International Journal of Advances in Engineering and Management (IJAEM)
Volume 5, Issue 4 April 2023, pp: 1321-1324 www.ijaem.net ISSN: 2395-5252

Relay Coordination of Over current Relay Using ETAP

Sanjay P Parmar
[1,2]*Student, Department of Elecrical Engineering*
Sankalchand Patel University, Visnagar, India

Date of Submission: 15-04-2023 Date of Acceptance: 25-04-2023

ABSTRACT:
In power system protection relay and circuit breaker are the most important instrument for large inter connected power system. In the event of fault, it is essential that relay should operate in correct sequence in order to maintain reliability in the power system network. Our main objective is to do over current relay coordination for radial feeder system using ETAP software.
Relays and circuit breakers are most important in the modern large interconnected power system. For a minimize unnecessary outage in the power system properly relay coordination is required. Ultimate goal is improved efficiency and decrease unnecessary outages.
KEYWORDS:ETAP software,Relay,CBs, X'mer, Isolator, Power grid, Bus bar

1. INTRODUCTION

In the electrical power sector the required to take prognosticative action rather than simply reacting to events after they occurs is requiring intelligent applications to provide real time prognosticative power system simulation, optimization and automation. Therefore, the design and operation of modern power grids require efficient and content-specific information exchange contained in model-driven engineering systems. A company that leads the industry and is raising the bar with every passing year is ETAP. Operation Technology, inc. ETAP is the designer and developer of ETAP (Elecrical Transient Analyzer Program) software. In electrical system for a design, modelling, analysis, optimization, monitoring, control and automation ETAP software is required. The company is provide service more than 35 years by providing the most comprehensive and widely used enterprise solutions for power generation, transmission, distribution and low voltage power systems. The protective relay should be able to discriminate between normal, abnormal fault conditions. The relay coordination clearly means of discrimination, selectivity and backup protection.

II. RELAY

Relay is a low powered electromechanical device is used to activate a high powered device. Relays main function to trigger circuit breaker and other switches in transmission and distribution systems and substations. The main goal of relays is to find problems at the initial stage and eliminate the damage or reduction or significant reduction of equipment in the power system. Microprocessor digital protection relay now imitates the original equipment and provides a type of protection and monitoring through electromechanical relay. Electromechanical relays provide only basic information about errors and their causes.

FIG 1.1 RELAY

III. OVERCURRENT RELAY

Current coil in the over current relay is essentially required. If the normal current flows through the coil, the magnetic effect generated by the coil is not enough to attract itself to make the mobile coil in the relay. In this condition the restraining force is greater and deflecting force is less . However, if the fault conditions increase the power through the coil, the magnetic effect increases and increases after a certain current level, and the derivation is generated by the magnetic tube, and the temporary force is over. As a result, the moving element began to move to change the contact position in the relay. There are many different types of overcurrent relays, but all overcurrent relays work on the same principle

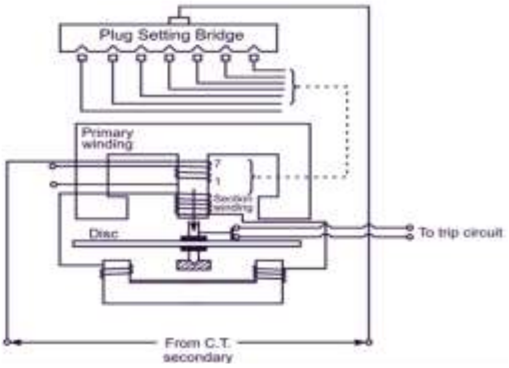

FIG 1.2 OVER CURRENR RELAY

IV. RELAY COODINATION

This project includes clever implementation of relay coordination the use of ETAP and also multifunction relay having blended particular time and inverse time characteristics. Relay coordination study is used in electrical power system to selectively isolate the faults. ETAP star-protective device coordination program is used for this section study.It has a broad device library, a Time Current characteristics curve with a geographical user interface, etc. We can fix false trips, relay miscoordination, etc. with the help of this study.

In order to complete this phase of the analysis, we must supply the CT and CB settings and the fault current flowing through the line. These parameters are used to choose and set up relay characteristics. After applying this defect to a line or bus, the relay operation is examined. If the relay operation is not coordinating then the TTC curve is adjusted to get the relay coordination. Since it has a loop system the relay in the loop has a directional element. The relay coordination is a study that assures tripping of protecting relay in a sequence or in a proper order in electrical power system.To isolate the defective component with the least amount of relay and circuit breaker, relay coordination is necessary.

With the help of relay coordination determine proper settings for over current protective devices ensure fast elective and reliable operation of protective device and also avoid nuisance tripping in plants and thus enabling continued services is healthy parts of network.

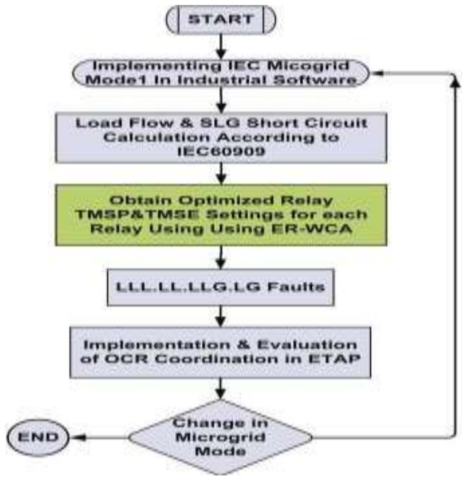

FIG 1.3 BLOCK DIAGRAM

V. PROCTION ZONES

- ❖ Generator
- ❖ Generator-Transformer Units
- ❖ Transformer
- ❖ Buses
- ❖ Line (Transmission and Distribution)
- ❖ Utilization equipment like- motors, statics loads,etc.
- ❖ Capacitor or Reactor(when separately protected)

VII. RELAY CALCULATION

Pick-up value is minimum value of actuating quantity at which relay starts operating.

- ❖ $\text{Plug setting} = \frac{\text{Pickup current}}{\text{Rated secondary current of relay}} \times 100$
- ❖ $\text{Plug setting multiplier} = \frac{\text{Fault current in relay coil}}{\text{Pickup current}}$

$$= \frac{\text{Fault current in relay coil}}{\text{Related secondary current} \times \text{currentsetting}}$$

- ❖ $\text{Time setting multiplier} = \frac{\text{Desired operating time of relay}}{\text{Relay operating time at selected TSM\&PSM=1}}$
- ❖ $\text{Relay operating time} = \text{TMS} \times \left[\frac{k}{\infty\left(\frac{I}{I_p}\right)-1}\right] \text{Seconds}$

Whare, I = Measured current value
Ip = pickup current
K, ∞ = Curve set related parameter

VIII. PROTECTIVE DEVICE SETTING

Relay name	Manufacturer	Model	CT Ratio	Time Dial setting
Relay_1	ABB	50B	50:5	0
Relay_2	ABB	50B	50:5	0
Relay_3	ABB	50D	50:5	0.05
Relay_4	ABB	50D	100:5	0.08
Relay_5	ABB	50D	100:5	0.11

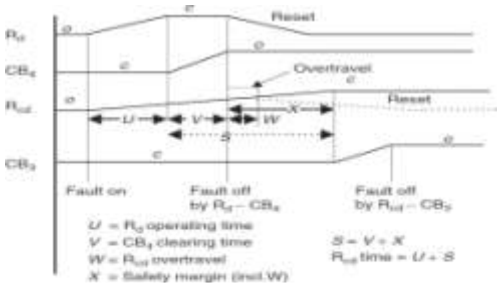

FIG 1.4 TIME DELAY SETTING FOR OC RELAY COORDINATION

IX. SIMULATION AND RESULTS

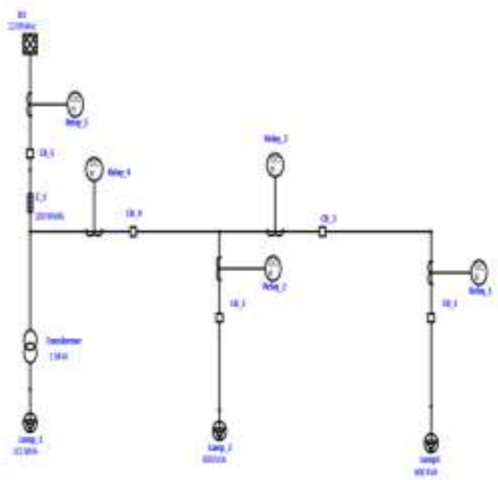

FIG1.5 MODEL OF REDIAL SYSTEM

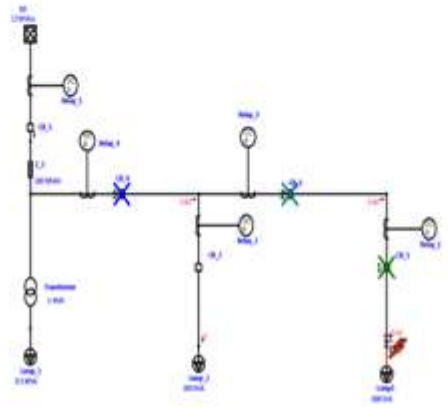

FIG 1.6 FAULT AT LUMPED LOAD 3

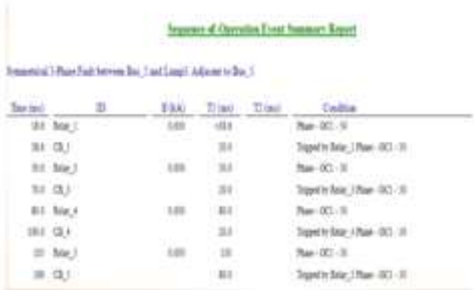

FIG 1.7SEQUENCE OF OPERATION OF CBs

❖ If relay give signal but circuit breaker is not operate because some technical problem, relay give signal to another circuit breaker.

FIG 1.8 SEQUENCE OF OPERATION OF CBs

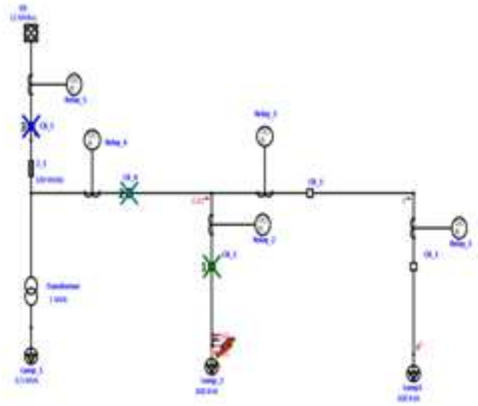

FIG 1.9 FAUL AT LUMPED LOAD 2

FIG 2.0 SEQUENCE OF OPERATION OF CBs

❖ If relay give signal but circuit breaker is not operate because some technical problem, relay give signal to another circuit breaker.

FIG 2.1 SEQUENCE OF OPERATION OF CBs

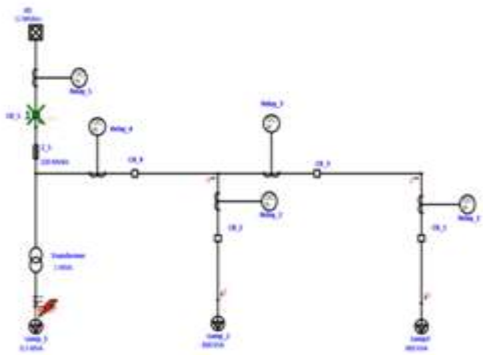

FIG 2.2 FAULT AT LUMPED LOAD 1

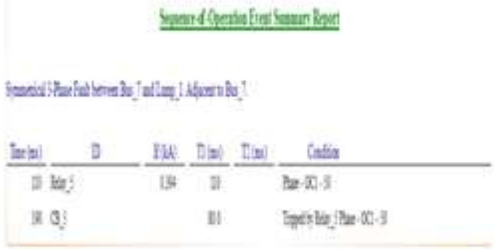

FIG 2.3 SEQUENCE OF OPEARION OF CBs

X. CONCLUSION

The simulation results show how we can achieve the correct order of operations with ETAP star coordination, also see the effect of harmonics on the order of operations when THD is high, and design filters to reduce this harmonic distortion to achieve correct relay coordination to obtain. Hand calculations were also performed for simple tuned filter designs and compared with ETAP calculations.

REFERENCE

[1]. "Impact of Harmonics on the Performance of Over Current Relays", by Hilary Tin, A. Abu-Siada, and M.S. Masoum, IEEE 2011
[2]. H. Saadat, "Power System Analysis", McGraw-Hills Inc., 2002
[3]. How the Harmonic Mitigating Transformer Performs Outperforms the K-Rated Transformer. HOEVENAARS, T. 1999 MIRUS International Inc
[4]. "Power System Analysis" by, G. Stevenson,
[5]. McGraw-Hills Inc., 1994
[6]. "Power System Protection and Switchgear" by Badri Ram, Tata 2007; McGraw Hill
[7]. The book "Protective Relaying Principles and Application" by J. Lewis Blackburn, published by CRC Press in 2014.
[8]. "Line Protection with Overcurrent Relays", C. Russell Mason, Wiley, 1956
[9]. "DRV-WP drive in power system" by Nikunj Shah, Siemens Industry Inc.
[10]. "Power System Harmonics" by Jos Arrillaga and Neville R. Watson, published by John Wiley & Sons in 2003
[11]. "Power Quality Powers and Mitigation Techniques", by John Wiley & Sons, 2015