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COMPARISON OF DIFFERENT METHODS FOR PROTECTION OF GENERATOR FIELD FAILURE

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Abstract: A generator's Excitation is being lost can trigger catastrophic harm across dual scenarios the generator as well as the related systems. The actions of several LOE protection methods about a hydro based generator linked to an infinite bus were investigated in this study, which included the R-X, G-B, U-I, and P-Q methods. Simulated data is used to assess the dependability and stability of existing LOE preventative activities, and a recommended strategy is chosen. A scheme enhancement further included in place to evade the LOE based relay from operating incorrectly in the event of external failures, for illustration short-circuit problems to the bus bar either transmission system.

Keywords: Loss of excitation, Mho characteristics, Recover Field Excitation, Various Methods Comparison

Introduction:

When there is a lack of excitation, the motor's speed exceeds the speed of synchronism and it begins for function as just an asynchronous generator, utilizing reactive power into grid rather than generating it. This might cause serious harm to both the generator and the electricity supply to which it is attached. As a result, the LOE is employed. Five protective methods will be utilized to safeguard the generator. G-B, R-X, U-I, and P-Q methods for a hydro based generator coupled up to the infinite bus, for example. Proposals for P-Q Obtaining measurements: The ability of a synchronous generator to provide real and reactive power is depends on its capabilities [1]. The capability curve presented by the manufacturer, network Steady state, limits the generator's operation.

As a consequence, the generating capability curve and SSSL may be used to determine the protection zone directly. P-Q design with an LOE and an under voltage element is illustrated. In a generator of salient poles, no such a big problem with stator area end area warmth [3]. As a result, the SSSL constrains the LOE component, also the LOE characteristics of the item is located within the SSSL slope. The maximum bound point located at C is the point at which the generator’s ratings of MVA evaluating and the scored power output(active) (0,9 pu); the lowest possible limit D is restricted by SSSL, which is (0, -U2 s /Xd) in the plane of P-Q. When the reactive power output of the generator surpasses the UEL, the alarm component sound [4].

So when functioning point enters the operational region, the LOE security feature detects it and sends a trip signal after 0.75 seconds. The P-Q schemes are the second LOE protection schemes. The LOE prevention method is focused on the measurement of generator’s active and reactive power result in the plane of P-Q. The generator's active and reactive power the outputs are constrained by the capabilities of the generator, the Structure of various types of limits like stability and excitation

Several Protection methods against disappear in excitism.

The R-X method, R-X with Positional component method, P-Q method, G-B method, and V-I method are the five Loss of Excitation protection methods used

[A] R-X Method.

This method is focused to the measurement of node impedance of a generator in RX plane. The generator terminal side voltages and stator currents are used as input signals for this protection procedure, which create two mitigated circles of mho impedance.

[B] P-Q method.

This method is derived on the measurement of output power (active & reactive) of generator in the plane P.

[C] G-B Method.

This particular method noticed about the calculation that given by generator in term of terminal admittance in plane of G-B.

[D] V-I Method.

This method works for comparison of phase angle data that taken from phase current & voltage.

[E] U-I measurement scheme.

This method is same as V-I method, but only key difference is that for comparing phase angle it used directional over current relay.

I. Proposed Methodology.

This all methods of LOE protection are relates on the measurement of impedance data provides by terminal of generator in plane of R-X. here for input signals which used in this methodology as input is taken from the terminal voltage that provides by generator and current from the stator, which causes two different offset mho impedance circles [5].

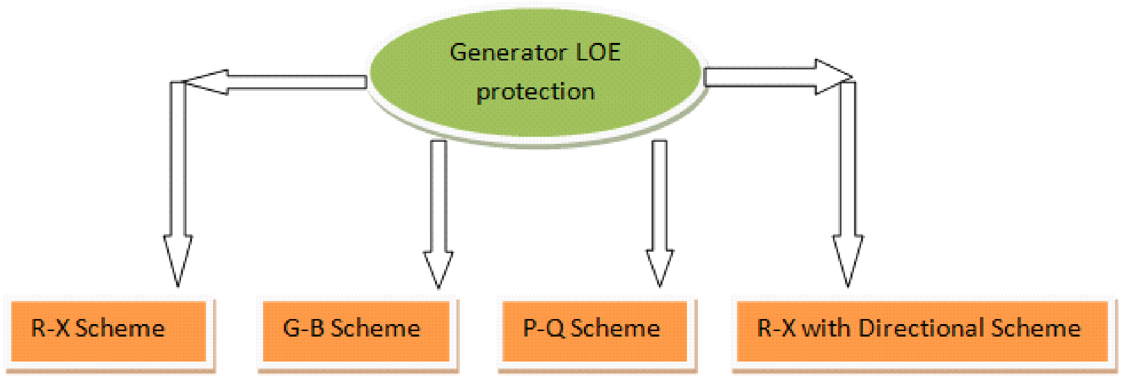

Fig: 1 Methodology Chart

In case of Loss of Excitation, methodology consist compare review on different scheme and conclude best result on it. In this paper proposed work mostly used two methods namely R-X plane and P-Q plane for LOE.

II. Mho-Relay:

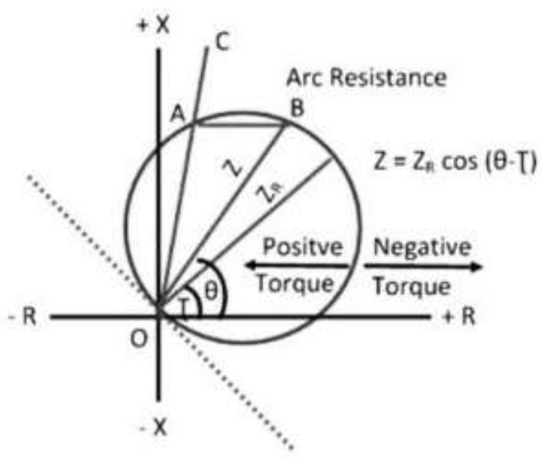

Fig: 2 Mho Relay Characteristics

The Mho relay's operating characteristics can be seen below. The result illustrates that the radius of the circle is virtually independent of voltage and current. However, when a spring effect is assumed at low voltage and current magnitudes, the diameter of the circle reduces. Let the circle's diameter be Zr = K1/K2, which is also recognized as the ohmic setting of the Mho relay [6]. Fig 2

III. Software Simulation:

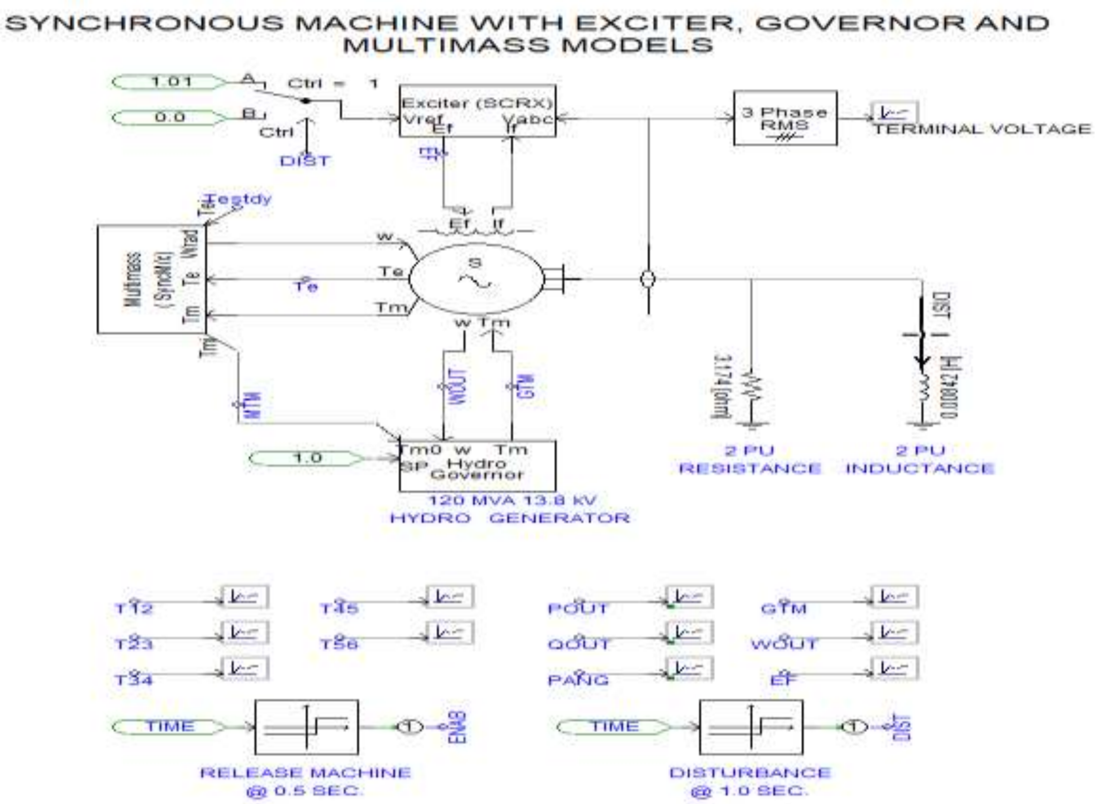

Fig: 3 Mho Relay Characteristics

PSCAD software was used to simulate the model's software. In this test, A synchronous machine will be used, along with an exciter governor and multi mass models. This system is performing data in software and gives simulation for the based LOE of a hydroelectric type generator. In the figure above, a simulation with connection of generator (salient pole) is attached with the bus through a step-up transformer(delta-star). The generator rating in this model is 120mva, and the generator multi mass system to be used has a rating of 13.8 kva..

R-X SCHEMES: The most prevalent LOE protection system is the impedance measuring technique. The Protection technique employs a relay (mho offset), that receives the current and voltage of terminal as signal for input and uses them to determined impedance of the terminal [7].

In this model all system will be interconnected to main system. To used subsystem mho relay on this inter-connected system. The generator ratings is 120 MVA, 13.8KV hydro generator .all system basic frequency is 60HZ. The possibilities for single input gate circuits are exhausted by inverters and buffers. What else can a single logic signal do but be buffered or inverted? To investigate other logic gate options, we must expand the circuit with more input terminals (s).

The model, which was created in PSCAD, calculates methods of LOE of a hydro based generator. Figure depicts the system arrangement that indicates the Generator 1 nodes impedance characteristic region I. here for simplicity we reduced time of simulation by 15 sec, implying that failure of excitism commences at zero sec and ends right after the synchronism outage[8]. a radio-controlled plane. In zone 2, curve of terminal impedance goes around time of 5.306s for an 80 percent load state, and Zone 2 generates a signal that alarms by 0.5sec.

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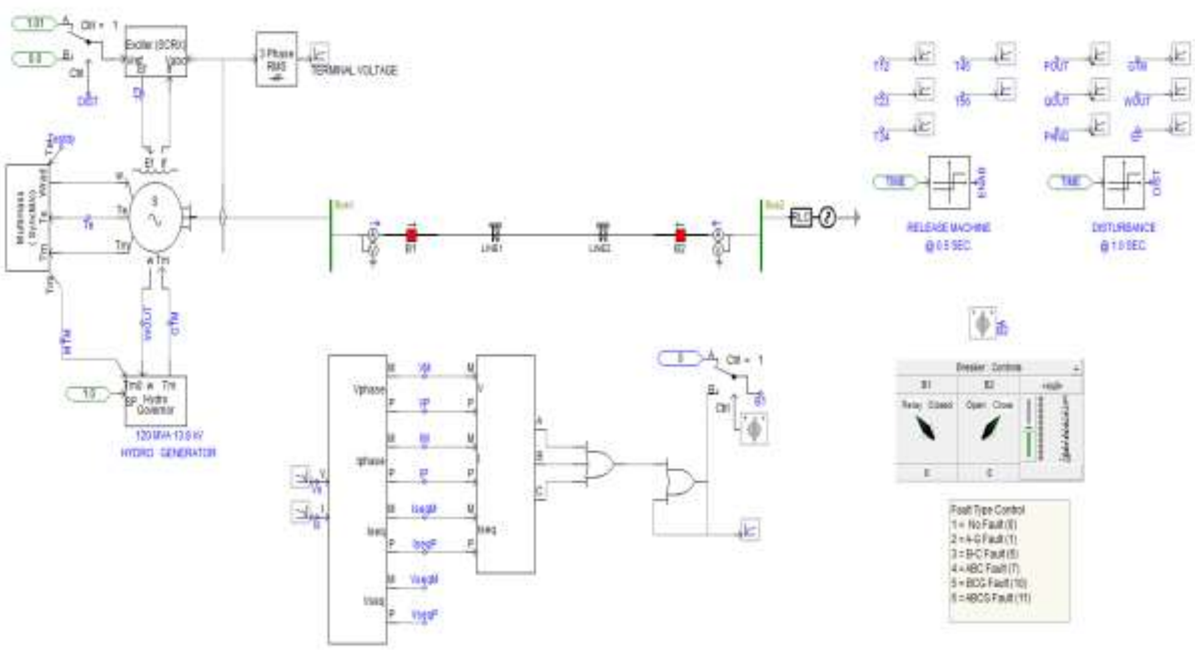

Fig: 4 Synchronous multi mass interconnected system

IV. Output

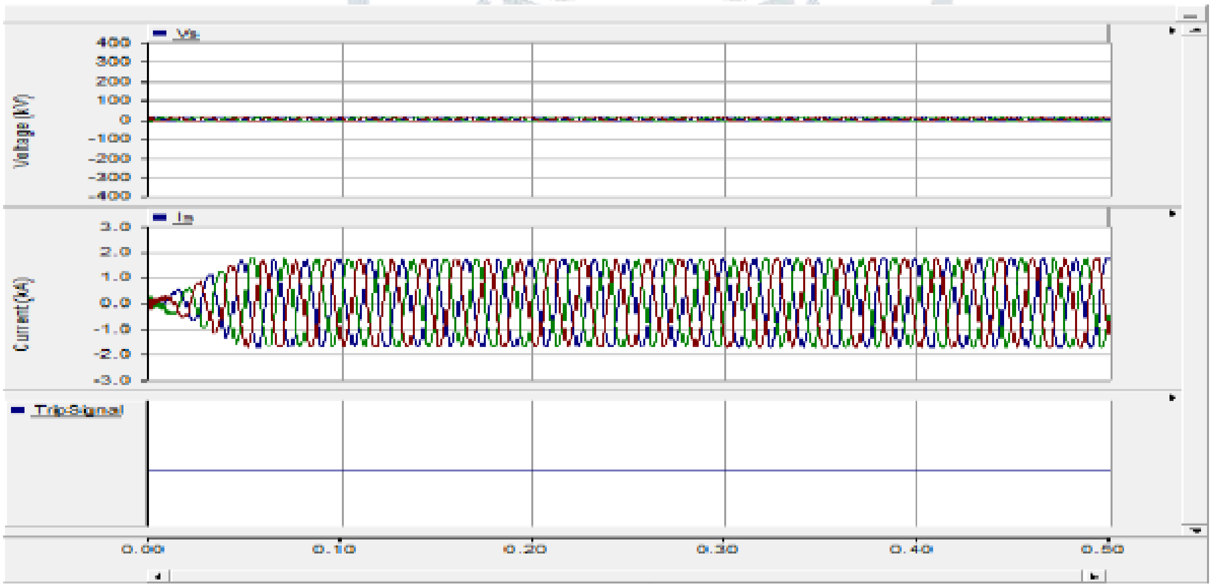

Fig: 5 Voltage Current and Trip signal

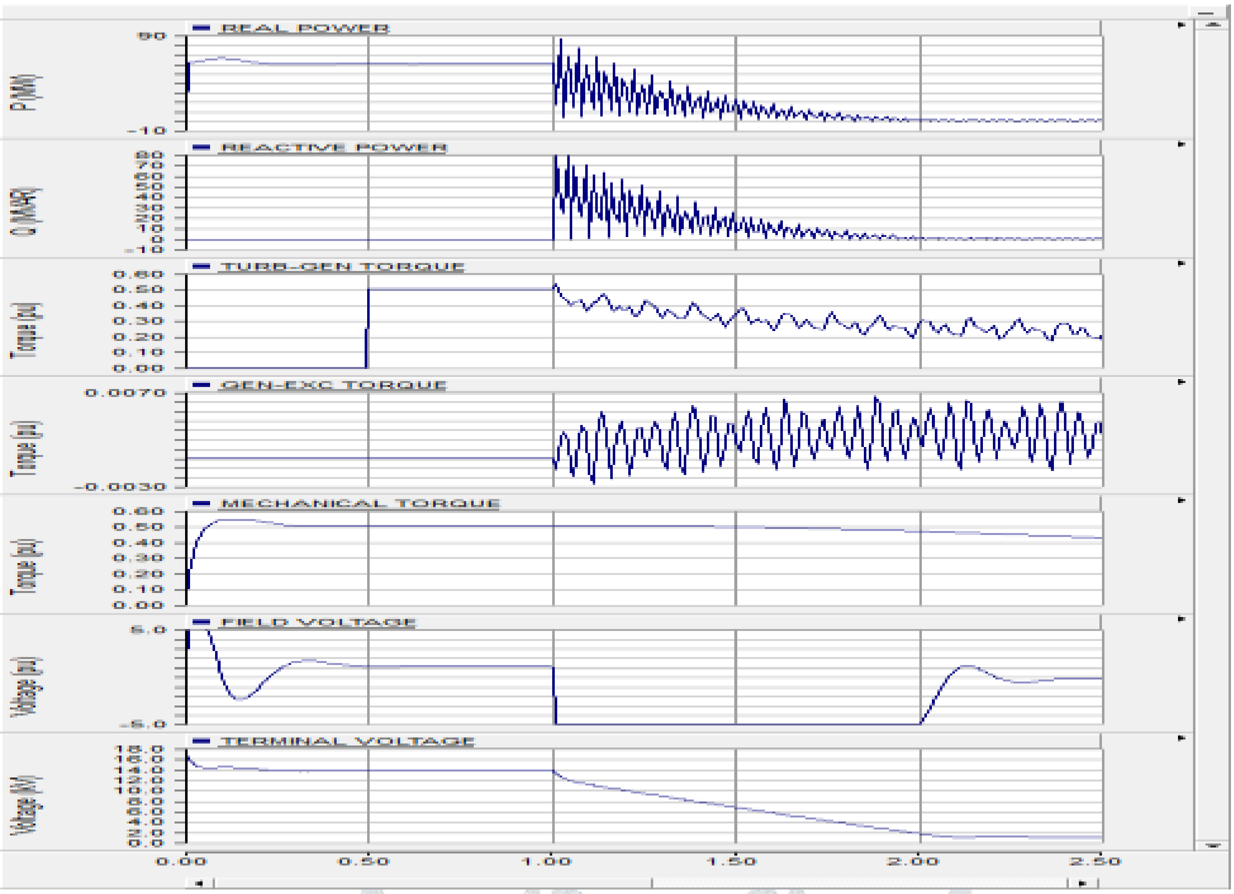

Fig: 6 Synchronous Machine Shaft torque, field and terminal voltage

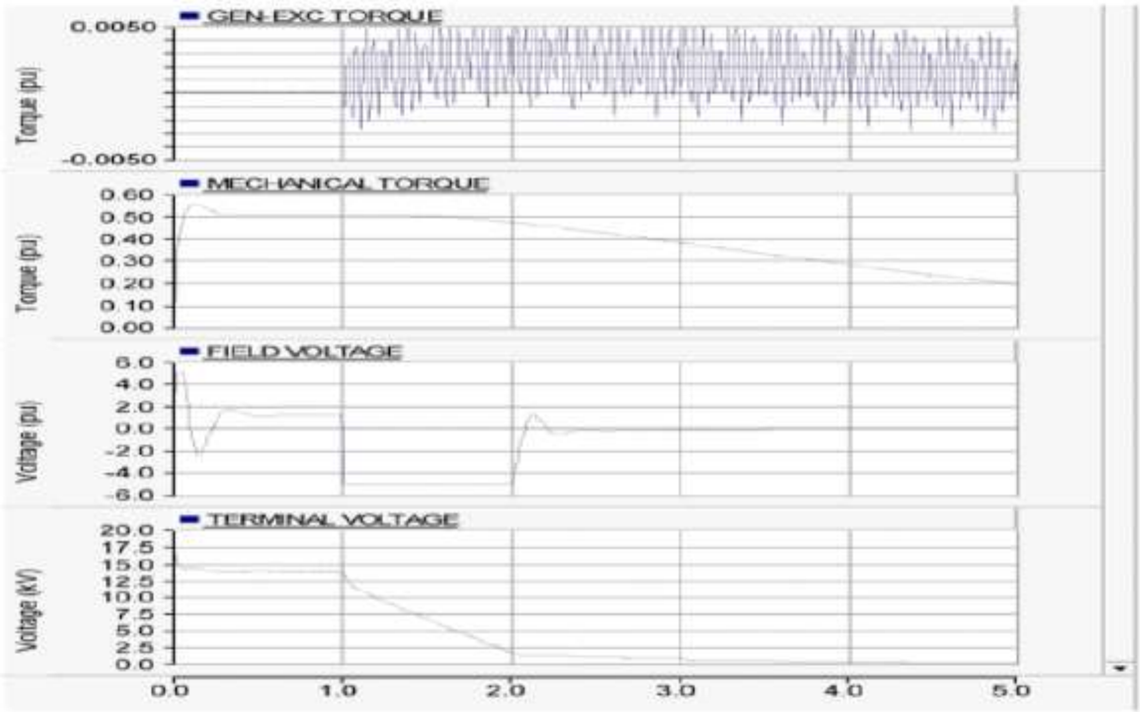

Fig: 7 Generator torque, mechanical torque, voltage at field & terminal

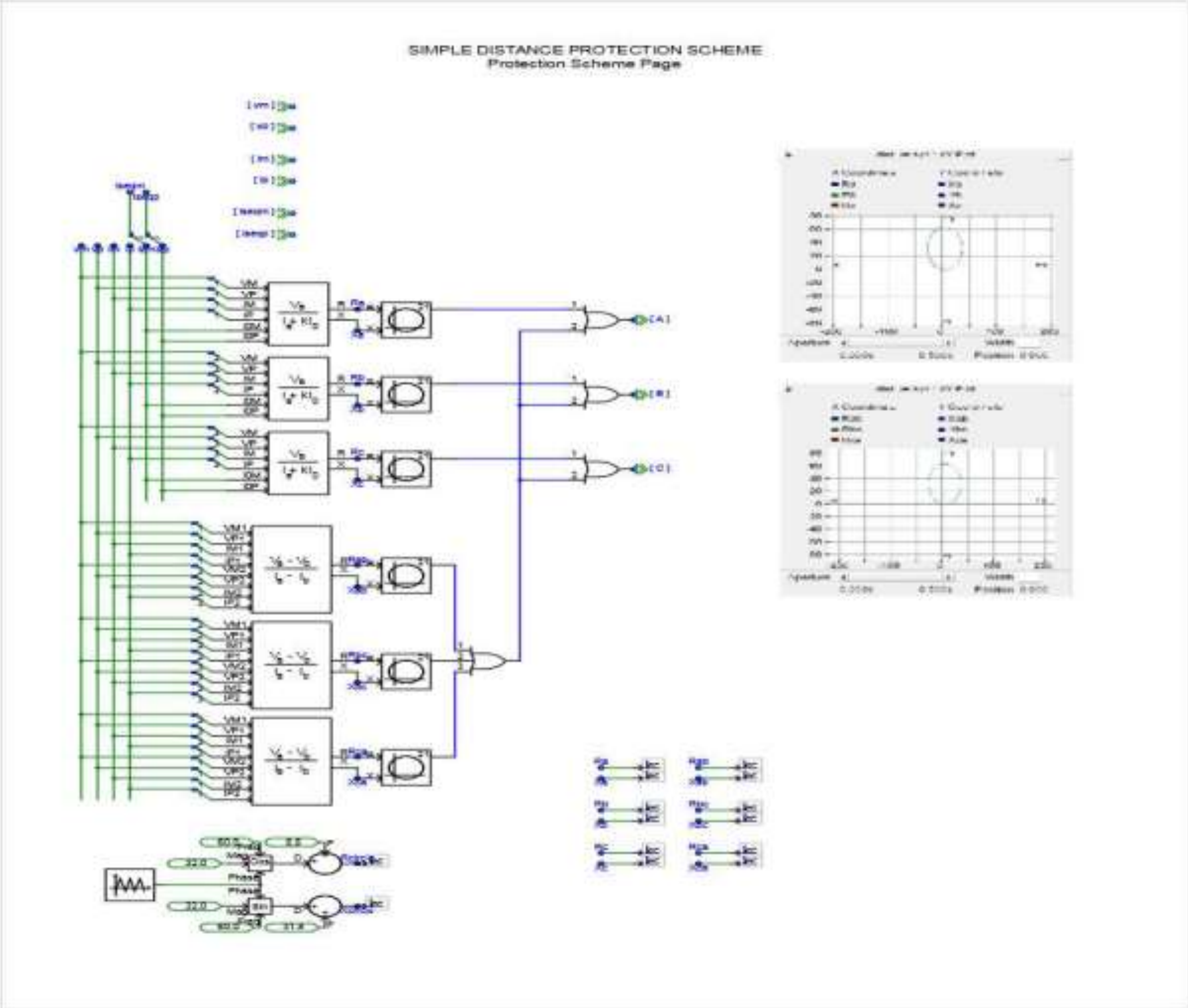

Fig: 8 representations of R-X Diagram

V. Conclusion

According to the data, when there is a excitation outage, the current in the field diminishes. Power (active & reactive) both decreases. It has also been observed that when external faults, such as when a failure produced to a bus-bar, R-X characteristic not allow to access to swing characteristics, which is a benefit of the R-X method.

Based on a simulation analysis in PSCAD, this research analyses the frequently found protection methods for LOE failures and analyses their stability and reliability. According to the output clarify that, R-X with directional component method responds quick to LOE failures than various methods.

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