International Journal of Research in Engineering, Science and Management
Volume-3, Issue-8, August-2020
journals.resaim.com/ijresm | ISSN (Online): 2581-5792 | RESAIM Publishing

Fault Analysis by Using MiPower Software and Circuit Breaker Design

R. Viji[1*], P. Nagaraj[2], A. Vasanthanathan[3]
[1]*Student, Department of Mechanical Engineering, Mepco Schlenk Engineering College, Sivakasi, India*
[2]*Sr. Professor, Department of Mechanical Engineering, Mepco Schlenk Engineering College, Sivakasi, India*
[3]*Associate Professor, Dept. of Mechanical Engineering, Mepco Schlenk Engineering College, Sivakasi, India*
*Corresponding author: viji062496@gmail.com

***Abstract*: Fault analysis on power system is very important and difficult job to find the fault current in different condition. The studies and finding that fault current used to determine the reliability and stability of the power system and used to increase the safety of the system. Fault analysis also called the name short circuit analysis. The fault current values are used to determine the correct rated protective device for the power system. Evaluate the fault current at different scenarios of fault. If the power system is large it's difficult to find the fault current by hand calculation. In the present project, the power system software is used to find out the fault current virtually at different fault condition. The power system software used in the project is MiPower. The power system software mainly used to found out the fault current in different condition and different location of power system. Different locations are fault at bus and fault at line. For evaluation of the software output, the theoretical calculations are used in the present project. Using this fault current value, the suitable circuit breaker would be chosen and installed on the power system to protect the system from severe fault.**

***Keywords*: Circuit breaker, Different location, Different condition, Fault analysis, Fault current, Power system, Short circuit analysis, Protective device, MiPower.**

1. Introduction

Fault analysis is an important consideration in power system planning, protection equipment selection, and overall system reliability assessment [6]. At the heart of today's power generation and distribution are high-voltage transmission and distribution networks. Short circuit analysis is the first basic step to find fault current in the system. Fault current found by applying different fault condition in system. The faults are symmetrical fault and asymmetrical faults [1]. In Symmetrical fault such as all phase are short circuited each other (LLL) and often to ground (LLLG) [3]. In Unsymmetrical faults are Single line to ground fault (LG), Line to Line Fault (LL), Double line to ground fault (LLG). Based on such results and studies, protective device are to be designed or selected. From this fault current respective circuit breaker is designed and implement to system to reduce the fault current.

During normal condition of operation current follow to the system is normal. Fault occurring condition the normal operating voltage and current of the system is changed suddenly. Fault mainly occurs by the reasons of the tree falling on the transmission line, wind damage, insulation failure of the transmission line, human error. Analysis mainly gives the current and voltage of abnormal condition and also gives the short circuit current value this is called fault analysis. Abnormal condition in a power system is known as fault. Operating condition in steady state that time fault occur this fault is called balanced fault. It disrupts the system suddenly [5].

When the insulation of the cable failure it touches external object that time short circuit or fault occur. This live point contact produce large amount of current. And damage the system and equipment. It is serious threat to human life, injury to human, extensive damage to equipment. Short circuit analysis for large systems needs to found both relay rating and rating of switchgear [4].

2. Objective

A. Main Objective

To find the different fault current of the power system. To ensures the safety and reliability of power system. Use these fault current values to select or design the respective circuit breaker. Reduce the short circuit current by implementing the respective circuit breaker. The determination of fault currents aids to selection and coordination of protective equipment to ensure the safe and reliable operation of the system.

B. Problem Identification

In company the capacity of power system is large, larger the capacity of power system supplying the system, the greater the available short- circuit current. Short-circuit current differ at different fault condition. Unsymmetrical fault is more dangerous than symmetrical fault.

3. About Mipower Software

MiPower is the power system based software. It is highly interactive, use friendly software for all planning design analysis and simulation on any power system given environmental condition and geographical irrespective [2]. Software conforms standard ANSI, IEEE, IEC and other

accepted worldwide standards.

A. *Procedure to work on MiPower*

The following steps represent the procedure of MiPower software,

- Draw the single line diagram
- And fill the required date into the generator, transformer and bus-bar voltage
- Click on the generator to fill generator MVA, KV values.
- Click on the transformer to fill voltage of the transformer.
- Click on the motor to fill motor details
- Then simulate the single line diagram for short circuit analysis.
- And get the result on notepad documentnt.

B. *One Line Diagram*

One-line diagram is also called single line diagram (SLD). It is representation of three phase power system. SLD has large applications in power system studies.

Electrical elements of power system such as transformer, circuit breaker, bus bar, capacitor and conductor are represented by using standardized symbols of schematic.

It is a one kind of block diagram graphically creates the power flow between the paths.

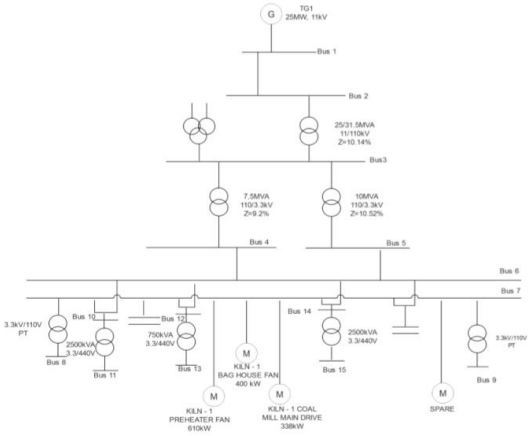

Fig. 1. Single line diagram of kiln-1

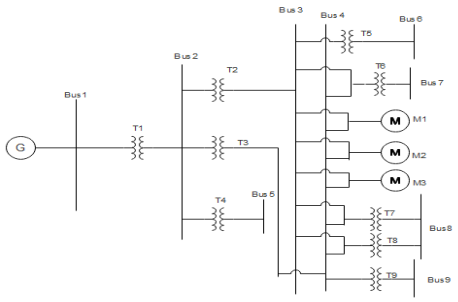

Fig. 2. Simple SLD of kiln-I

C. *Methodology*

Collecting the required data for entering into the MiPower software is the first important step. The data are Generator Voltages, bus voltage, transformer impedance value in per unit and load impedance value in per unit. Data collection is little difficult. Collected date not in required form so converted to require per unit values. Once data collection is over then draw the single line diagram in sheet. The open the MiPower software and draw that single line diagram on it. During the draw period data is simultaneously enter into the power system components such as bus, generator, transformer and load. Then according to the fault the fault condition will be changed and fault location also changed. Finally, the output of the MiPower Software is compared by theoretical calculation to verifying the output of the software. By using is short circuit current value suitable circuit breaker is selected and installed in the power system.

The following steps taken to done the analysis,

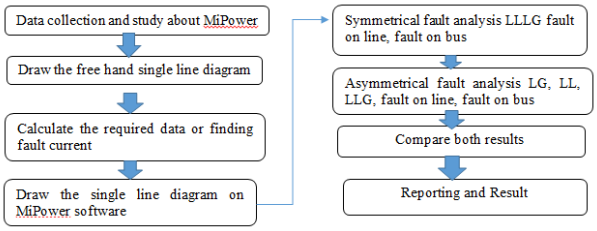

Fig. 3. Methodology

Table 1
Generator data

Source	MVA	kV	X%	Zp.u new (p.u)
TG	25	11	18	j0.2268

Table 2
Bus data

Bus	Voltage
Bus 1	11 kV
Bus 2	11 kV
Bus 3	3.3 kV
Bus 4	3.3 kV
Bus 5	3.3 kV
Bus 6	110 V

4. Simulation

A. *Power system diagram*

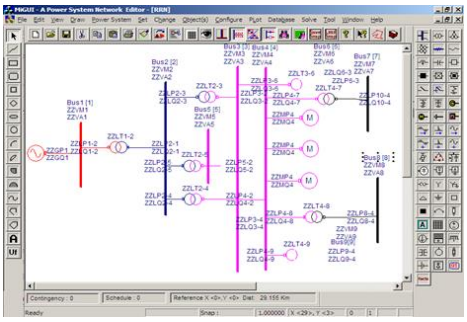

Fig. 4. Power system diagram

Table 3
Transformer data

Transformer	From Bus	To Bus	MVA	kV	Impedance(Z) in %	Zp.u new (p.u)
T-1	1	2	25/31.5	11/110	10.14	j0.1014
T-2	2	3	10	110/3.3	10.52	j0.3314
T-3	2	3	7.5	110/3.3	9.2	j0.3864
T-4	2	5	10	110/3.3	10.52	j0.3314
T-5	7	9	1.5	3.3kV/110 V	5.2	j1.092
T-6	3-4	7	2.5	3.3kV/110 V	4.2	j0.5292
T-7	3-4	8	0.75	3.3kV/110 V	5.4	j2.268
T-8	3-4	8	2.5	3.3kV/110 V	5.6	j0.7056
T-9	4	9	1.5	3.3kV/110 V	5.7	j1.197

Figure 4 shows the power system diagram how shown inside the simulation software.

B. Output of the fault current

The value of the short circuit current is shown in the following figure 6.

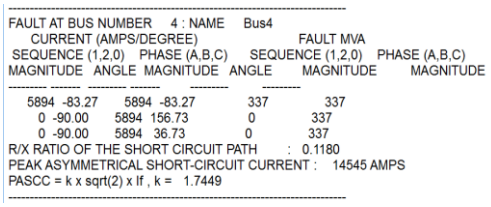

Fig. 6. Output of short circuit current

1) Short circuit current of bus at different fault condition

Table 5
Short Circuit Current

Bus no.	3phase G AMPS	LG AMPS	L L AMPS	L L G AMPS
Bus 1	11952	4922	6618	8845
Bus 3	1108	417	557	792
Bus 4	5894	1065	2952	3311
Bus 5	3452	849	1730	2063

Table 6
Final Result from the Calculation

Bus no.	3phase G AMPS	LG AMPS	L L AMPS	L L G AMPS
Bus 1	7243	4925	6410	8760
Bus 3	1107	412	550	780
Bus 4	5917	1057	2891	3302
Bus 5	3460	799	1665	1999

5. Conclusion

The fault analysis by using MiPower software was able to generate the result based on the given input data. The result of the MiPower software was verified by the theoretical calculation. The main intension of this project is to select correct rating protective equipment for power system. This fault analysis must take in each and every power system, after the power system take place in any requirements like domestic, commercial and industrial purpose. This fault analysis is suitable for every power system. Each and every industry must have these details in document format. If any abnormal situation these documents used to found out the reason for fault. The slight variation between theoretical calculation and simulation output of the software. The both fault current noted respectively for bus 1, bus3, bus4 and bus5. The different fault condition was fault take place and the respective fault current values are noted.

References

[1] A. Prabhu, A. Subramaniya Siva, “Short Circuit and Contingency Analysis Implementation for IEEE-14 Bus System using MiPower Software,” International Journal of Advanced Research in Computer and Communication Engineering, 2019.

[2] Drishti Yadav, “Short Circuit Studies on 6-bus Power System using MiPower Software,” International Journal for Scientific Research & Development, 2017.

[3] Sumit Rathor, “Short Circuit Analysis Case Study & Circuit Breaker Design,” 2016.

[4] Debniloy De, Shivanjali A. Mishra, Aditya Kar and Sheila Mahapatra “Short Circuit Analysis of a Power Grid using MiPower Software,” Advance in Electronic and Electric Engineering Research India Publications, 2014.

[5] Pranshu Shrivastava, Shweta Sahu Modi, Pooja Shrivastava, “Short circuit analysis by using mi-power,” International Journal of Engineering Research and Applications, 2014.

[6] S. Srivastava, “Three Phase Fault Analysis and Breaker Sizing Using Mipower Software,” Proceedings of International Academic Conference on Electrical, Electronics and Computer Engineering, 8th Sept. 2013, Chennai, India ISBN: 978-93-82702-28-3.