



Review on – Impact of Symmetrical/Unsymmetrical Fault on Parallel Feeder Based Distribution System Using PSCAD/EMTDC Software

Prof. Digambar.R.Bhise¹, Badhe Prasad Arun², Ekhande Pratik Jitendra³, Gavit Ishwar Sudam⁴, Jadhav Abhijit Sanjay⁵

¹Assistant Professor, Department of Electrical Engineering, Matoshri College of Engineering and Research Centre Nashik.

²Student, Department of Electrical Engineering, Matoshri College of Engineering and Research Centre Nashik.

³Student, Department of Electrical Engineering, Matoshri College of Engineering and Research Centre Nashik.

⁴Student, Department of Electrical Engineering, Matoshri College of Engineering and Research Centre Nashik.

⁵Student, Department of Electrical Engineering, Matoshri College of Engineering and Research Centre Nashik.

ABSTRACT:

Installation of parallel feeder increases reliability and uninterrupted power failure in distribution system and continuity of power supply maintained for consumers. Parallel feeder increases flexibility and scalability of power system. In this project, deals with examine of fault impact on parallel feeder based distribution system. The work presented in this project consist of simulation of parallel feeder in PSCAD/EMTDC software. Observing both sources current and load current is done in the simulation. The impact of fault current on different four busses under the influence of L-G, LL-G, LLL-G and LL with and without protection is studied. The severity of fault is much more in LLL-G fault as compared to other faults.

Keywords: Distribution feeder, circuit breaker, symmetrical and unsymmetrical fault.

1. INTRODUCTION

Electric power distribution is the final stage in the delivery of electricity. Electricity is carried from the transmission system to individual consumers. Distribution substations connect to the transmission system and lower the transmission voltage to medium voltage ranging between 2 kV and 33 kV with the use of transformers.

A parallel distribution feeder system [1] refers to a network where multiple distribution lines run in parallel to supply electricity to consumers. These parallel feeders enhance reliability [5] load sharing, and fault tolerance. By distributing the load across multiple paths, power distribution becomes more efficient and resilient.

2. PROBLEM STATEMENT

In urban and rural area power interrupted because of radial feeder used. In radial system different feeders radiate from a substation and the distribution at one end a fault in the feeder will result in supply failure to associate that connected consumers as there is no any alternative feeder to feed the distributor.

3. OBJECTIVES

- Observe Behaviour of parallel feeder during normal operating condition.
- Observe Behaviour of parallel feeder during symmetrical and unsymmetrical fault condition.
- Determine of short circuit current when fault at feeder line 1 and feeder line 2.
- Observing all bus voltages is during normal and faulty condition.
- Different fault impact analysis of feeder line (L-G, L-L-G, LLL-G, L-L) and protect system from fault current with the help of over current protection.

4. LITURATURE SURVEY

LITURATURE SURVEY NO. 1 (Based Paper)

- Title of Paper: - Analysis of three phase parallel distribution feeder fed from different substation.
- Journal/Conference Name:- A.P.Berman is with utility consulting International, San jose, USA.
- Publisher/Vol/ Page No :- 978-4244-6547-7110,2010, IEEE

What is given in the paper	Methodology	How is it useful for our project
➤ Parallel distribution feeder in the environment of automated distribution operation coordinate with transmission operation.	➤ Using compensation method find three phase weakly meshed distribution system with multiple source.	➤ The critical segment is the one with the smallest ampere margin, in which the current will increase after paralleling.

LITURATURE SURVEY NO. 2

- Title of Paper :- Design & Development of directional overcurrent relay for parallel feeder protection
- Journal/Conference Name:- International journal of engg. Research & development(IJERD)
- Publisher/Vol/ Page No :- ISSN : 2278-067* (RTEECE 17th – 18th April 2019)

What is given in the paper	Methodology	How is it useful for our project
➤ Implementation of directional overcurrent relay for parallel feeder protection.	➤ Using directional, Bidirectional overcurrent relay protect the power system for various faulty condition.	➤ The working of overcurrent protection relay when various type of fault occurs in distribution system with parallel feeders.

LITURATURE SURVEY NO. 3

- Title of Paper :- Performance evaluation of overcurrent protection relay base on ROT
- Journal/ Conference Name :- International journal of electrical engg. And applied science.
- Publisher/Vol/ Page No:- ISSN:2600-7495 IJEEAS , vol.1 , No.1 , April 2018.

What is given in the paper	Methodology	How is it useful for our project
➤ A model of overcurrent protection scheme and how investigate the effect of overcurrent relay performance on relay operation time (RTO)	➤ Model of Overcurrent relay is provided. To asses the performance of this model an overcurrent relay model is designed and simulated by using PSCAD simulation.	➤ Performance of over current relay during normal operating & faulty condition base on relay operating time.

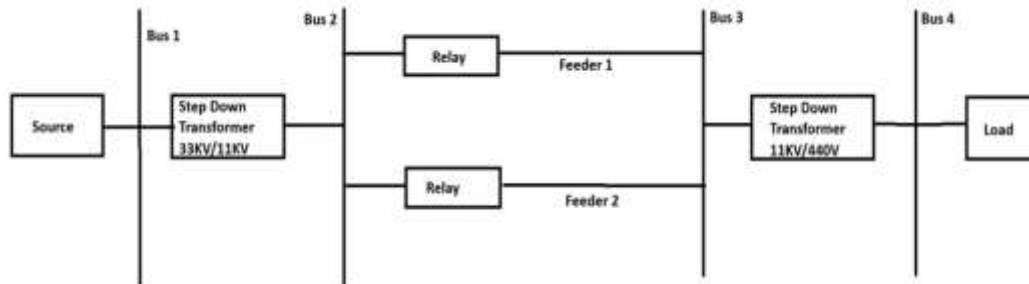
5. METHODOLOGY

- PS-CAD Software will be detailed system design, simulation & modelling [4] the parallel feeder system to observe the behaviour during fault.
- The project will begin by thoroughly studying existing system fault analysis techniques and how parallel feeder system work for that gather valuable insights from different substation.
- Parallel feeder load shifting method at manually [6] and after that used automation in distribution system.
- Data will be collected from Samangaon substation nashik (33/11 kV) distribution substation to validate its result in our system.

6. MOTIVATION

Parallel feeder is the source to minimize limitation and disadvantages of radial feeder during faulty condition. Parallel feeder used where load sharing is an emergency but this case not happened in radial feeder. In urban area most of time the power interrupt because of radial feeder used.

7. SYSTEM ARCHITECTURE



7.1 TRANSFORMER: - A transformer is an electrical device that transfers energy between two or more circuits through electromagnetic induction. It is commonly used to step up or step down voltage levels in electrical power transmission and distribution systems.

7.2 FEEDER: -A feeder is a component of an electrical distribution system that delivers electrical power from a substation to a specific area or group of consumers. It typically consists of conductors, switches, and protective devices to regulate and control the flow of electricity.

7.3 BUS-BAR:- A busbar is a metallic strip or bar used to distribute electrical power within a switchboard, distribution board, or electrical substation. It provides a common connection point for multiple electrical circuits and facilitates the efficient transmission of electricity.

7.4 CIRCUIT BREAKER:- A circuit breaker is a safety device designed to automatically interrupt electrical flow in a circuit when it detects an overload, short circuit, or other fault. It helps protect electrical equipment and prevent damage or fire by quickly cutting off power in hazardous situations.

7.5 RELAY:- A relay is an electromechanical device that switches electrical circuits on or off based on signals received from other devices or circuits. It acts as a remote-controlled switch, allowing for the automation of various electrical processes and systems.

8. SOFTWARE TOOL USE IN OUR PROJECT

PSCAD/ EMTDC--: PSCAD is a simulation software widely used for analysing and designing power systems. It allows engineers to model complex electrical networks, simulate various operating conditions, and evaluate system performance. Its user-friendly interface and comprehensive library of components make it a preferred choice for electrical engineering projects.

9. SYSTEM UNDER STUDY:

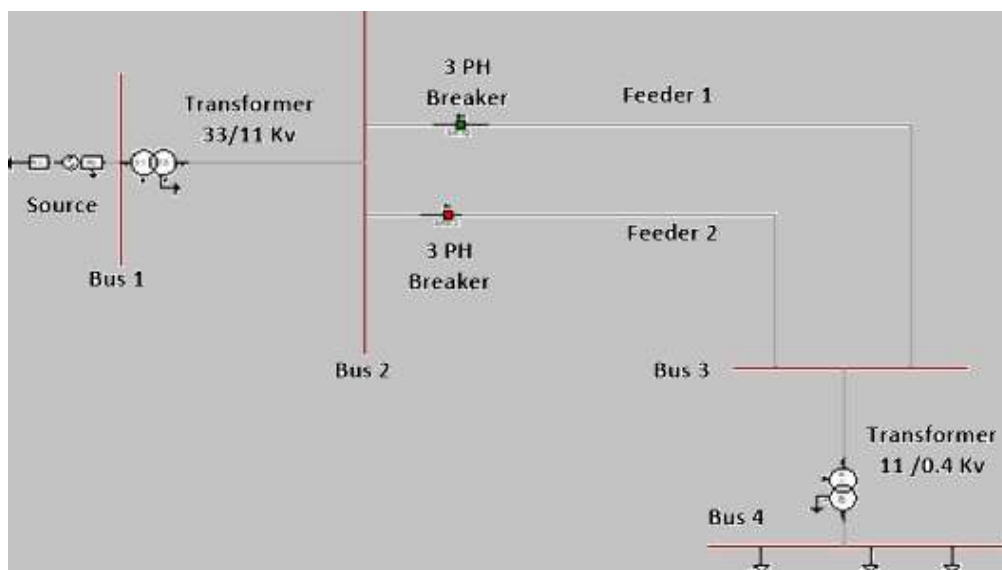


Fig.1 PSCAD Simulation of Four Bus System

Above fig shows PSCAD simulation of four bus parallel feeder based distribution system. It has source side transformer rating is (33/11) kV .The system having two parallel feeders equipped with relays and three phase circuit breaker for fault detection and load shifting at faulty condition. Each relay monitors electrical parameters and activates to disconnect the faulty feeder, ensuring uninterrupted power supply by shifting the load to the healthy feeder and continuity of power is provided to load side (consumers). In our project verify Kirchhoff law at normal operating condition and check source current equal to load current or not and measure short circuit level after creating fault [2]. After that created different fault like (L-G, LL-G, LLL-G LL, LLL-G) on feeder line 1 and validate result. Required data will be collected from Samangaon substation (33/11 kV) Nashik distribution substation to validate its result in our system.

Following cases created in our project

- System with normal operating condition (Without fault).
- System with fault at feeder line 1.
- System with fault at feeder line 2.
- System with different fault such as (L-G, LL-G, LLL-G ,LL, LLL) (without overcurrent relay)
- System with different fault such as (L-G, LL-G, LLL-G ,LL, LLL) (with overcurrent relay)

10. ADVANTAGES OF PARALLEL FEEDER BASED DISTRIBUTION SYSTEM

- Increase the overall reliability of distribution system.
- The Contribution to the development of more robust and resilient distribution system design, ensuring reliable power supply to consumers, even in the presence of fault.
- Reduce downtime and more reliable power supply is essential or there are loads such as hospital which required high level of reliability.

11. SYSTEM REQUIREMENTS

- **System compatibility:-**

The PSCAD software must be compatible with the following operating systems: Windows 7,10,11 and more. It should be compatible with both 32-bit & 64-bit systems. Minimum hardware requirements should include dual-core processor, 8GB Ram.

- **User Interface :-**

The software's user interface is intuitive for engineers to design, configure, and run simulations effortlessly. It offer visual representations of power systems, real-time data visualization, and support import/export functionality for common formats (e.g., CSV, MATLAB, and CDF).

CONCLUSION

We have successfully define objective and methodology of our project. Architecture and simulation is ready in first module. In next module will verify result the of parallel feeder based distribution system in PSCAD software. The future scope of this research lies in implementing advanced fault detection technologies and developing strategies for quicker fault recovery in distribution system. This research serves as a stepping stone for creating more resilient and adaptive distribution systems, addressing challenges and ensuring a more reliable power supply as well as build automated distribution system in the future.

REFERENCES

- [1] Alex Berman , Nokhum Markushevich Member IEEE , “*Analysis of Three-Phase Parallel Distribution Feeders Fed from Different Substations*” 978-1-4244-6547 , IEEE , San Jose , USA , 2010.
- [2] Digambar Bhise, Ravishankar Kankale, “*Impact of distributed generation on short circuit level*” ISSN No 2349-784X IJSTE vol .5 issue 3, September 2018.
- [3] Mohd Hendra Hairi , Mohd Shahrieel Mohd Aras , Farhan Hanaffi , Marizan Sulaiman , “*Performance Evaluation of Overcurrent Protection Relay Based on Relay Operation Time (ROT)*” , ISSN: 2600 – 7495 , IJEEAS , Vol. 1 , No. 1 , April 2018.
- [4] Vijay Khunt , Bhumit Bhadiyadra , Balvant Dharajiya , Chirag Sukhadiya , Milind B Trivedi and Deepak C Bhonsle , “*Design and Development of Directional Overcurrent Relay for Parallel Feeder Protection-A Lab Prototype*” , ISSN: 2278-067X , IJERD , ITM Universe-Vadodara , RTEECE 17th – 18th April 2015.
- [5] Wenpeng LU'AN , Helen IOSFIN BC hydro –Canada “*Parallel Feeder Operation Scheme Based On Distributed Automation Logic*” 21st International Conference on Electricity Distribution , Frankfurt, 6-9 June 2011.

[6] Nichita Cristian , Al Ameri Ahmed, Brayima Dakyo “*Impact Analysis of Distributed Generation on Mesh and Radial distribution network*”, Overview and State of the art, PLUMEE Conference – Romania, 2013.