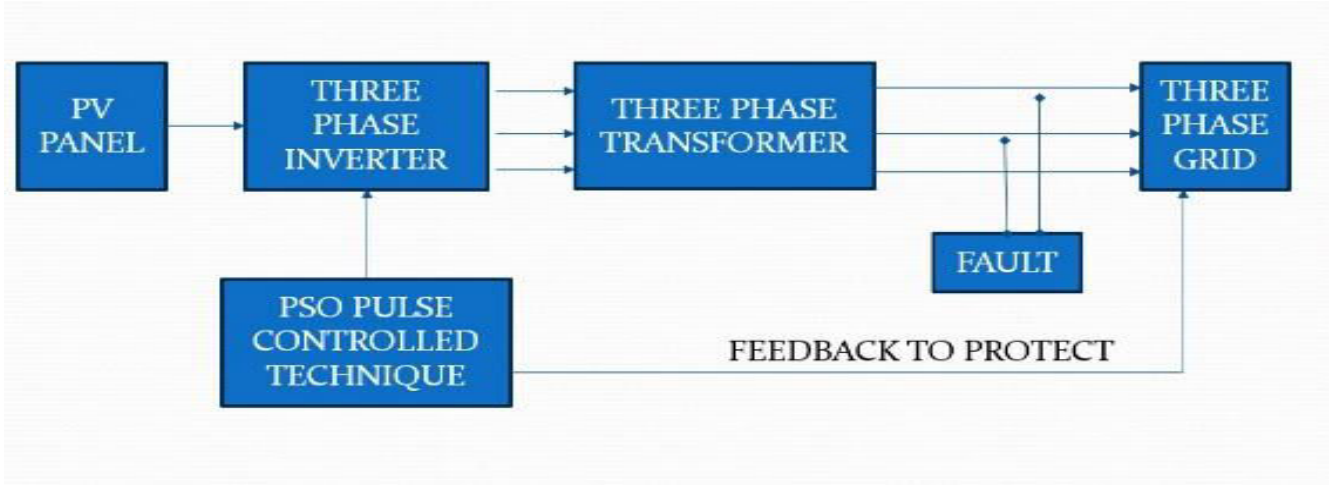

Fig-3:The value of the controller output is fed into the system as the manipulated variable input. In the case of tuning a PI controller, it is a two dimensional search space where the elements to be estimated are the K_p and K_i values.

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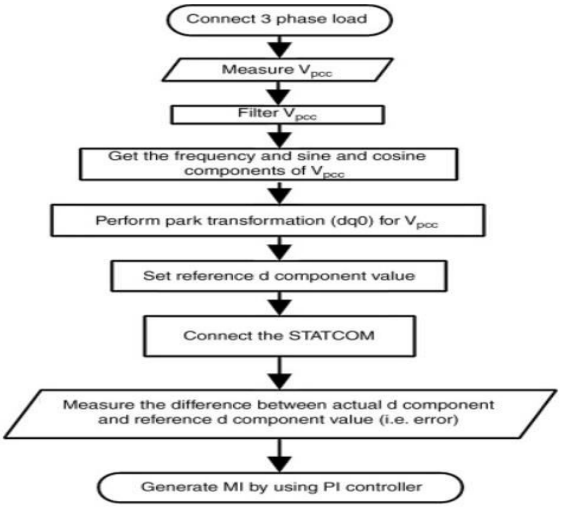

Fig-4: A flow chart which describes the operation of a PSO

Particle Swarm Optimisation (PSO):

A particle swarm optimisation (PSO) based method is presented for selective harmonics elimination (SHE) solution in pulse-width modulated (PWM). PSO is used to determine the switching pulses by solving the non-linear equation's formed with the Fourier analysis of the output waveform which enables the control of the fundamental component. The application of the proposed method to single phase and three phase inverter is demonstrated with respect to harmonic distortion by eliminating the unwanted lower harmonic component up to 19th order. The selected performance features are validated by relevant waveforms, which are obtained by simulation of different examples with the use of MATLAB software, which shows the better perform of the proposed method.

A flow chart which describes the operation of a PSO is given herewith.

SIMULINK DIAGRAM:

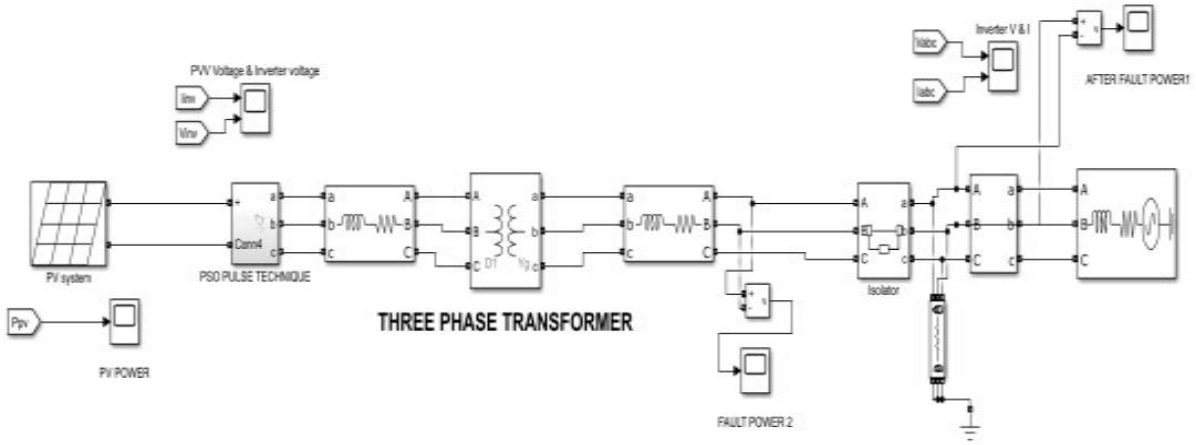

Fig-5: Simulink diagram of pso pulse controlled technique of a transformer

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SIMULATION RESULTS:

Fig-6: PV INPUT POWER (3.2KW) CURRENTBEFORE GIVEN TO TRANSFORMER

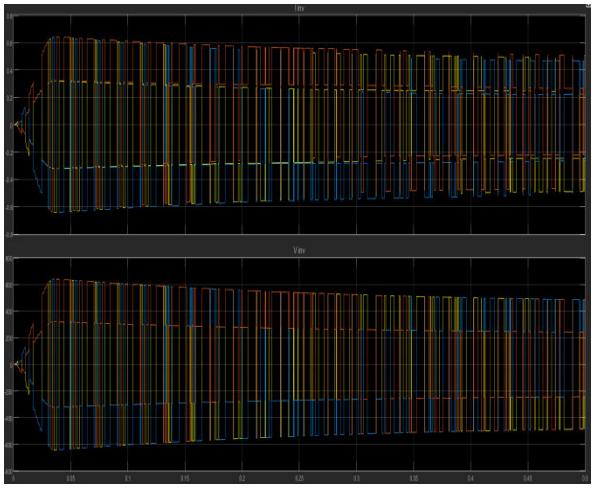

Fig-7: PWM INVERTER VOLTAGE AND

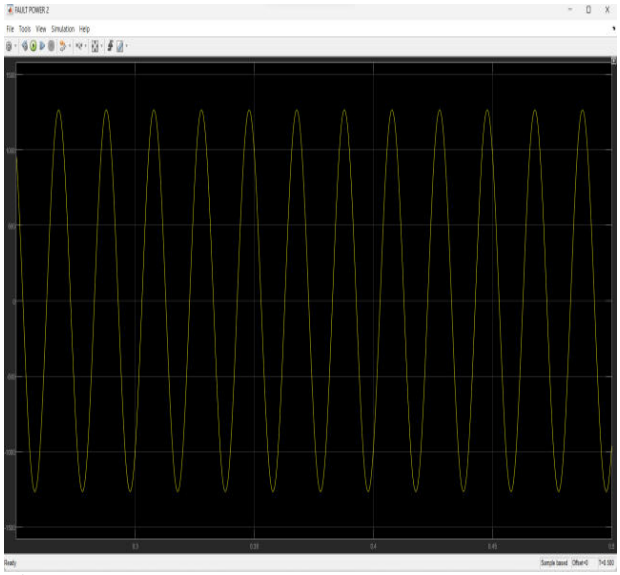

Fig-8: POWER OUTPUT FROM (AFTER)TRANSFORMER ANY PHASE

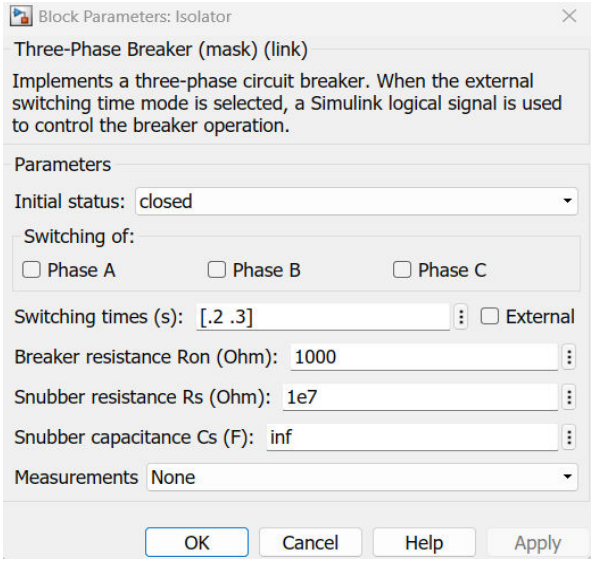

Fig-9: WHEN NO FAULT OCCURS AT

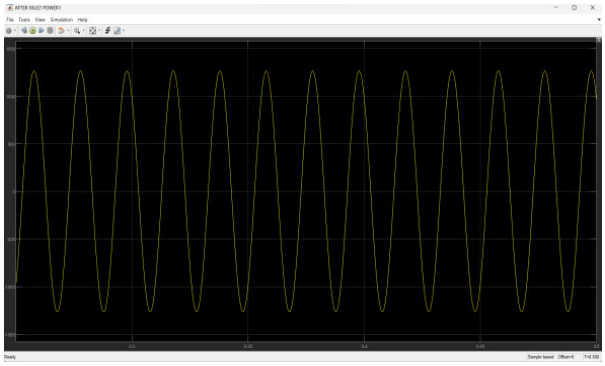

Fig-10: POWER OUTPUT DISTRIBUTED TO GRID

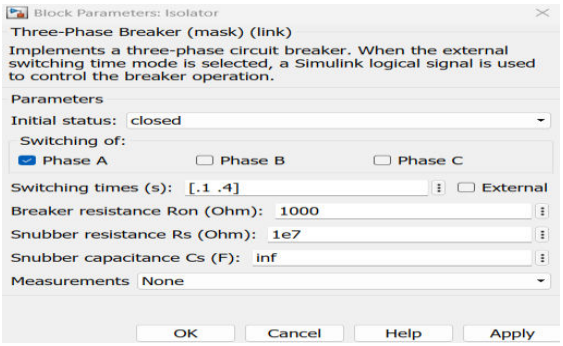

Fig-11: WHEN FAULT OCCURS AT PHASE A

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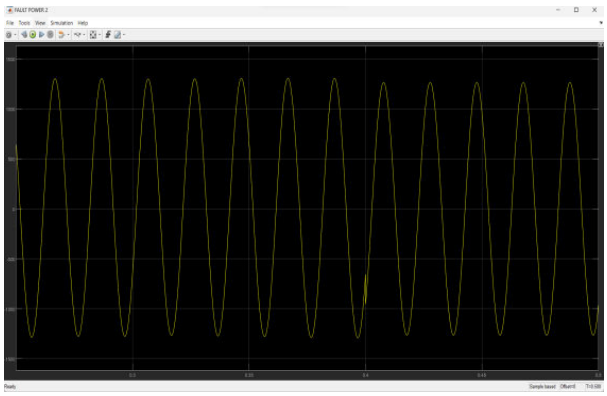

Fig-12: POWER OUTPUT FROM (AFTER)TRANSFORMER DISTRIBUTED TO GRID

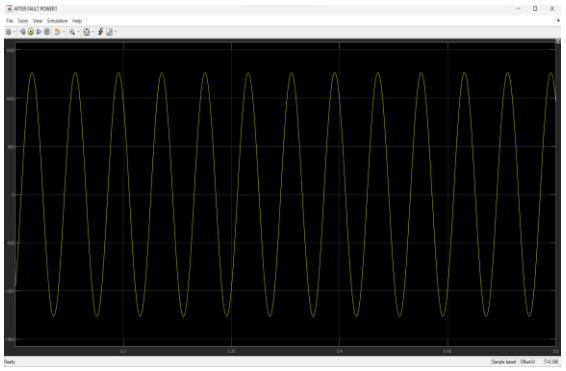

Fig-13: POWER OUTPUT

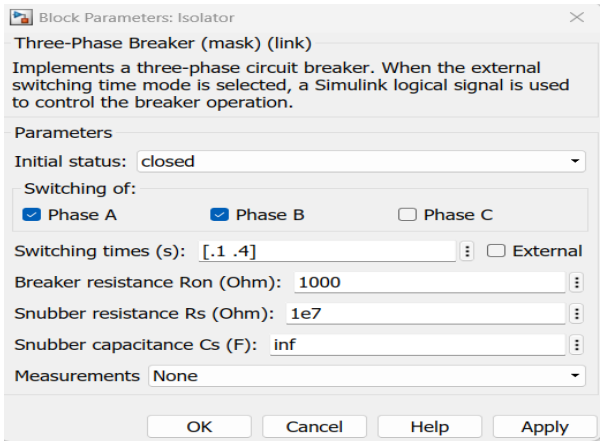

Fig-14: WHEN FAULT OCCURS AT PHASE A, B

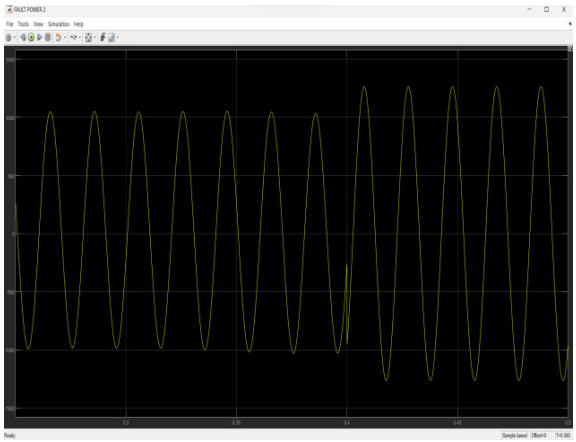

Fig-15: POWER OUTPUT FROM (AFTER) TRANSFORMER

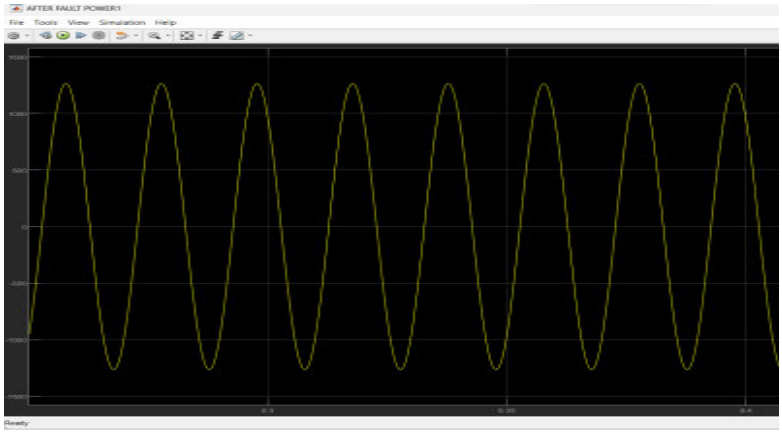

Fig--16: POWER OUTPUT DISTRIBUTED TO GRID

IV. CONCLUSION AND FUTURE WORK

Studied various reasons of distribution transformer failures and simulation is done on how the converter is efficient than relay to prevent the failure of distribution transformer which aims to detect internal faults, operational continuity, personal safety and asset protection, Simulation and analysis of three-phase electric transformer fault to achieve results of the transmission line system parameter is possible and convenient through the use of MATLAB software. In this research work, the transmission power system was modelled to show the Variations of voltage and current when a single-line-ground fault, double-line-ground fault and a three-line ground fault occurs in the transformer. To complete

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the task of isolating faulted parts of the power system, to maintain the continuity in power supply, fault analysis need to be carried out in every location under various fault conditions, its priority is to determine the appropriate protection scheme by determining the fault currents and voltages. In other words, the analysis of faults leads to optimum protection settings which can be analysed to select suitable circuit breaker rating and type of relays.

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