

Relay Coordination for Four Busbars Transmission Grid

R. Karthikeyan and K. Kavitha

Abstract--- Protection system is one of the important parts of the power system. The protection system can be accepted if and only if it is efficient, reliable and realizes some requirements. For protection of transmission line three stepped distance protection can provide remote backup protection to transmission line by zone two and zone three, but during the calculation of operation setting for different protection zones of the distance relays, some problems have been raised (overlap and under reach). These problems cause improper trips in the network. The aims at overcoming the problems are by taking into consideration the specifications of the adjacent transmission lines, the effect of arc resistance, earth resistance and the effect of remote in feed. The line insurance plans are made out of separation transfers and directional overcurrent transfers where the setting of the transfers must be figured thinking about the two transfers. Separate hand-off calculation would prompt loss of selectivity. The standard joined with the contemplations of zone stumbling time have been utilized so as to defeat the coordination issues with the fundamental security (separation insurance) as a nearby assurance and to give remote reinforcement security to the next overcurrent transfers in the matrix. In this strategy, the security of the transmission lines in run of the mill transport bars framework has been explored in detail. The best possible settings for both fundamental security (for example separation security) and reinforcement insurance (for example overcurrent security) gadgets have been resolved. Have been utilized as mimicking apparatuses to approve the assurance settings methods of the transfers. Three methodologies of settings have been utilized for the referenced transfers. The correct settings of the two transfers of the whole undertaking

Keywords--- Transmission Line, Stepped Distance, Overcurrent Transfers.

I. INTRODUCTION

Transmission lines are imperative pieces of the electrical transmissions framework, as they give the way to move power from the age to the heap. Transmission lines work at voltage levels from 69 kV to some kilowatts and are in a perfect world firmly interconnected for a dependable activity. Shortcomings in transmission lines cause an interruption of power flexibly, which will influence to the general force framework and lead to a wide size of power outage. As a matter of fact around some percentage of issues in the force framework happen on the transmission line systems.

The quality of the transmission line has a significant impact in the force framework unwavering quality by distinguishing the nearness of the aggravation on the transmission line, sending the order to open the circuit breakers at each end promptly and disengaging just the blamed segment, all together for the security of the transmission line to be structured as essential (or 'fundamental') (for example separation insurance) and for the reinforcement assurance (for example over current security) to work in equal.

In centers around the technique conspire setting for the run of the mill Bus bars transmission matrix. Two unique guidelines for separation transfer settings and the coordination of the over current as a reinforcement security for zone of separation hand-off have been examined in subtleties utilizing as digestion devices to approve the assurance settings of the quality transfers. Separation transfer has been built to identify and characterize the shortcoming condition that may happened in the transmission lines and send stumbling to its own electrical switch so as to detach the blamed segment from the remainder of the framework utilizing, alongside that the over

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flow hand-off have been examined utilizing, Inverse Definite Minimum Time sort of trademark have been utilized to decide the best possible settings of the over flow transfers as a reinforcement nearby and remote insurance, down to full assurance coordination for the whole venture.

The issues of cover and under reach in separation zone and zone settings coordination because of the remote in feed and the distinctions in the impedances of the transmission lines which is identified with the kind of the transmission lines, close to that the impact of circular segment obstruction and earth protections on the separation transfer capacity to recognize the high blames impedance. These three issue have been defeated in the suggested settings by including the impact of the impedance contrasts, remote in feed and circular segment opposition in the transfer's zones settings. In extra to, the flighty stumbling for overcurrent transfers with non-directional settings just as the unjustified misfortune for the heaps, on the opposite of directional settings which accomplished acceptable stumbling to the circuit breakers with the necessary time.

II. LITERATURE REVIEW

3.1 Introduction

This part begins with writing survey of past contextual analysis on the method conspire setting for the transmission network. Understanding previously mentioned analysts are significant as direction for this investigation to proceed onward. Writing survey on security some kilo watts transmission line is examined thus. Increasingly data on separation assurance gadget is additionally introduced.

3.2 Faults Occurrences

The idea of a flaw is basically characterized as any unusual condition, which causes a decrease in the essential protection quality between stage conductors, or between stage conductors and earth or any earthed screens encompassing the conductors. Practically speaking, a decrease isn't viewed as a shortcoming until is it is recognizable, that is until it results either in an abundance current or in a decrease of the impedance between conductors, or among conductors and

earth, to an incentive beneath that of the most minimal burden impedance ordinary to the circuit. Along these lines a further extent of contamination on a cover string, in spite of the fact that it decreases the protection quality of the influenced stage, notes become an issue until it causes a flash float over the string, which thusly delivers overabundance current or other perceptible abdominal muscle ordinariness, for instance irregular current in a circular segment

3.2.1 Lightning

The greater part of the electrical shortcomings happening on overhead force transmission lines are brought about by lightning. The principle customary methodologies for decrease of the lightning flashover issues on electrical cables are bringing down of the balance obstruction and utilizing of various protecting wires, and differential protection.

3.2.2 Pollution

Pollution is commonly caused by deposited soot or cement dust in industrial areas, and by salt deposited by wind-borne sea spray in coastal areas. A high degree of pollution on an insulator string, although it reduces the insulation strength of the affected phase, does not become a fault until it causes a flashover across the string, which in turn reduces excess current or other detectable abnormality, for example abnormal current in an arc-suppression coil.

3.2.3 Fires

The event of fire under transmission lines is answerable for an incredible number of line blackouts in numerous nations. Deficiencies are for the most part because of conductor to ground hamper mid length or stage to-stage impede on line setup and voltage level. Blackouts to a base, the leeway of existing lines must be expanded in backwoods. Clearing and vegetation on the line option to proceed in such territories is additionally a thought. Another issue emerging from consuming is the pollution of the protectors because of the aggregation of particles (residue, dust) on its surfaces. For this situation, the line protection necessities ought to be resolved so that the blackouts enduring an onslaught could be decreased to a base. Different reasons for shortcomings on overhead lines are trees, flying creatures, airplane, mist, ice,

snow stacking, punctured or broken encasings, open-circuit conductors and anomalous stacking.

3.2.4 Types of Faults

Force framework deficiencies might be sorted as shunt issues and arrangement flaws. The most happening sort of shunt deficiencies is Single Line-to-ground shortcomings, which one of the four kinds of shunt flaws, which happen along the electrical cables.

This kind of deficiency happens when one channel tumbles to ground or contacts the nonpartisan wire. It could likewise be the consequence of falling trees in a winter storm. The second most happening kind of shunt deficiencies is the Line-to-Line fault. It is the consequence of two conductors being short circuited. As on account of an enormous feathered creature remaining on one transmission line and contacting the other, or if a tree limb fall on head of the two of the electrical cables. Third kind of shortcoming is the Double Line-to-Ground flaw. This can be a consequence of a tree falling on two of the electrical cables, or different causes. The fourth and least happening kind of deficiency is the reasonable three stage, which can happen by a contact between the three electrical cables in various structures.

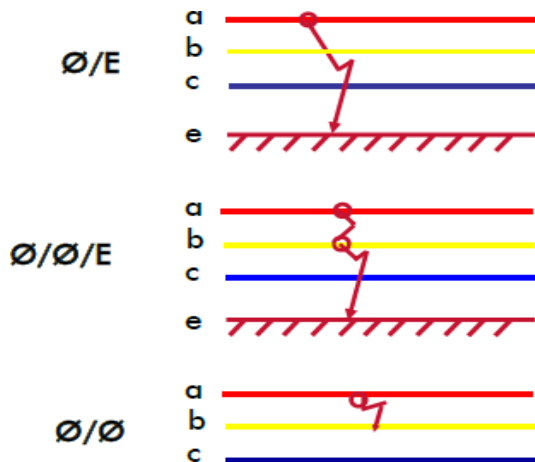


Figure 1: Types of Transmission Line Faults

3.3 Power System Protection

Force framework assurances are one of the electrical forces building that in the matter of electrical force frameworks from shortcomings through the separation of the blamed framework from the soundness of the electrical

system. To be stated, it is significant framework to shield people or any parts from increase any harm. Framework insurances are utilized to identify and disconnects the broken framework naturally. Some strange conditions are frequently happening in an interconnected framework. Therefore, the harm of the hardware and the interference of the gracefully associated with the force framework could be occur.

3.4 Protection System Components

Generally protection system consist of three main components which are protection devices (relay), instrument transformers (CTs and VTs) and circuit breakers.

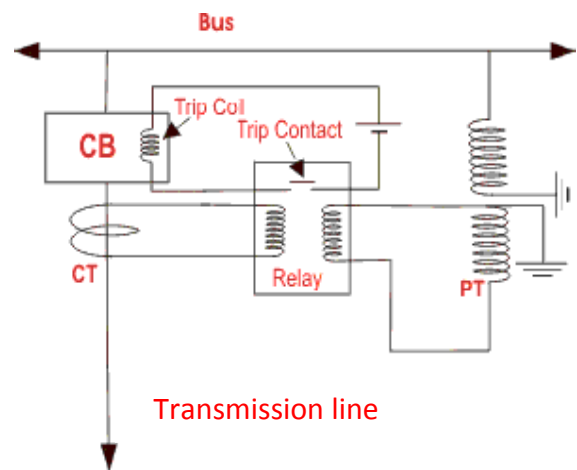


Figure 2: Power System Protection Components

3.4.1 Current Transformers

They give a current relative to the current coursing through the essential circuit so as to perform vitality metering or to examine this current through a security gadget. The auxiliary is associated with low impedance (utilized in for all intents and purposes short circuited conditions). BS 3938 explicitly characterizes current transformers intended for assurance under the heading.

As indicated by the British Standard, class X is characterized by the evaluated optional current, the base knee-point voltage, the greatest obstruction of the auxiliary winding and the most extreme polarizing current at the appraised knee-point voltage.

Appraised knee-point voltage at the evaluated recurrence is the voltage esteem applied to the optional terminals, which, when expanded by causes a most extreme increment of in

charging current. While the most extreme opposition of the optional winding is the most extreme obstruction of this twisting, amended at or at the greatest working temperature if this is more prominent. The most extreme charging current is the estimation of the polarizing current at the evaluated knee-point voltage, or at a predefined level of this current.

3.4.2 Voltage Transformers

A voltage transformer is intended to give the optional a voltage corresponding to that applied to the essential. For a VT, the essential voltage optional voltage proportion is steady, the principle tow type are electromagnetic voltage transformer and capacitive voltage transformer which allude to inside tightening. Voltage transformers utilized for security in consistence. The IEC precision classes are 3P and. By and by, just class is utilized, the exactness class is ensured for the accompanying qualities, voltages between of the essential voltage and the most extreme estimation of this voltage which is the result of the essential voltage and the evaluated voltage factor and for an auxiliary burden between and of the precision power with an inductive force factor

3.4.3 Protection Devices (Relays)

One of the significant gear's in the insurance of intensity framework are defensive transfers. A hand-off as "an electric gadget that intended to decipher input conditions in a recommended way, and after determined conditions are met to react to cause contact activity or comparable sudden changes in related electric control circuits.

Therefore the principle capacity of defensive transfers is to isolate a flawed region by controlling the electrical switch with minimal interference to give administration. The transfer is programmed gadgets to distinguish and to gauge strange states of electrical circuit, and shuts its contact with the framework. There are numerous sorts of hand-off can be utilized in secure transmission lines frameworks as indicated by their trademark, rationale, impelling boundary and activity instrument, for example, extent transfer, prompt hand-off, differential hand-off, directional hand-off, and separation plans.

3.4.4 Circuit Breaker

The International Electro specialized Commission (IEC) Standard characterizes an electrical switch as "a mechanical exchanging gadget, equipped for making, conveying and breaking flows under ordinary circuit conditions and furthermore making, conveying for a predefined time and breaking flows under determined strange circuit conditions, for example, those of short out.

The defensive handoff distinguishes and assesses the flaw and decides when the circuit ought to be opened. The electrical switch capacities leveled out of the hand-off, to open the circuit when required. A shut electrical switch has adequate vitality to open its contacts put away in some structure (for the most part a charged spring). At the point when a defensive hand-off signs to open the circuit, the store vitality is discharged making the electrical switch open. With the exception of in extraordinary situations where the defensive transfers are mounted on the breaker, the association between the hand-off and electrical switch is by hard wiring.

3.4.5 Tripping Batteries

The activity of checking gadgets like transfers and the stumbling instruments of breakers require autonomous force source, which doesn't fluctuate with the principle source being observed. Batteries give this force and henceforth they structure a significant job in security circuits. The hand-off/electrical switch blend relies totally upon the stumbling battery for effective activity. Without this, transfers and breakers won't work, turning out to be 'strong', making their capital venture futile and the presentation of the entire system inadmissible. It is along these lines important to guarantee that batteries and chargers are normally examined and kept up at the most elevated conceivable degree of proficiency consistently to empower right activity of transfers at the right time

3.5 Zones of Protection

Production is orchestrated in zone so as to constrain the broadness of the force framework which is detached when a deficiency happens. The insurance zones cover around circuit breakers. The design is to verify that no area of the framework

is left unprotected. Back-up insurance is given to guarantee that the blamed component of the framework is detached regardless of whether the essential assurance neglects to seclude the blamed component. Back-up security can be given locally or from a remote area. Neighborhood back-up security is given by hardware that is notwithstanding the gear accommodated essential assurance though remote back-up insurance is given by gear that is genuinely situated at substations from the area where hardware for essential.

3.6 Protection of Transmission Lines

The assurance of transmission lines comprises of principle (or essential) and reinforcement insurance (so as to give high power framework unwavering quality) which are worked in equal, in case of disappointment or non-accessibility of the essential security some different methods for guaranteeing that the shortcoming is segregated must be given. These optional frameworks are alluded to as 'back-up assurance. Remote back-up security is given by assurance that recognizes an un-cleared essential framework shortcoming at a remote area and afterward gives a neighborhood trip order, for example the second or third zones of a separation hand-off. In the two cases the principle and back-up security frameworks identify a shortcoming at the same time, activity of the back-up insurance being postponed to guarantee that the essential assurance clears the issue if conceivable. Typically being unit security, activity of the essential insurance will be quick and will bring about the base measure of the force framework being detached. Activity of the back-up insurance will be, of need, increasingly slow outcome in a more noteworthy extent of the essential framework being lost.

3.7 Distance Protection

Separation security has been generally utilized for ensuring transmission and sub-transmission lines in light of its effortlessness, economy, appropriateness, and unwavering quality. The essential standard of separation insurance includes the division of the voltage at the transferring point by the deliberate current. The obvious impedance so determined is contrasted and the arrive at point impedance. On the off chance that the deliberate impedance is not exactly the arrive

at point impedance, it is expected that an issue exists on the line between the transfer and the arrive at point. The determined evident impedance is contrast and foreordained impedance is called reach of the hand-off. The evident impedance is must bigger than the impedance of reach of the transfer during typical activity. Nonetheless, if the flaw happens, the evident impedance is not exactly the impedance-reach so transfer will impart an outing sign to the breaker.

3.8. Overcurrent Protection

Overcurrent insurance is an assurance against over-burden current which is past regularly current rating of the gear and against earth deficiency if there should arise an occurrence of short out to the earth. Hand-off time-current qualities are separated into four classes, for example, unmistakable time transfers, converse time transfers, very backwards time transfers and reverse distinct least time transfers. In this undertaking, Inverse Definite Minimum Time hand-off is utilized for the overcurrent security.

3.9 Directional Overcurrent Protection

At the point when shortcoming current can stream in the two headings through the transfer area, it's important to develop the reaction of the hand-off directional by the directional control office. The office is given by utilization of extra voltage contributions to the hand-off. Non-directional transfers are applied to resemble feeders having an equivalent source, any deficiencies that happen on any one line will detach the two lines and totally separate the force gracefully. It is important to apply directional transfers at the less than desirable end and to review them with the non-directional transfers at the sending end, to guarantee right discriminative activity of the transfers during line deficiencies. This is finished by setting the directional transfers R1' and R2 with their directional components investigating the secured line, and giving them lower time and current settings than transfers.

3.10 Methodology

A few stages are taken so as to guarantee that the ideal destinations are accomplished. This section will clarify in detail on the techniques taken to finish the venture. This venture is partitioned into four sections. The initial segment

covers the demonstrating of the little framework transport bars, which comprises of three generators, nine transport bars, six transmission lines and three pipelining utilizing software to construe the heap stream and short out examination, the subsequent part covers the computations of the setting for both of the principle assurance (separation transfers) and reinforcement insurance (over current transfers), which will be fundamentally founded on the network evaluations, the third part covers the recreation of the separation security transfers

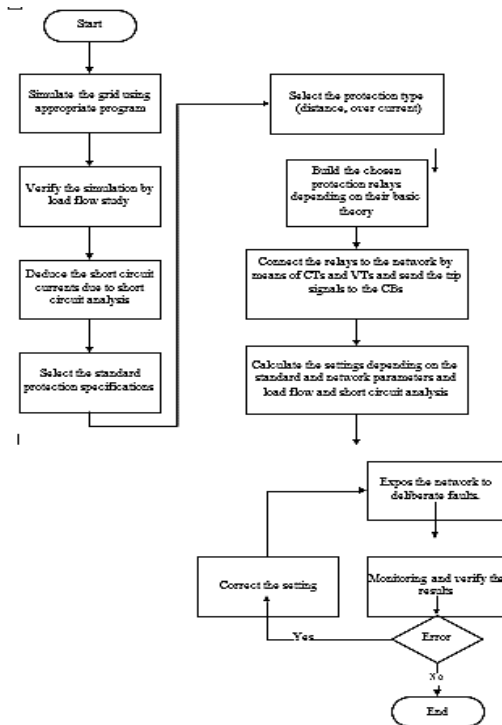


Figure 3: Flow Chart of the Project

3.11 Test Bus System and Data

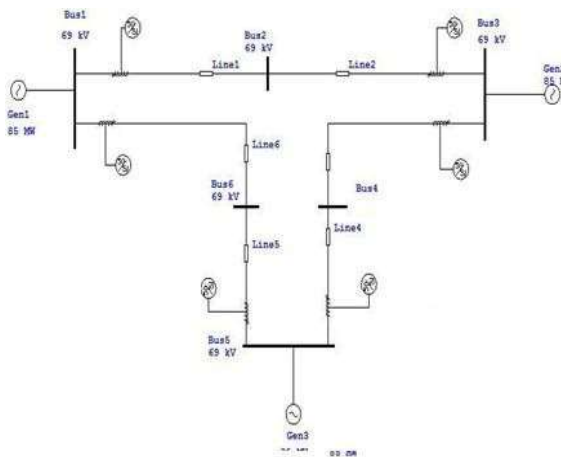


Figure 4: Working Principal of Test Bus System and Data

3.12 CT Ratio

Relay no.	CT Ratio	Relay no.	CT Ratio
1	400/5	4	400/5
2	200/5	5	300/5
3	200/5	6	200/5

3.13 Primary/Backup Relay Pairs and Fault Currents

Backup Relay	Fault current (KA)	Primary Relay	Fault current (KA)
5	1.457	1	2.673
4	0.327	2	1.666
1	0.543	3	1.666
6	0.765	4	2.673
3	1.005	5	1.325
2	0.670	6	2.469

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